

Drivers and barriers of Cloud Business Intelligence: An investigation into the adoption factors for Small and Medium-sized Enterprises.

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Abstract

Cloud BI has characteristics that could be drivers as well as barriers for the adoption by Small and Medium-sized Enterprises (SMEs). With the emergence of Cloud BI businesses are able to avoid barriers of regular BI implementation and exploitation. The main theory used in this research to explain the adoption of Cloud BI by SMEs is the SME adoption model for Electronic Data Interchange (EDI) developed by Kuan & Chau (2001). This research shows that the adoption of Cloud BI by Small and Medium-sized Enterprises (SMEs) depends on three factors: (1) Perceived Benefits, (2) Organizational Readiness and (3) External Pressure. The drivers of Cloud BI; (1) Universal access to resources, (2) Cost Benefits, (3) Latency and Agility characteristics and (4) Scalability characteristics positively influence the Cloud BI adoption by SMEs while the barriers of Cloud BI; (1) Privacy Issues, (2) Data Control issues and (3) Security/Reliability concerns negatively influence the Cloud BI adoption by SMEs. Further research is needed to test the validity of these propositions.

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1. Introduction.

1.1 Business Intelligence.

Organizations in nearly all sectors are faced to the challenge to manage large amounts of unused data; this is called the Big Data paradigm (Dermikan & Delen, 2012). This requires higher capable IT-resources (Weinhardt et al., 2011). This big amount of data is becoming increasingly larger because of the growing information collection by computing systems but also other devices such as cell phones, laptops and sensors (Demirkan & Delen, 2012).

Business Intelligence is the collection of decision support systems for enterprises to enable knowledge workers such as executives, managers and analysts to make better and faster decisions (Chaudhuri et al., 2011). With the emergence of Business Intelligence (BI) tools, (such as mathematical models reporting and visualization, trend analysis, customer behavior analysis and predictive modeling) organizations can exploit useful information and knowledge from the available data (Jun & Jun, 2011).

1.2 Small and medium-sized enterprises.

In contrast to larger organizations, smaller organizations or businesses face several barriers and challenges for the implementation of BI systems (Sahandi et al., 2012, Beheshtian-Ardekani & Salchenberger, 1988, Tuunainen, 1998). In this paper the adoption by Small and Medium Sized Enterprises are investigated. SMEs have less than 250 employees, 50 million euro or less turnover and 43 million euro or less Balance sheet total, this definition is used by the European Union, the World Bank, the United Nations and the World Trade Organization (European Commission, 2003). SMEs often have difficulties in obtaining capital for the implementation of new IT resources; this restricts them to obtain new technologies or innovations (Sahandi et al., 2012). Former research has shown that barriers for SMEs to BI implementation include; financial limitations (Beheshtian-Ardekani & Salchenberger, 1988, Tuunainen, 1998, Kuan & Chau, 2001), lack of organizational learning capabilities (Hong, 2002, Ke, 2007, Tuturea et al., 2012) and physical capacity restrictions (Kaefer & Bendoly, 2000).

1.3 Cloud Computing.

Hence, with the emergence of Cloud Computing (CC) there might be possibilities for SMEs to evade several barriers of BI implementation (Marston et al., 2011, Weinhardt et al., 2009, Abadi, 2009). The National Institute of Standards and Technology (NIST) defines Cloud Computing as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction” (Demirkan & Delen, 2012, p. 2).

1.4 Cloud Business Intelligence.

Combining CC components with BI activities is called the Cloud Business Intelligence paradigm (Cloud BI), which is a new service model (Marston et al. 2011, Seruga & Hwang, 2012). Former research showed that CC technology has changed and improved the BI activities for organizations (Demirkan & Delen, 2012, Sean Marston et al., 2011, Seruga & Hwang, 2012, A. Fernandez, 2013).

Due to the characteristics of Cloud BI it might be suitable for SMEs to overcome the barriers introduced. One important characteristic of Cloud BI is that the application that is used by a client is running on an external server (running in the cloud), this eliminates the need to install and run the application on a client computer, examples of Cloud BI include Salesforce.com and Netsuit (Marston et al., 2011, Benlain & Hess, 2011, Seruga & Hwang, 2012). Cloud BI is also a solution to store the high volumes of data (Xu, 2009).

1.5 Cloud BI advantages.

The literature that is investigated for this paper showed beneficial characteristics of Cloud BI that regular BI does not have. If these characteristics succeed to break through the barriers of BI adoption, it might be possible to make it easier for SMEs to adopt Cloud BI than regular BI.

If these advantages of the cloud positively influence the adoption factors of SME adoption, SMEs might be possible to consider implementation Cloud BI. These advantages also meet two major trends in information technology- (a) IT efficiency, whereby the power of modern computers is utilized more efficiently through highly scalable hardware and software resources and (b) business agility, whereby IT can be used as a competitive tool through rapid

deployment, parallel batch processing, use of compute-intensive business analytics and mobile interactive applications that respond in real time to user requirements (Marston et al., 2011).

1.6 Cloud BI disadvantages.

Prior research also investigated disadvantages of Cloud BI (Marston et al., 2011, Hayes, 2008, Chow, 2009, Abadi, 2009, Benlian & Hess, 2011, Sahandi et al., 2011, Faasen, 2013, Bhattacharjee & Park, 2013), these Cloud BI disadvantages could be barriers for SMEs to adopt it. This prior research showed that since the introduction of Cloud BI new issues and risks emerged. These risks and issues might be barriers for SMEs to implement Cloud BI.

