

The Development That Leads To The Cloud Computing Business Framework

Ms. Neha Tiwari¹ , Dr. Navneet Sharma²

¹Research Scholar IIS Deemed to be University, Jaipur.

²Associate Professor IIS Deemed to be University, Jaipur

Abstract

The present study empirically analyzes the factors that determine the adoption of cloud computing (SaaS model) in firms where this strategy is considered strategic for executing their activities. A research model has been developed to evaluate the factors that influence the intention of using cloud computing that combines the variables found in the technology acceptance model (TAM) with other external variables such as top management support, training, communication, organization size, and technological complexity. Data compiled from 150 companies in Andalusia (Spain) are used to test the formulated hypotheses. The result of this study reflect what critical factors should be considered and how they are interrelated. They also show the organizational demands that must be considered by those companies wishing to implement a real management model adopted to the digital economy, especially those related to cloud computing.

Introduction

Cloud computing has attracted a lot of attention in both business and academic spheres in recent times. This is a service- and applications-related technology run in a distributed network that uses virtual resources and is accessible through networking and Internet standards [1]. Cloud computing has been developed and has evolved out of distributed, grid, and utility computing [2].

There are three main models of cloud service: Infrastructure as a Service (IaaS), based on outsourcing processing and data storage equipment; Platform as a Service (PaaS), which provides developers with a cloud platform to create applications and services; and, lastly, Software as a Service (SaaS), which enables users to access their applications through a

browser instead of installing software on their own computers. The last model provides centralized configuration and hosting as well as automatic updates [3], releasing users from installing and maintaining software and simply allowing them access via the Internet [4, 5].

The following stand out among the benefits for businesses that are regularly attributed to cloud computing: the reduction in software and hardware resource costs and access to services from anywhere in the world [6, 7]; the noncomplex use of cloud-based solutions [8], a scalable [9] market-oriented [10] architecture; the potential to transform business processes [11]; its potential to provide better knowledge management and a tighter link between information systems and management requirements [12] and even its ability to provide competitive advantages, given the reductions in capital outlay and IT-related operating and maintenance costs that enable resources to be redirected toward core business activities [13].

Notwithstanding, the literature also reveals that obstacles and difficulties exist in organizations' adoption of cloud computing, such as reticence regarding information security and protection against nonauthorized access [14, 15], the absence of knowledge on the privacy capabilities of service providers [16], a lack of understanding between the organization and the cloud provider as to service scope and implementation [17], technical barriers [18], and financing problems that companies in certain sectors might have to address the required investment in technology and qualified IT personnel, especially in the case of small and medium enterprises [11, 19].

Bearing the above in mind, the present paper seeks to find the factors that determine cloud computing adoption by organizations. Numerous studies can be found in the literature that address the use of cloud systems in such companies, ranging from technical issues, such as infrastructure security through proposed new architectures and methods [20–25], efficient data management [26–28], performance and quality of service measurement criteria [9, 29, 30], and the issues surrounding interoperability standards and difficulties for their integration and customization [31–33]. In other cases, the backbone of research deals with problems more related to business management issues, such as cloud computing-associated opportunities, costs and risks [34–37], and the importance of trust and data privacy [38–44].