1.7 SME adoption.

Point of departure for this study is the Electronic Data Interchange (EDI) adoption model developed by Kuan & Chau (2001). In this paper EDI adoption by SMEs is investigated. In an EDI a business starts implementing processes to move business documents and other data electronically between or within firms, this may contain new IS requirements and implementations (Kuan & Chau 2001). The adoption process by small businesses, according to the EDI-adoption model, is influenced by three factors. These factors are (1) Perceived Benefits; (2) Organizational Readiness and (3) External Pressure (Kuan & Chau 2001). Results of an empirical research showed that the model is reliable to describe the EDI adoption process of SMEs (Chweloss et al., 2001).

Another reason for choosing the EDI adoption model of Kuan & Chau (2001) is because the influencing factors for EDI adoption are mainly similar to Cloud BI adoption by SMEs, like perception of benefits (Marston et al., 2011, Venters & Whitley, 2012, Xu, 2009, Sahandi et al., 2012), financial efforts (Weindhardt et al., 2009, Benlian & Hess, 2011, Bhattacharjee & Park, 2013), technological efforts (Demirkan & Delen, 2012, Fernandez 2013, Bhattacharjee & Park, 2013) and sectorial influences (Demirkan & Delen, 2012, Marston et al., 2011). This paper investigates the influences of Cloud BI drivers and barriers on the same three influencing factors as in the EDI adoption model for SMEs.

This adoption model is also used in a research about SME Internet adoption for web-based services by Mehrens et al. (2011). Since Cloud BI services are mainly web-based (Hayes 2008, Faasen, 2013, Tuturea et al., 2012, Marston et al., 2011), this model might be assumed suitable to use for describing the Cloud BI adoption process for SMEs.

This paper aims to relate the Cloud BI drivers and barriers with the factors of the SME adoption model by answering the following research question:

RQ: What are the drivers and barriers of Cloud Business Intelligence adoption by Small and Medium-sized Enterprises?

The contribution of this research is to give an overview of components of Cloud BI and to define which of these components are drivers or barriers. Another contribution of this research is to link these drivers and barriers with the factors of the adoption model for SMEs. As far to my knowledge there is no study about the drivers and barriers of Cloud BI by SMEs. With the implications coming from this study SMEs have an overview of the advantages and disadvantages of Cloud BI which can be taken in consideration in forming a BI strategy.

1.8 Structure of this paper.

Each section of this paper has an objective. In the first part (Section 2.1) the influencing factors for Cloud BI adoption by SMEs are introduced and investigated. The second part (Section 2.2) investigates the drivers of Cloud BI and the relation between these Cloud BI drivers and the three factors that influence Cloud BI adoption of SMEs. In the third part (Section 2.3) the Cloud BI barriers and the relation between these Cloud BI barriers and influencing factors of Cloud BI adoption are investigated. In the last part (Section 3) is concluded and discussed what is written in the prior sections to give managerial implications and recommendations for further research. A reflection of the scientific contribution of this research is also given in Section 5.

2. Theory.

2.1. Cloud BI adoption by SMEs.

In this first section the Cloud BI adoption factors by SMEs are explained. The reason for this overview is to underpin that Cloud BI adoption for SMEs have the same or similar influencing factors as EDI adoption by SMEs. The adoption model that is used in this paper is developed by Kuan & Chau (2001). In their paper Electronic Data Interchange (EDI) adoption by small business is investigated. In an EDI a business starts implementing processes to move business documents and other data electronically between or within firms, this may contain new requirements and implementations of information systems (software and hardware) (Kuan & Chau, 2001). The EDI adoption by SMEs is influenced by the following factors ;(1)

Perceived Benefits; (2) Organizational Readiness and (3) External Pressure (Kuan & Chau, 2001).

A research about SME Internet adoption by Mehrens et al. (2011) described these influencing factors to describe the adoption of web-based services for SMEs. Since Cloud BI services are mainly web-based, SMEs have to deal with factors for Cloud BI adoption that can be considered comparable to web-based services addressed in prior studies. This makes the EDI adoption model of Kuan & Chau (2001) suitable to use for describing the Cloud BI adoption process by SMEs.

2.1.1 Perceived Benefits.

The Perceived Benefits factor contains the perception of the benefits by and for the organization that can be derived from the adoption of Cloud BI. These technological benefits can be divided into two types of benefits; Direct Benefits and Indirect Benefits (Kuan & Chau, 2001).

Direct Benefits of Cloud BI adoption by SMEs include faster implementation of Cloud BI than regular BI due to lower entry costs (Marston et al., 2011), faster time to market for organizations through immediate access to hardware resources (Sahandi et al., 2012, Marston et al., 2011) and ensuring for no performance lags for end-users through interacting with a cloud-based service (Venters & Whitley, 2012). A higher level of Perceived Benefits stimulates the adoption by SMEs (Kuan & Chau, 2001).

Indirect Benefits include having other companies care for hardware and software issues (Demirkan & Delen, 2012) and making it possible to cope with the requirements of large-scale data storage and computation through the scalability of cloud services (Xu, 2009).

This line of reasoning leads to the following proposition:

P1: Perceived Benefits positively influences Cloud BI adoption by SMEs.

2.1.2 Organizational Readiness.

The Organizational Readiness factor contains the evaluation of the financial and technological resources of the adopting firm, this factor can also be divided into two aspects; Financial Readiness and Technological Readiness (Kuan & Chau, 2001).

In this paper Financial Readiness is referred to the financial resources of the firm available for the Cloud BI implementation. If the implementation costs are too high to consider it will lead

to lower Financial Readiness, which will lead to lower Organizational Readiness of the firm (Kuan & Chau, 2001).

According to empirical research of Beheshtian-Ardekani & Salchenberger (1988) reasons for not purchasing or developing an expert system, lack of Cost Effectiveness was far biggest reason. Lack of financial resources blocks implementation of sophisticated systems involving complex telecommunications which are required for regular BI tools (Tuunainen, 1998).

However, Cloud BI services have lower financial barriers (Marston et al., 2011), so BI performed in the cloud might increase the financial readiness of an SME.

Technological Readiness refers to the level of sophistication of IT usage and IT management in organizations (Kuan & Chau, 2011). The lower technical competence required for Cloud BI includes easier dynamic integration of business partners (Dorsch & Hackel, 2013). A greater level of easiness of these two aspects might lead to a lower level of Technological Readiness, which leads to a higher level of Organizational Readiness of the firm. A higher level of Organizational Readiness of an SME stimulates EDI adoption. As discussed earlier, EDI is considered comparable to Cloud BI, so higher organizational readiness stimulates the adoption of Cloud BI by SMEs. This leads to the following proposition:

P2: Organizational Readiness positively influences Cloud BI adoption by SMEs.

2.1.3 Environmental Pressure.

The factor Environmental Pressure refers to the influencing factors of the external business environment (Kuan & Chau, 2011). Firms have to deal with pressure of the radically changing external environment of the IT industry (Hong et al., 2002). The External Pressure Factor of the adoption model can be divided into two aspects; Perceived Industry Pressure and Perceived Governmental Pressure (Kuan & Chau, 2011). In this paper only Perceived Industry Pressure is considered because as far of my knowledge there is not enough literature written about the link between Cloud BI (and the adoption of Cloud BI by SMEs) and governmental initiatives at this moment.

Examples of Perceived Industry Pressure include the usage of IT to reach business agility for competitive advantage (Marston et al. 2011), the communication of the benefits of Cloud BI by vendors motivate end-users to implement these solutions (Bhattacharjee & Park, 2013), the advance of technology make small businesses able to enjoy new emerging technological benefits (Kuan & Chau, 2011) and the rapidly changing environment requires businesses to change their information systems (Hong 2001). A study by Ramakrishnan et al. (2012)

indicated that there exists a relationship between external factors (institutional pressure) and BI implementation efforts. This line of reasoning leads to the following proposition:

P3: Environmental pressure positively influences Cloud BI adoption by SMEs.

2.2 Drivers for Cloud BI adoption by SMEs.

In this section the drivers of Cloud BI for SME adoption are discussed. Prior research indicated that these drivers attract and tempt SMEs to adopt BI supported by CC features (Marston et al., 2011, Demirkan & Delen, 2012). The drivers that are derived from prior research about Cloud BI and are being discussed in this paper are:

- Universal access to resources (Rayport & Heyward, 2009, Bhattacharjee & Park, 2013, Tuturea et al., 2012, Benlian & Hess, 2011, Marston et al., 2011, Seruga & Hwang, 2012, Weinhardt et al., 2009, Hayes, 2008, Lenart et al., 2011, Fernandez, 2013).
- Cost benefits (Sahandi et al., 2012, Beheshtian-Ardekani & Salchenberger, 1988, Tuunainen, 1998, Demirkan & Delen, 2012, Weinhardt et al., 2009, Benlian & Hess, 2011, Fernandez, 2013, Faasen, 2013, Bhattacharjee & Park, 2013).
- Latency and agility (Marston et al., 2011, Sahandi et al., 2012, Demirkan & Delen, 2012, Azvine, Cui & Nauck, 2005, Venters & Whitley, 2012).
- Scalability (Bhattacharjee & Park, 2013, Demirkan & Delen, 2012, Ramakrishnan et al., 2012, Marston et al., 2011, Venters & Whitley, 2012, Sahandi et al., 2012, Tuturea et al., 2012).

2.2.1 Universal access to resources.

CC makes it possible for users to have access anytime and anywhere to (cloud-hosted) resources and processing power (Rayport & Heyward, 2009). With the emergence of CC users can employ a third-party to provide for data storage and other computing services through Internet-hosted software applications (Bhattacharjee & Park, 2013), an example of these applications is Cloud BI software (Tutureau et al., 2012). These on-demand Internet-hosted software applications are referred to as Software-as-a-Service (SaaS), which is a service model of the CC paradigm (Benlian & Hess, 2011, Marston et al., 2011, Seruga & Hwang, 2012, Weinhardt et al., 2009).

Fig. 1 represents the infrastructure of the CC-service model. Applications in the cloud are used to deliver data from devices that are connected with the cloud (Weinhardt et al., 2009).

Thus it can be assumed that with this infrastructure end-users have universal access to resources such as data, software and other computing services that are stored in the cloud.

With the CC infrastructure SMEs can physically locate their computers, servers and other devices in geographical areas where space and electricity is cheaper, and these devices can be accessed over long distances via the internet (Marston et al., 2011).

Through the internet connection end-user

have universal access to the computer systems over a simple Web-based interface, no matter where these devices are located (Marston et al., 2011). These web-based interfaces deliver parallel computing applications that fully exploit multicore processors (Hayes, 2008), so the location of the end-user does not matter for the usage of the computer systems. The National Institute of Standards and Technology (NIST) defined the independency of location as one of the characteristics of CC (Lenart et al., 2011, NIST, 2011).