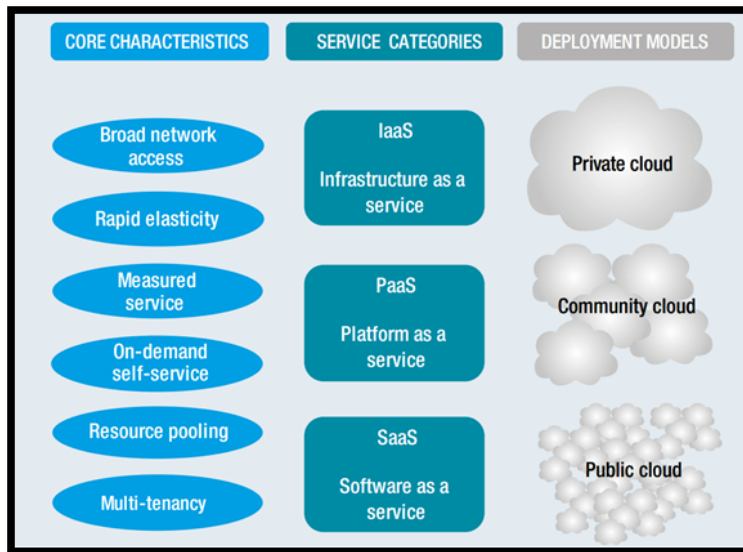


Figure1: Service Categories of cloud

Literature Review

Adoption Models. A range of widely used technology acceptance models can be found in the literature that provide useful frameworks for determining the critical factors or variables that influence user ICT adoption and its use and behavior in organizations [56]. Such is the case of Fishbein and Ajzen's [57] Theory of Reasoned Action (TRA). Adopted in many disciplines, this theory explains that the attitudes toward following a given conduct are positively associated with and predict the intention to adhere to said behavior. Also, the attitudes of others toward a particular technology often influence a person's intention to use the same technology. Ajzen [58] subsequently developed the Theory of Planned Behavior (TPB), adding to the TRA model the beliefs of control and perceived ease of use and behavior control.

This model's key lies in behavior intention and distinguishes between three types of belief: behavioral, normative, and control.

The Davis [59] technology acceptance model (TAM) was subsequently used to find an explanation for the relationship between technology acceptance and adoption and the intention to use it [17]. TAM proposes that perceived usefulness and perceived ease of use are the most critical factors in the technology adoption process and system use [60, 61]. TAM can be considered a special case of TRA in which perceived usefulness and perceived ease of use are considered to be "beliefs and evaluation" that lead to attitude, which in turn leads to intention of use and, finally, to real behavior [62–64]. TAM is a widely accepted model for understanding ICT adoption and usage processes [45] and has been applied in a large amount of research into technology adoption in the organization [65]. TAM consistently explains a large part of variance in the intention of use of a variety of ICT by users in numerous

environments and countries [60, 65–68]. Since it first appeared, the TAM model has been widely analyzed and expanded into different variants. Some of the most important evolutions have been the Venkatesh and Davis [46] TAM 2, the Venkatesh et al. [69] Unified Theory of Acceptance and Use of Technology (UTAUT), for example, applied to mobile applications [70], the Wixom and Todd [71] integrated model of technology acceptance and user satisfaction, and the TAM 3 model proposed by Venkatesh and Bala [68] in the field of e-commerce.

Apart from cloud system adoption and use itself, numerous recent studies can be identified within the information systems area that use TAM to explain the adoption of different technologies. Most of these add other external variables to the original TAM model that are considered to be interesting for the research. Thus, it is frequently used in studies on ERP implementation and use in companies [50, 52, 72–82], applications for e-commerce [83], file digitization systems [84], Internet banking [85], mobile social gaming [86], and e-learning platforms [62, 87–90], among many other sectors. Meanwhile the TOE (Technology-Organization-Environment [91]) framework proposes that technological innovation adoption is influenced by three aspects: organizational context (related to resources and their internal characteristics); environmental context (within which it conducts its business processes); and technological context (formed of organization-related internal and external technologies available in the market used, or not, by the organization). This is a framework for examining adoption of a range of information systems, products, and ICT services on the organizational (and not the individual) level.

TOE is one of the most widespread theoretical frameworks on ICT adoption [93]. It provides a broad overview of technology adoption and application and predicts the impact on value chain activities and the subsequent diffusion of the factors that influence business decisions [39]. However, the weaknesses of the TOE framework may be twofold: TOE's main constructions are not very clear and specific determinants identified within the three contexts vary across different studies [39].

Prior Studies on the Adoption of Cloud Computing.

Focusing on the specific area of cloud computing, some studies based on theories and models such as a TPB and TAM can be found that analyze adoption and use from the end user perspective. Such is the case of Bhattacharjee and Park [110], who study the motivation of end users to migrate from the client-server model to cloud computing, and Giessmann and Stanoevska [111], who analyze consumer preferences in a PaaS method-based study. Also, based on TAM, Behrend et al.

[112] examine student behavior in SaaS method cloud system adoption. Along a similar line, Wu et al. [47, 113] propose an acceptance model that combines TAM with other variables and test it in a university institution.

Burda and Teuteberg [48] examine the intention of a sample of university students to use cloud storage. Based on the TAM model, some external variables are added, such as satisfaction, provider's reputation, familiarity, risk, and trust. The study emphasizes the importance of trust to reduce uncertainty and the perception of risk, which are major obstacles for intention of use. Moqbel et al. [114] also use a sample of university students to apply a theoretical framework based, among other things, on the TRA and TAM models. Aspects are included such as compatibility, social influence, and perceived familiarity. Another recent study by Shiau and Chau [2] uses a multiple model comparison approach to examine university student behavioral intention toward cloud computing. These authors test and unify six theories which exhibited adequate explanatory power: service quality, self-efficacy, motivational model, TAM, TRA/TPB, and DOI.

The number of studies directly related to research on cloud computing adoption in companies and organizations is not yet very numerous, although some can be found with different adoption frameworks.

Finally, the recent study by Gangwar et al. [45] develops an integrated TAM-TOE model that includes a range of exploratory features and is tested using a sample of 280 companies in various sectors in India. The authors suggest that the variables in technological and organizational contexts have a direct effect on the TAM model and, consequently, an indirect effect on adoption. The combined model proposes an indirect impact on adoption of the environmental variables. The conclusions of the study show that all the variables of the three contexts are major determinants of the adoption of cloud computing, whether directly or indirectly.

Main Stream Cloud (Computing) Frameworks

This section presents selected frameworks and architectures relevant to Service Oriented Architecture (SOA) and Cloud Computing, which confirm the top-down relationship between Business Models and IT Services. Additionally four frameworks are used to explain the top-down relationship between Business Models and IT Services.

The majority of literature reviews define a Cloud Computing Framework as a SOA (Foster et al; 2008; IBM 2008; Sun Microsystems, 2009; Leighton, 2009; Schubert, Jeffery and Neidecker-Lutz, 2010; Chang et al. 2010 b) with three types of services:

Infrastructure as a Service (IaaS) is divided into Compute Clouds and Resource Clouds. Compute Clouds provide access to computational resources such as CPUs, hypervisors and utilities. Resource Clouds contain managed and scalable resources as services to users – in other words, they provide enhanced virtualisation capabilities. Hypervisor is one of many virtualisation techniques which allow multiple operating systems, termed guests, to run concurrently on a host computer.

A Reference Model for Cloud (RMC) for integrating Cloud Computing and operation

Chen et al. (2010) present a comprehensive overview of Cloud Computing, and this includes (i) the types of clouds, and key benefits (ii) definition of research clouds, and the proposal of six research cloud use cases; (iii) a review of commercial solutions and cases; and (iv) a review of open source solutions and cases and (v) key recommendations. They include extensive case studies to support their research output, where their Reference Model for Cloud (RMC) is an Enterprise Cloud Architecture for research and industrial practices, and plays a central role in defining research clouds, use cases and added values. RMC defines Cloud Computing as a tower architecture, where the virtualization layer sits directly on top of hardware resources and sustains high-level cloud services. Similar to Buyya et al. (2009) and Schubert, Jeffery and Neidecker-Lutz (2010), their RMC divides clouds into Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) on top of the Virtualisation and Hardware layers presented in Figure 1. The three core layers in the RMC are summed up as follows:

The IaaS layer provides an infrastructural abstraction for self-provisioning, controlling, and management of virtualised resources. In PaaS, consumers may leverage the development platform to design, develop, build, and deploy cloud applications. The SaaS layer is the top of the cloud architectural tower and delivers specific applications as a service to end users. There is a self-managing cloud system for dynamic capacity planning, which is underpinned by monitoring and accounting services. Capacity

The IT Infrastructure Library (ITIL) Version 3 Service Framework

ITIL V3 (Office of Government Commerce, 2007; Hanna et al., 2009) is a framework that describes Best Practice in IT service management. It provides a framework for the governance of IT, and focuses on continual measurement and improvement of the quality of IT services delivered, from both a business and a customer perspective. This includes five processes, each of which is closely related to the others:

- Service Strategy - this provides guidance on how to design, develop and implement Service Management.
- Service Design – this is concerned with the design and development of IT Services.
- Service Transition – this process focuses on the deployment of IT services.
- Service Operation – this ensure that IT services are delivered effectively and efficiently.
- Continual Service Improvement – this process focuses on improving the quality of existing services on continuous basis.