In the CC-infrastructure end-user applications are typically accessed via a web browser, this eliminates the need for the user to install or maintain additional software on their device (Seruga & Hwang, 2012). Since cloud-application providers strive for the same or better software performances than software installed locally on end-user computers, end-users have no need to buy complete new hardware equipment to run the software, i.e. a simple PDA device with a web browser is enough to run the software (Weinhardt et al., 2011, Fernandez, 2013).

Results of empirical research showed that Omnipresence, the same organizational data that is being present everywhere, is a factor that influences IT-adoption (Bhattacharjee & Park, 2013). Since usage of the CC-infrastructure makes it possible for end-users (who work in SMEs) to work through different devices with the same data, it can be assumed that this omnipresence characteristic of the CC-infrastructure has a positive influencing effect on the Cloud BI adoption by SMEs.

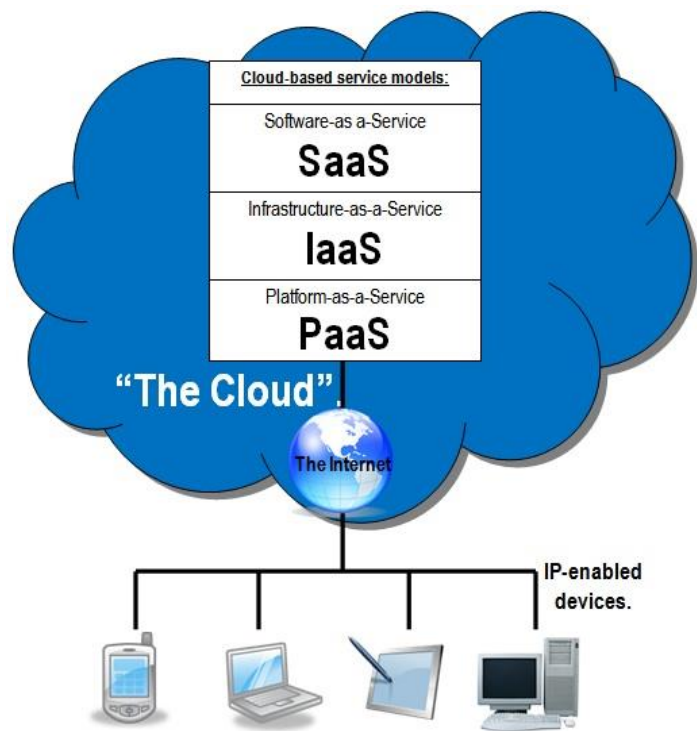


Figure 1 The Cloud Computing infrastructure.

Given this reasoning we can assume that Universal access to resources is perceived as a benefit by SMEs. Therefore the following proposition is stated:

P4: Universal access to resources positively influences Perceived Benefits of Cloud BI for SMEs.

2.2.2 Cost Benefits.

High costs of implementation and utilization of IT-systems can be a barriers for SMEs to adopt it (Sahandi et al., 2012, Beheshtian-Ardekani & Salchenberger, 1988). Lack of financial resources might be a reason for SMEs to not implement IT-systems involving complex telecommunication architecture (Tuunainen, 1998). With the emergence of Cloud BI with the pay-as-you-go or subscription price model (Demirkan & Delen, 2012, Weindhardt et al., 2009, Benlian & Hess, 2011), SMEs can obtain various services without investing in the underlying architecture (Weindhardt et al., 2011, Fernandez, 2013, Benlian & Hess, 2011). The usage of Cloud BI lowers the entry cost barrier for SMEs and allows them to have access to large data centers and other services that otherwise require high capital costs (Marston et al., 2011, Weinhardt et al., 2009).

Empirical research showed that cost advantages of implementation are one of the main advantages of Cloud BI (Benlian & Hess, 2011, Faasen, 2013). Next to cost reduction after the implementation, Cloud BI also has low cost of ownership (Demirkan & Delen, 2012) and lowers switching costs of IT-systems (Bhattacharjee & Park, 2013).

By looking at the research and literature that is discussed in this section, it can be assumed that cost benefits are main drivers for Cloud BI adoption by SMEs. For these lower costs SMEs require less financial efforts for implementation, which increases the organizational readiness of an SME (Kuan & Chau, 2011). Therefore the following proposition is proposed:

P5: Cost Benefits of Cloud BI positively influence Organizational Readiness of SMEs.

2.2.3 Latency and agility.

CC helps to deal with the business agility trend through rapid deployment and possibility for compute-intensive business analytics (Marston et al., 2011). This business agility consists delivering end-users ready-to-consume resources such as software platforms and applications

including the right infrastructure, which gives end-users a faster time to market (Sahandi et al., 2012). This can be perceived as a benefit by SMEs.

Today's cloud solutions should be able to give businesses the possibility to perform business analytics real time (Demirkan & Delen, 2012), these real-time analytics give businesses real-time action based insights (Azvine, Cui & Nauck, 2005). This paradigm is called Real Time Business Intelligence (RTBI) (Azvine, Cui & Nauck, 2005). To perform RTBI the IS system should be able to obtain zero latency in the process (Azvine, Cui & Nauck, 2005), and should have no performance lags (latency issue) in the connection between end-user and the cloud service (Venters & Whitley, 2012). Since CC has these latency and agility characteristics (Marston et al., 2011), it can be assumed that performing BI in the cloud can lead to benefits derived from real time analytics.