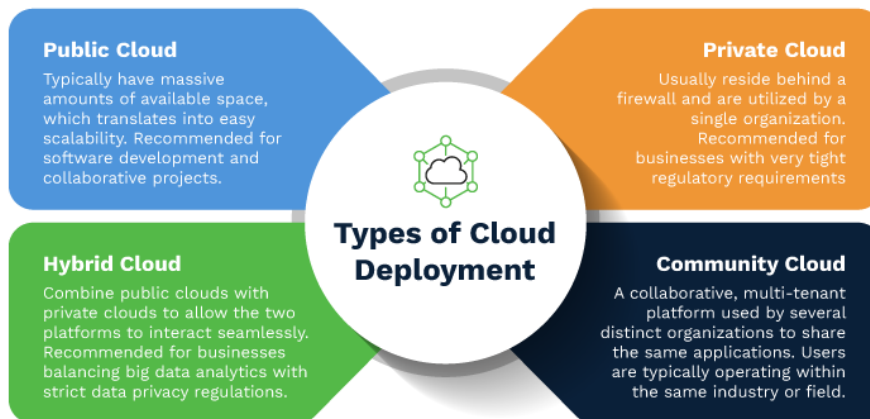


Figure 2: Various types of Cloud Deployments

Service Oriented Architecture by Papazoglou and Georgakopoulos

Papazoglou and Georgakopoulos (2003) explain the concept of Service-Oriented Computing and present an overview of Service-Oriented Architecture (SOA) with Service layers, functionality and roles. Each role is related to its respective services, and all services and roles are linked in the SOA. See Figure 2.

Identifying the important factors to help clarify risk and suitability



Figure 3: Risk and Suitability of Cloud

The Top-Down relationship between Business Models and IT Services

Several industry-led frameworks have emphasised the importance of business models, business processes and business project management that can significantly influence the success of IT projects in terms of management, execution and control. There are several examples, including

Projects In Controlled Environments version 2 (PRINCE2) (OGC, 2009), ITIL V3 (OGC, 2007;Hanna et al., 2009) and IBM Service Oriented Architecture (SOA) framework (IBM, 2008; IBM Certification Programme, 2010).

Projects In Controlled Environments version 2 (PRINCE2) is a widely-used industry framework and methodology, which covers the management, control and organization of a project, particularly for IT-based projects. PRINCE2 2009 edition (Office of Government Commerce, 2009) describes procedures to coordinate people and activities in a project, how to design and supervise the project, and what to do if the project has to be adjusted. Divided into manageable stages, PRINCE2 enables an efficient control of resources. This is relevant to Cloud Computing, since control of resources does not just relate to Quality of Services (QoS) and the Service Level Agreement (SLA), but needs to be addressed from the strategic point of view also.