According to the literature discussed in this paragraph, the following proposition can be stated:

P6: Latency and agility characteristics positively influence Perceived Benefits of Cloud BI by SMEs.

2.2.4 Scalability.

Cloud BI allows businesses to deal with demand elasticity by its rather easy scalable attributes (Bhattacharjee & Park, 2013, Demirkan & Delen, 2012). Competitors and other institutions in the external area of a business influence implementation for IT as a competitive tool (Ramakrishnan et al., 2012, Marston et al., 2011). For IT-initiatives, including BI-systems, to be successful organizational fit is important (Hong, 2001).

With the scalable attributes of Cloud BI SMEs have the possibility to deploy new arising requirements of resources very fast (Marston et al., 2011, Venters & Whitley, 2012).

Empirical research showed that scalability is one of the main reasons for SMEs to enable IT-initiatives in the cloud (Sahandi et al., 2012), including Cloud BI (Tutureau et al., 2012).

Given this line of reasoning the following proposition is proposed:

P7: Scalability positively influences the perceived benefits of Cloud BI for SMEs.

With these scalable attributes of Cloud BI, it can be assumed that SMEs are better able to deal with the external pressure of competitors and other institutions that pressure SMEs to implement BI-initiatives. Since the emergence of Cloud BI with its scalable characteristics,

SMEs can scale their BI-initiatives easily to their wanted capacity without the fear of great amounts of resources being unused (Venters & Withley, 2012).

According to the results of prior research that is reviewed in this paragraph, the following proposition is stated:

P8: Scalability of Cloud BI moderates the relation between External Pressure and Adoption by SMEs.

2.3 Cloud BI Barriers for SME adoption.

In this section the Cloud BI aspects that are barriers for adoption by SMEs are discussed. In the literature research for this paper two main barriers for SMEs for Cloud BI adoption are found:

- Privacy and data control issues (Marston et al., 2011, Hayes, 2008, Chow, 2009, Abadi, 2009, Sahandi et al., 2012, Faasen, 2013).
- Security and reliability issues (Benlian & Hess, 2011, Bhattacharjee & Park, 2013, Chow, 2009, Abadi, 2009, Faasen, 2013).

2.3.1 Privacy and data control issues.

Once the data is stored in the cloud, the user of the cloud service has no idea in which location the data is stored and which parties could have access to the data (Marston et al., 2011, Sahandi et al., 2012). The server of a cloud service provider can be replicated and placed on different places in the world (Abadi, 2009); this is illustrated in **Fig. 2**.

End-users have uncertainty about issues related to ownership of the data that is stored on the cloud service (Hayes, 2008). End-users also have uncertainty about the possibility to take their stored data with them if they switch cloud service provider (Hayes, 2008, Sahandi et al., 2012), or if their stored data is deleted if they leave their cloud service provider (Chow, 2009). According to research of Faasen (2013) loss of control and lack of vendor trust are two main inhibitors of SME intention to implement a Cloud BI services (Faasen, 2013).

These issues about lack of control of own data stored in the cloud are major worries by end-users (Chow, 2009). These privacy and data control issues can be perceived as disadvantages of Cloud BI. These disadvantages might give resistance to the technological advantages of Cloud BI.

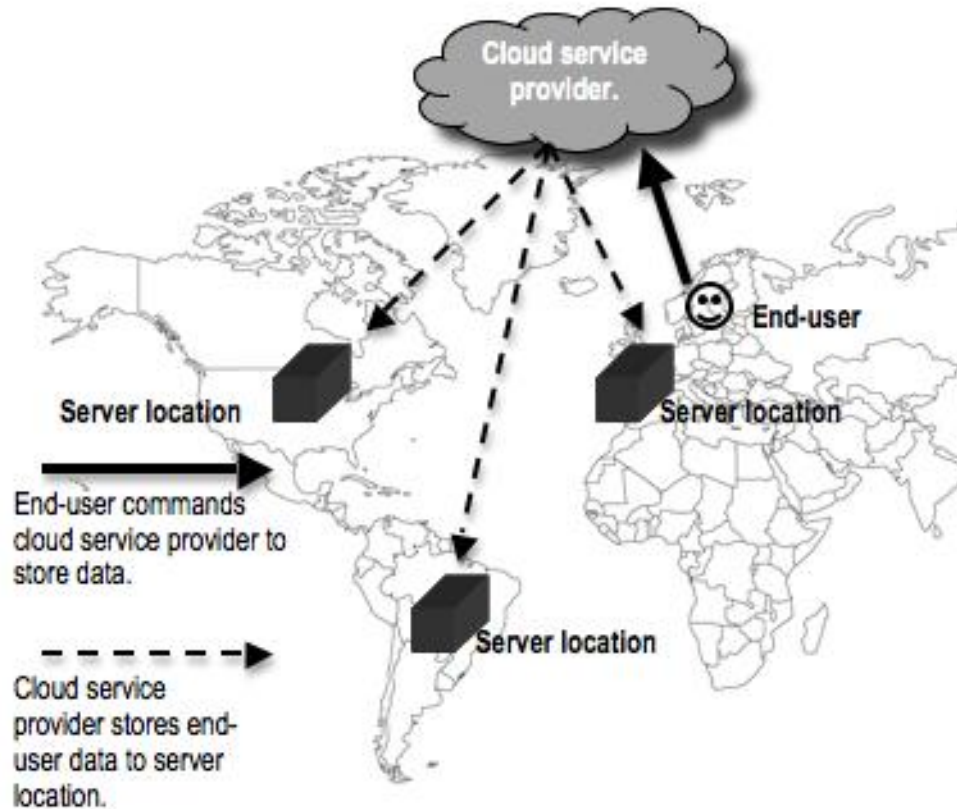


Fig. 2 End-user data can be replicated and placed on several server locations across the world.