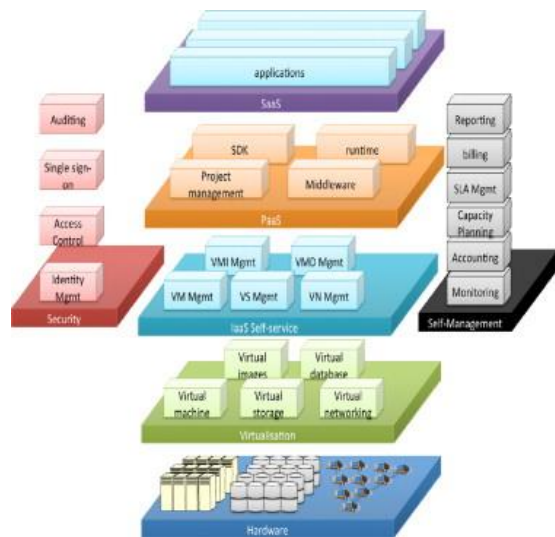


Figure 4: Application of SAAS in Virtual Storage

Cloud Computing Business Overview

Business Computing is an area linking both computing and businesses, and provides insights into how challenges can be resolved in the business context with improvements in efficiency, profitability and customer satisfaction (IBM SOA, 2008). Business Computing is closely related to Cloud Computing, since Cloud Computing offers business opportunities and incentives (Schubert, Jeffery and Neidecker-Lutz, 2010). To understand how Cloud businesses can perform well with long- term sustainability, having the right business models will be essential (Chou, 2009; Weinhardt et al., 2009 a). Thus, this section describes the relevance of Business Models and their influences. winning strategies is critical (Mitchell, 2008). For example, some SME have adopted SAP and have managed well to control their risks and cost saving by the use of SAP Cloud services to consolidate their resources and improve their efficiency (Chang et al.,

2011 e). This illustrates the importance of classifying and adopting the right business strategies and models for long-term sustainability.

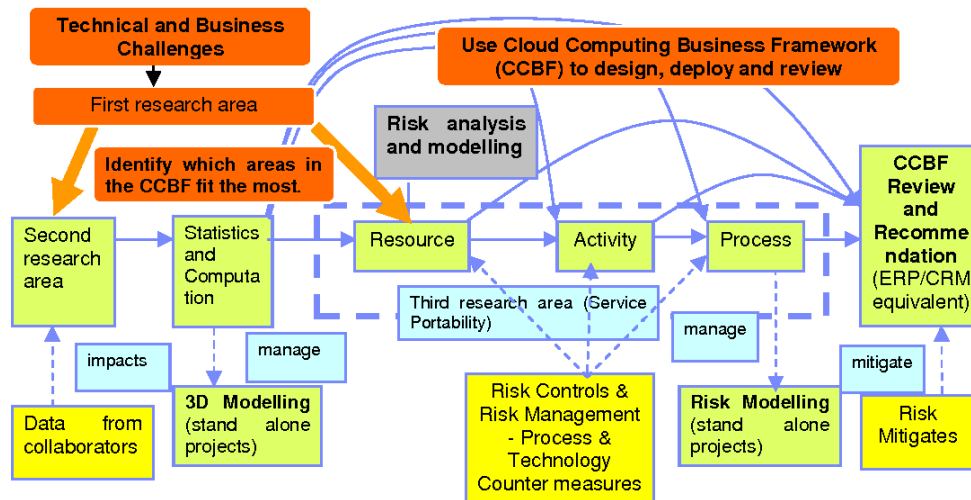


Figure 5: Overview of computing area linking both computing and businesses

Lazonick (2005) presents comprehensive details for a business model and is an influential researcher in this area. Lazonick states that the US government played a critical role in consolidating the US economy after the Second World War, and encouraged collaboration between the academia and industry. In addition, numerous active start-ups in Silicon Valley have helped in improving the economy in the past decades. Many of those start-ups were recipients of venture capital, which helped growth and expansion of their businesses. Some start-ups have become small and medium enterprises (SME), and they have done well by offering a “support and services contracts” model. There were exceptional SMEs such as HP and Cisco who outperformed other businesses, and expanded into global firms through adopting the right strategies for investments, merger and acquisition and integrating their products and services. Lazonick also argues that although IBM is not from Silicon Valley, it has obtained a similar level of achievement to HP and Cisco, and those companies are considered as “All-In-One Enterprises”, as part of this “New Economy” model applicable to all sectors. Based on Lazonick’s insight, there are four business models which can be identified: (i) Government Funding; (ii) Venture Capital; (iii) Support and Services Contracts and All-In-One Enterprises. There are researchers supporting Lazonick’s points. Firstly, Educause (2008) explains the use of the Cloud in Higher Education is an initiative from Government Funding. Secondly, Hunt et al. (2003) demonstrated how the venture capital model has helped technological and Grid-based companies insustaining their businesses. Thirdly, Etro (2009) investigates the EU SMEs that focus on Cloud Computing, and those SMEs who follow Support and Services Contracts models. Lastly, Weinhardt et al. (2009 a; 2009 b) have proposed an Enterprise Cloud model that perfectly explains and fits the “All-In-One Enterprises” model.