According to the literature discussed in this paragraph, the following two propositions are stated:

P9: Privacy issues negatively influence Perceived Benefits of Cloud BI for SMEs.

P10: Data control issues negatively influences Perceived Benefits of Cloud BI for SMEs.

2.3.2 Security and reliability concerns.

According to prior research other main Cloud BI adoption barriers are related to security and reliability concerns (Benlian & Hess, 2011, Bhattacharjee & Park, 2013, Chow, 2009).

Organizations are wary of entrusting providers if they can commit high quality and guarantee availability that is being demanded (Marston et al., 2011). CC resources that are built on cheap hardware commonly have failure (Abadi, 2009). This failure might cause delay in BI activities or loss of valuable data, which affects the advantages of performing BI in the cloud.

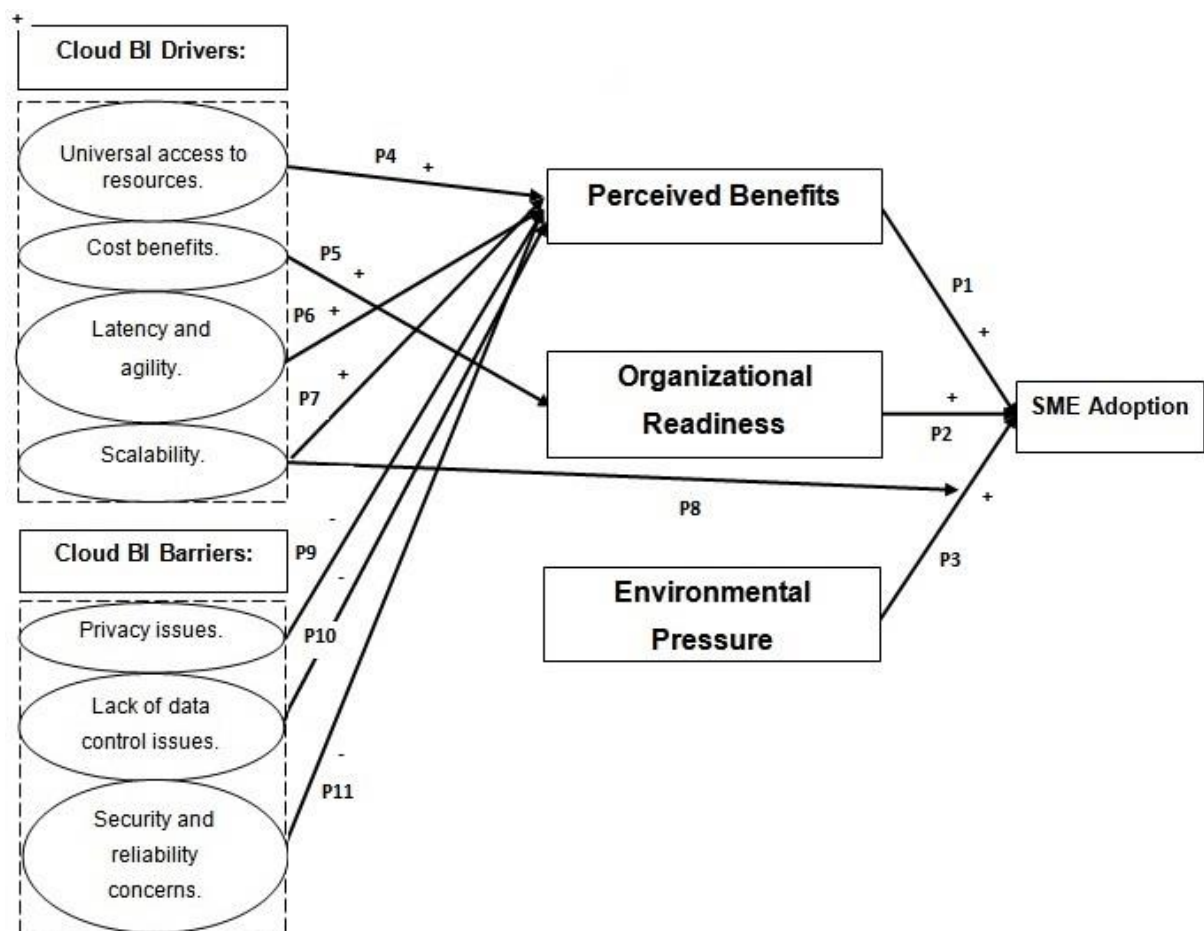
According to an empirical research of Faasen (2013) systems performance and availability risks are inhibitors for SME intentions to adopt Cloud BI services. It can be assumed that if an SME performs BI activities in the cloud, those activities are dependent on the performance of the cloud service provider. To outweigh this form of dependency it is most likely that SMEs should select a cloud service provider that is reliable.

According to the security and reliability issues of Cloud BI discussed in this paragraph, the following proposition is stated:

P11: Security and reliability concerns of Cloud BI negatively influence the Perceived Benefits of SMEs.