Chang, Mills and Newhouse (2007) explain the open source business models and ways to achieve long-term sustainability with several case studies to present and support their arguments. They propose a Support Contracts model, which is very similar to “Support and Services Contracts” in Lazonick’s definition. They also propose a Community model, which acts as a “One-Stop Resources and Services” for vendors, users, stake-holders, resellers and collaborators to interact and gain mutual benefits in a single platform. This allows the building up of a community to consolidate each other’s strength and provide a resource sharing platform. They further propose a “Macro R&D Infrastructure”, where the source of funding is from Government for selected R&D projects, and is considered as a Government Funding model. Their proposal about “Valued- added closed source” (VACS) is similar to the SaaS business model. However, VACS also includes emerging technologies outside open source domains such as cloud computing. Between 2007 and 2010, the rise of gaming, mobile and entertainment industries has made significant impact on the development of ICT. The iPhone and iPad have made phenomenal sales between Year 2009 and 2010, and the mobile and gaming industry has generated billions of income (Brennan and Schasfer, 2010; Turilin, 2010). Facebook has reached more than 1 billion users from Year 2009 and 2010, and is in the stage for initial public offering (IPO). Thus, a new business model,

Criteria of Business Model Classification	Papers
Service Provider and Service Orientation	Buyya et al. (2009) Chen et al. (2010) Armbrust et al. (2009) Weinhardt et al. (2009 a; 2009 b) Schubert, Jeffery and Neidecker-Lutz (2010)
Support and Services Contracts	Lazonick (2005); Etro (2009)
In-House Private Clouds	Schubert, Jeffery and Neidecker-Lutz (2010); Claburn (2009) White papers: Oracle (2009 a; 2009 b); Sun Microsystems (2009); Vmware (2010 a; 2010 b) Note: Hull (2009) – supporting the same idea although he is based on microeconomic points of views only.
All-In-One Enterprise	Lazonick (2005) Weinhardt et al. (2009 a)
One-Stop Resources and Services	White paper: CStTransform (2009); Jassen and Joha (2010); Kiu, Yuen and Tsui (2010)
Government Funding	Lazonick (2005); Educause (2008)
Venture Capital	Hunt et al. (2003); Lazonick (2005)

<p>Entertainment and Social Networking</p>	<p>Madhavapeddy et al. (2010), Maranto and Barton (2010) White paper: IBM (2008), Right Scale (2010) Popular products: Apple iPhone; iPad; TV; iPod nano and Facebook (where the press has much more articles and updates than papers)</p>
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Table 1: Comparison of Various Business Models

Cloud Computing for Business Use

Several papers have explained IaaS, PaaS and SaaS as the cloud business model (Buyya et al. 2009; Chen et al., 2010; Armbrust et al., 2009; Weinhardt et al., 2009 a; Schubert, Jeffery and Neidecker- Lutz, 2010). Despite all having a slightly different focus, all of them are classified under “Service Provider and Service Orientation”, regardless of whether they are IaaS, PaaS, or SaaS service providers, or their focus is on billing, or SLA or CRM, since this is a mainstream model that still has areas of unexploited opportunities. In addition, CC can offer substantial savings by reducing costs whilst maintaining high levels of efficiency (Oracle 2009 a; Schubert, Jeffery and Neidecker-Lutz, 2010). In Oracle (2009 b) and VMware (2010 a; 2010 b) scenarios, both propose “In-House Private Clouds” to maximise use of internal resources to obtain added value offered by CC while keeping costs low. This allows organisations to build their own Cloud to satisfy IT demands and maintain low-costs, and is a new model from a micro economic point of view (Claburn, 2009; Hull, 2009). Successful business models are not restricted to particular sectors or areas of specialisation and can be applicable for businesses including CC businesses. Table 1 on page 6 gives a summary of criteria and supporting papers.