2.4 Research model.

According to the investigation done in this paper the following research model with relations and propositions is presented. Relations are found between Cloud BI drivers and barriers and factors that influence adoption by SMEs.



3 Discussion.

3.1 Summary and conclusions.

In this research the Cloud BI drivers and barriers for SME adoption are discussed to answer the research question of this paper:

RQ: What are the drivers and barriers of Cloud Business Intelligence in the adoption process by SMEs?

The research of this paper showed that there are four drivers and three barriers for Cloud BI adoption by SMEs. The drivers for Cloud BI adoption by SMEs are: (1) universal access to resources, (2) cost benefits, (3) latency and agility characteristics and (4) scalability characteristics. The barriers for Cloud BI adoption by SMEs are: (1) privacy issues (2) data control issues and (3) security/reliability issues. These drivers and barriers influence the three factors of SME adoption that form the SME adoption model of Kuan & Chau (2001). This study aimed to identify the relationship of between the drivers and factors of the adoption model and between the barriers of the adoption model.

There are advantages of implementing BI in the cloud that don't exist otherwise. Universal access to resources is one of these advantages. Due to the web-based interface of Cloud BI resources SMEs only have to acquire devices, such as pc's, laptops, PDA's or tablets, that can operate on web-browsers (Fernandez, 2013). Since this was not possible before the emergence of Cloud BI, having access to BI resources at different places and on different devices can be perceived by SMEs as a technologic benefit.

Operating BI in the cloud saves time and costs because implementation of software and hardware is significantly reduced (Seruga & Hwang, 2012). For implementing Cloud BI high investments in software and hardware are not required (Weindhardt et al., 2011, Fernandez, 2013, Benlinan & Hess, 2011). With these cost benefits SMEs have financial resources available earlier (Kuan & Chau, 2001), which is assumed in this research to stimulate the adoption of Cloud BI.

This research also shows that latency, agility, and scalability characteristics of Cloud BI are drivers for Cloud BI adoption by SMEs. These agility and latency characteristics of Cloud BI didn't appear in the technology of regular BI. This helps SMEs to deal with the external pressure that is coming from the emergence of new BI technologies.

With prior literature this research showed the importance for SMEs that scaling their BI resources should not be too difficult (Marston et al., 2011, Venters & Whitley, 2012) and should be flexible enough to perfectly fit for the organization to be successful. SMEs could have the fear that a great part of their investments in BI resources are unused (Venters & Whitley, 2012), but on the other hand it is most likely to assume that SMEs do not want their BI resources to be inadequate. Since the technology Cloud BI has the characteristics that make it for easier for SMEs to scale their BI resources, SMEs could perceive it as benefits. Since perceived benefits are drivers for SME adoption and helps SMEs to deal with the external pressure that requires that their BI resources are sufficient enough.

Performing BI in the cloud also has several disadvantages, which are perceived as barriers for SMEs to adopt Cloud BI. Prior literature and research showed that these main barriers are issues related to privacy, data control, security and reliability. These barriers affect benefits of Cloud BI perceived by SMEs.

SMEs might fear that the information being stored on cloud services could never be deleted (Chow, 2009), for rather classified and sensitive information this could be a serious issue. Since cloud providers decide on which location and on which machines data of end-users is being stored, SMEs could lose control of their data.

It is also important that the technology being used to perform BI is reliable. Prior literature showed that Cloud BI has several security and reliability issues (Abadi, 2009) and that this affects the adoption of by SMEs (Benlian & Hess, 2011, Bhattacharjee & Park, 2013, Chow, 2009).

Empirical research shows that these worries about privacy and loss of their data control are inhibitors for SMEs to implement Cloud BI (Faasen, 2013). The sixth and seventh proposition of this research (P6 and P7) state that these disadvantages of Cloud BI technology are barriers for Cloud BI adoption by SMEs.

3.2 Implications for research and practice.

This research implicates that Cloud BI is a solution to a lot of barriers for SMEs to acquire BI resources. This research also implicates that Cloud BI has risks and negative issues. For that reason the advice according to this research is that SMEs have to investigate what Cloud BI implementation means for their situation and what the benefits and advantages will be.

SMEs that have a lot of employees that work at far geographical distances could consider acquiring Cloud BI solutions that emphasize on universal access to resources. By doing this employees can have access to the centralized Cloud BI resources with multiple devices, for example with their smartphones, tablets, laptops or other resources. By having access with multiple devices employees does not have to return to specific locations where their BI systems are located to perform their BI activities.

For SMEs where lack of financial resources is the major issue, it is recommended to acquire Cloud BI resources that emphasize on low cost. It is possible that Cloud BI resources that cost less perform less than relatively more expensive Cloud BI resources. But if SMEs do not reserve a lot of financial resources for BI activities, it can be a signal that BI does not have a high priority. So when BI activities are on a relatively lower level than other activities in an SME, it is recommended not to do high investments in Cloud BI.

If there is not a lot of time reserved for the implementation of a BI system, the latency and agility characteristics of Cloud BI are the solutions. SMEs for example in the retail sector could have the wish to implement BI resources fast and make contact to their customers really fast. Since Cloud BI resources are mainly web-based, there are not a lot of hardware or software installations required to finally use the BI system.

Another advantage of the fact that Cloud BI is mainly web-based is that it has the advantage of the cloud infrastructure. With all the information stored at one central location (in the cloud) that can be accessed via the web, the lags between different hardware and software systems is eliminated. This increases the latency that SMEs can respond on the market.

SMEs that forecast growth in their activities, and want to perform BI on these activities, should look for Cloud BI solutions that are highly scalable. By choosing these types of Cloud BI solutions SMEs have BI resources that can perfectly fit their demands in the beginning phase. If their demands for BI activities are growing, Cloud BI solutions that are highly scalable could be enlarged as great as the client wants. An advantage of scalable Cloud BI resources is that there are no or minimal changes required in hardware and software and the data does not have to be transported or changed, only the capacity of the Cloud BI resource increases.

SMEs that work with sensitive data should be careful when choosing a Cloud BI service. This research has shown that privacy issues are barriers for Cloud BI adoption by SMEs.

Performing BI in the cloud, which is the internet, brings the danger that due to failures or by working not careful by the SME of Cloud BI service, the data could be leaked locations and parties where it is not supposed to. This way other parties could have a look in SMEs private data and the control of who access to the data and where the data is stores decreases. So the advice is choose a Cloud BI service carefully or to do not perform BI in the cloud at all.

When BI is an important activity for an SME, it is important that the service is reliable.

Storing great amounts of important data on a Cloud BI service makes an SME more dependent on that service. If the Cloud BI service where the data is stored has to deal with system failures or other reliability issues, SMEs should worry and consider if their data is stored safe on that location. The advice from this research to SMEs and Cloud BI vendors is to make clear arrangements about security and reliability. If an SME that spends a lot of time and money in BI activities assumes that the security or reliability of a Cloud BI service is not high enough, the advice is to not perform BI with that service.

3.3 Scientific contribution reflection.

This research gave an overview of the drivers and barriers of Cloud BI and an explanation of the effects, positive or negative, on SMEs. This paper about Cloud BI does not investigate the effects on companies of all sizes, but specifically aims on SMEs. With these results information is revealed about what the effects of Cloud BI characteristics are on the factors of the adoption process of SMEs.

With the adoption model that is used in this paper, the characteristics of Cloud BI can be linked to the adoption process of SMEs. Since the adoption factors are already investigated by Kuan & Chau (2001), the results of this research directly show the effects that the drivers and barriers have on the adoption process of SMEs.

3.4 Limitations of this research and directions for future research.

A limitation of this research is that prices, technologies and implementations of BI and Cloud BI are not examined and compared with each other. With the absence of comparison this research does not have a clear and detailed view of why SMEs should implement Cloud BI instead of regular BI or vice versa.

Another limitation of this research is that no empirical evidence is collected. The propositions that are stated in this research are based on investigations of prior literature. With the absence of empirical data the research model cannot show how strong the relations between the constructs are.

Future research can aim on the prices and technical specifications of Cloud BI which are perceived as technological benefits by SMEs. Since this research only gives a summary of benefits of Cloud BI perceived by SMEs, further research could have a closer look in this direction.

Future research can also aim at how SMEs could deal with the barriers of Cloud BI that are discussed in this paper.

4. Dutch summary.

Dit onderzoek weergeeft de stimulerende en remmende karakteristieken voor de adoptie van Cloud BI door MKB-bedrijven. Daarbij worden deze karakteristieken gekoppeld aan de factoren van het adoptieproces van MKB-bedrijven.

Business Intelligence (BI) projecten implementeren in het bedrijf om betere resultaten te bereiken, was voor de komst van Cloud BI voornamelijk weggelegd voor de grotere bedrijven. Dit met als reden dat deze BI projecten voor het midden- en kleinbedrijf (MKB/SMEs) verschillende drempels heeft. Met de ontwikkelingen op het gebied van Cloud Computing (CC) is het mogelijk om BI projecten op een nieuwe manier uit te voeren, deze combinatie van BI en CC wordt Cloud BI genoemd.

Cloud BI heeft karakteristieken die een stimulans zijn voor MKB-bedrijven om het te adopteren en karakteristieken die de adoptie van Cloud BI door MKB-bedrijven remmen. Het model dat is gebruikt in dit onderzoek om de factoren voor de adoptie van Cloud BI door MKB-bedrijven te verklaren is ontwikkeld door Kuan & Chau (2001) en bestaat uit de volgende adoptiefactoren; (1) Perceived Benefits, (2) Organizational Readiness en (3) External Pressure. De karakteristieken van Cloud BI die een positief effect hebben op de adoptiefactoren, en dus adoptie door MKB-bedrijven stimuleren, zijn; (1) Universal acces to resources, (2) Cost benefits, (3) Latency/agility en (4) Scalability. De karakteristieken van Cloud BI die een negatief effect hebben op de adoptiefactoren, en dus de adoptie door MKB-bedrijven remmen, zijn ; (1) Privacy Issues, (2) Lack of data contol issues en (3) Security and reliability concerns. In dit paper is onderzocht welke effecten van de karakteristieken van Cloud BI hebben op de factoren van het adoptieproces van MKB-bedrijven.

Cloud BI is een mooie oplossing voor MKB-bedrijven waarvoor de implementatie van BI voorheen een zwaar of zelfs onhaalbaar project was. Naast de voordelen van Cloud BI zijn er echter ook nadelen om BI uit te voeren in de Cloud. Het is voor MKB bedrijven belangrijk om specifiek te blijven kijken naar de stimulerende en remmende karakteristieken van Cloud BI die in dit onderzoek zijn aangegeven, dit zal bijdragen aan de discussie of het verstandig is om BI in de Cloud uit te voeren.

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