Cloud Challenges in business Context

Armbrust et al. (2009) described technical Cloud challenges, and considered vendors’ lock-in, data privacy, security and interoperability as most important challenges. Security and privacy being areas that require regular improvement, there are also other critical business challenges (Weinhardt et al., 2009 a; 2009 b). There are three business challenges described as follows. Firstly, all cloud business models and frameworks proposed by leading researchers are either qualitative (Briscoe and Marinos, 2009; Chou, 2009; Weinhardt et al., 2009 a; Schubert, Jeffery and Neidecker-Lutz, 2010) or quantitative (Brandic et al., 2009; Buyya et al., 2009; Armbrust et al., 2009). Excluding SLA-based research, there are few whose frameworks or models can demonstrate linking both quantitative and qualitative aspects and for those that do, the work is still at an early stage. Secondly, there is no accurate method for analysing cloud business performance other than the stock market. A drawback with the stock market is that it is subject to accuracy and reliability issues (Chang, et al., 2010 b; 2011 a). There are researchers focusing on business model classifications and justifications for why cloud business can be successful (Chou, 1519

2009; Weinhardt et al., 2009 a;2009 b). But these business model classifications need more cases to support them and more data modelling to validate them for sustainability. Ideally, a structured framework is required to review cloud business performance and sustainability in systematic ways. Thirdly, communications between different types of clouds from different vendors are often difficult to implement. Often work-arounds require writing additional layers of APIs, or an interface or portal to allow communications. This brings interesting research questions such as portability (Beaty et al., 2009; Armbrust et al., 2009). Portability refers to moving enterprise applications and services which can be challenging, and not just files or VM over clouds.

Relationship within Services

Weinhardt et al. (2009 a; 2009 b) propose their Cloud Business Model Framework (CBMF) as a strategic way for all organisations to be successful in cloud businesses. They present four core business cloud elements: Infrastructure, Platform, Applications and Business Model. Each main layer is supported by its core functions and service providers, and is also stacked on top of others. Research questions can be posed and discussed within the Service Level, and can be independent of whether they are Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). This is confirmed by Truong and Dustdar (2010), who demonstrate that work-in-progress and completed work such as classification, modelling, and experiments can be performed at the same time. This means work on each research question is considered as a key area in the framework. Similarly, these can be performed in each of IaaS, PaaS and SaaS. This fits in with Weinhardt et al. (2009 a) suggestions. Challenges in the business context are discussed by Chang et al. (2011 a) and there are research issues associated with Classification, Organisational Sustainability Modelling, Service Portability and Linkage. Each area is relevant to each of IaaS, PaaS and SaaS. Each key area is described as follows.

The fourth key area: Linkage. Linkage between different Services, and between Business and Services

In the IBM SOA framework, services are exported by an Enterprise Service Bus (ESB), which links different aspects of business processes and also provides flexibility that allows business process inefficiencies to be corrected rapidly. The ESB has major advantages over point-to-point solutions in terms of versatility and adaptability because service mediation and routing logic within the ESB are adaptable for different needs. The drawback with the ESB is that defining, writing and validating business processes is complex. One work-around is to use both Business Process Execution Language (BPEL) and Business Process Model and Notation (BPMN) for definition and validation, but this does not simplify the linkage between different services. It also needs personnel with business analyst backgrounds to interpret the problems fully and understand the best route for linkage. In addition, there is a conceptual mismatch between BPEL and BPMN since each was initially created for different purposes (Recker and Mendling, 2006).

IaaS, PaaS and SaaS are connected to Business Models.

Weinhardt et al., 2009 a; 2009 b; Schubert, Jeffery and Neidecker-Lutz, 2010) or quantitative (Brandic et al., 2009; Buyya et al., 2009; Armbrust et al., 2009). Qualitative research focuses on defining the right strategies, business model classifications and support from case studies and user feedback. Quantitative research focuses on billing and pay- as-you-go models, Return on Investment (ROI) calculations and validation supported by experiments or simulations. Each business model, either qualitative or quantitative, is self-contained. Each contains a series of proven hypotheses and methods supported by case studies and/or experimental results. Generally there is no interaction or collaborative work between different models, except the SLA approach. However, costs per usage deals with operational levels and there is a lack of recommendations proposing or standardising the strategic levels. In addition, different schemes, policies and measurements of pricing may differ between SLA techniques. It would be sensible therefore to provide linkage between SLA and research focusing on strategic levels. Therefore, linkage between different Cloud adoptions is required. Etro (2009) and Schubert, Jeffery and Neidecker-Lutz (2010) also state that Cloud strategies and adoption in the EU are different from their peers in the US. Thus, linkage between Cloud business strategies, core businesses, billing models and core technologies need to be strongly established. This also leads Etro (2009) to investigate Cloud Computing economic impacts for the EU, and he develops his own model, using dynamic stochastic general equilibrium (DSGE), to calculate CC economic values and its impacts for the EU economy. DSGE takes on the social and economic factors and SME business models as the foundation of this model. Etro then defines his econometric- based model, and defines what to measure and how to collect data. After data collection, Etro explains his computational results and their impact on the EU, based on calculations and analysis of his data. Thus, he offers linkage between qualitative and quantitative methods, and also links EU SME interests and current status to econometric models.

Characteristics for linkage

Have dynamic, versatile and adaptable characteristics. Linkage should translate different requirements from one domain to another, such as that between IT and business. It should fit into any type of cloud business and any cloud technology. It should fit into any stage of the project, and any situations, status, resources and deployment. Before selecting the best approach, a number of techniques and methods are studied. Etro (2009) started from a qualitative approach, since user requirements and problems can be useful to decide which techniques are to be deployed. A similar approach is adopted by Klems, Nimis and Tsai (2008), who define core components essential for cloud business, and explain where the linkage is necessary. In regard to all these, Table 3 shows the list of studied methods.

Reframing Assessment and the Heptagon models (Hosono et al., 2009) partially fulfil the requirement to establish easy-to-use linkage. They have presented seven elements, in which cost

is an element but normally is funded from Corporate management. Frameworks such as ITIL V3, IBM SOA and PRINCE2 2009 define cost as the top- level business challenge rather than at the operational level, although it is influential on the way operational services can work. The other six elements to review IT projects and determine their status of success can be used for IaaS, PaaS and SaaS. Due to the strategic focus, a different set of six elements for cloud business success will be identified and supported by the literature review. This means in the business model layer, different elements for review will be used.

Methods	Strength	Weakness	Selected?
Enterprise Service Bus (ESB)	ESB links between different aspects of business processes and also provides flexibility that allows business process in efficiencies to be rapidly corrected.	Drawback is it needs a high level of complexity to define, write and validate business processes. A work around is to use BPEL and BPMN.	No. This is because using BPEL and BPMN works well in the laboratory environment. It will be useful to have organisational data before defining and mapping begin.
Dynamic stochastic general equilibrium (DSGE, Etr o, 2009)	Very well-defined in his hypothesis and data. Linkage is established between qualitative and quantitative methods.	Only works for some EU SME because his approach is designed for EU SME and not transferable for business performance calculations on Cloud Computing directly.	No. But this will be selected if this is an economics related research project.
Cloud Business Model (Klems, Nimis and Tsai, 2008)	They define core components essential for cloud business, and have explained why, what and how linkage is made in their conceptual model.	There are no quantitative methods elements, which are crucial for Organisational Sustainability and ROI.	No. Quantitative computation is highly important and cannot be neglected.

Reframing Assessment and heptagon model (Hosono et al., 2009)	They have listed seven core elements for IT project review, and these have been adopted by a few research groups.	Their framework assessment works in their environment and is not designed for the Cloud, but is a generic solution.	Partially. Their model is suitable for types of Services, but not the strategic business model. However, their core elements for project review can be used.
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Table 2: Comparative Analysis of various models

Conclusion

This paper presents the development that leads to the CCBF, and demonstrates CCBF as a working framework as a whole for organisations adopting Cloud Computing. This includes explanations of how different areas within the CCBF work. The top-down strategic relations between the Business Models and IT services are described, which are supported by four different frameworks: PRINCE2 2009, ITIL V3, IBM SOA Framework and Luo et al (2010) VAR framework. Key features and benefits offered by PRINCE2 2009, ITIL V3 and IBM SOA have been used to explain the top-down business and IT relationships. These four frameworks demonstrate that the business model is strategic and acts on the top of operational levels of Cloud Computing. Refer to Figure 4, the top-down approach defines requirements and presents strategic direction. The bottom-up approach is influenced by the Business Model and focuses on delivery of services, where revenues/benefits are crucial for businesses.

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