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## Abstract

*Both the cloud computing and open innovation paradigms represent recent phenomenon and as such many unanswered questions still persist. Indeed cloud computing's full innovation potential may only be fully realised through an open innovation approach. In responding to this research gap we propose a new value creation framework which is based on a review of the literature on cloud computing, innovation, open innovation and value. Taking the framework layer by layer, this paper describes the innovation potential across components capable of offering value to organisations. The main contribution of this paper lies in proposing a framework that seeks to identify best route(s) to value, thus providing a visual mapping to enable organisations determine which cloud computing components, implementations, solutions and innovation approach is most suitable for value attainment.*

Keywords: cloud computing, innovation, open innovation, value

# 1 Introduction

Although neither the premise nor the foundations of cloud computing are new (Gong et al., 2010), cloud computing represents a set of emerging technologies, implementations and ecosystems that are still rapidly evolving. Cloud computing has built its foundations "on decades of research in virtualisation, distributed computing, utility computing, networking and more recently web and software services" (Vouk, 2008). Recently it has been argued that "the real strength of cloud computing is that it is a catalyst for innovation and in keeping with Moores Law, as cloud computing becomes more cheaper and ubiquitous further opportunities

for innovation will manifest" (Brynjolfsson et al., 2010). Yang and Tate (2012) argue "that value and implications of cloud computing are still under-recognised in business disciplines".

The traditional vertically integrated model of innovation, commonly referred to as a closed innovation model (Chesbrough, 2003a) describes the process of commercialising innovations solely within the confines of the organisation. More recently, millennial organisations have been proactively seeking alternative approaches to the 'closed' innovation process. This is evidenced by "studies of technological innovations created outside organizations and contemporary phenomena such as open source software and crowdsourcing"(Bogers and West, 2012). Open innovation involves organisations co-operating across organisational boundaries in order to commercialise innovations in their pursuit of value and competitive advantage. Like open innovation, cloud computing involves collaboration between firms, suppliers and customers as evidenced by Amazon's and Salesforce.com's cloud computing offerings. Amazons cloud computing services have been labelled as a 'open co-innovation model' and Salesforce.com cloud computing services have been labelled as a 'qualified co-innovation model' (Iyer and Henderson, 2010).

While some research has been carried out in order to determine how organisations can reap the benefits associated with cloud computing e.g. (Zhang et al., 2010, Brynjolfsson et al., 2010, Armbrust et al., 2010, Weinhardt et al., 2009, Buyya et al., 2009), there is no empirical study which has examined how the principles of open innovation could complement a cloud computing approach for the creation of value. Nor has research looked at how individual components of the cloud computing model layers are more conducive than others for the attainment of value. Thus it is the objective of this study to explore the notion of cloud computing, its applicability, implications in a multiple partnering project ecosystem in order to identify key cloud centric enablers of value and ascertain the model of innovation utilised in the process. The remainder of the paper is structured as follows. The next section presents building the theoretical framework, followed by a description of the research methodology and future project steps.

# 2 Building the Conceptual Framework

For our theoretical base, we propose a layered 5-4-3-2-1 conceptual framework model. Figure 1 depicts a potential pathway to value. The framework model provides a useful lens with which to identify key cloud-centric enablers of business value and the method of innovation utilised in the process of its attainment. Taking the framework layer by layer, this paper delineates the innovation potential across components.

## 2.1 Value Layer

The concept of 'value' has been well traversed in business literature. According to Dominguez-Péry et al., (2011) "value creation has been discussed through technological and innovation logic". Both cloud computing and open innovation broaden the traditional view of technological innovation as both paradigms entail novel methods of technological collaboration and exchange. Cloud computing may offer a new architecture for fostering innovation and introducing new business value propositions. Platform technologies such as cloud computing possess the potential to create considerable value when they are broadly accepted, however a difficulty exists with regard to the establishment and the

advancement of these platforms (Chesbrough, 2003b). Chesbrough (2003b) proposes that an organisation can overcome such challenges by 'opening' up their innovation processes to external organisations. This synergistic partnering may be viewed as an instantiating solution to capitalise on external knowledge capabilities in order to accelerate business value and innovation.

## 2.2 Cloud Computing 5-4-3 Stack Model Layers

According to Mell and Grance (2010), as proposed by the proposed by the American National Institute of Standards and Technology (NIST), cloud computing may be defined as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (for example, networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction." This description is specific in detailing cloud computing as comprising five essential characteristics, four deployment models, and three service models. It is this definition and delineation that we employ in this paper, in particular, what we term the cloud computing 5-4-3 stack model consisting of the essential characteristics layer, the deployment model layer and the service model layer (Clohessy, Acton and Coughlan, 2013).

### 2.2.1 Essential Characteristics Layer

This base layer contains 5 well-described components that underpin the dogma of cloud computing. Numerous aspects buttress this layer, such as user -friendly user interfaces to cloud services and applications, network optimisation, security, resource sharing techniques, system virtualisation and leverage of existing best standards in distributed computing (See Vouk, 2008, Vaquero et al., 2009, Gong et al., 2010, Buyya et al., 2009). Certain components such elasticity provision and resource pooling are provision-dependent, meaning that it is the role of the cloud provider to provide their functionality. The manifestation of these 5 characteristics in an organisation is largely dependent on the deployment model utilised.

### 2.2.2 Deployment Model Layer

There are primarily four cloud deployment models, public, private, hybrid and community. According to Garrison et al., (2012) organisations may fail to capitalise on the benefits associated with cloud computing "if cloud deployment is ineffective". The innovation value to an organisation rests with the cloud deployment model that best fosters an innovation process that promotes a greater focus on increasing core competencies while balancing this focus with the cost of cloud -based services. Take for example, a hybrid cloud which constitutes a combination of both public and private cloud deployment models. An organisation may choose a hybrid cloud model in order to achieve the extra capacity afforded by a public cloud whilst also capitalising on the benefits afforded by an 'isolated' private cloud environment (Garrison et al., 2012). The manifestation of innovation potential is largely dependent on the choices made in the upper service model layer.

### 2.2.3 Service Model Layer

This layer comprises the 3 well-established cloud computing service models commonly referred to as the SPI (Software, Platform, Infrastructure) model describing each as a service (Gong et al., 2010, Mell and Grance, 2010, Vaquero et al., 2009). The

innovation value of this layer is dependent on the choices made by organisations in the immediate sub deployment model layer. Innovation can be facilitated by channelling various outbound organisational services through one of the SPI components, and is dependent on the business focus of the organisation.

Based on the aforementioned analyses the following propositions are delineated.

**Proposition 1:** The deployment model layer and service model layer of the cloud computing paradigm play pivotal roles in creation of an innovation pathway(s) to value.

**Proposition 2:** Discrete individual components of each cloud computing layer are more conducive than the others in the creation of an innovation pathway(s) to value.

## 2.3 Innovation Layer

Over the last decade, innovation research literature has witnessed a considerable debate concerning the merits for organisations in adopting a 'closed' or an 'open' approach to innovation (See Almirall and Casadesus-Masanell, 2010, Hertzog, 2008, von Hippel and von Krogh, 2003, Chesbrough, 2003a). Enkel et al., (2009) propose that "as innovation largely stems from a recombination of existing technologies, solutions and knowledge, an important source of innovation will be companies from other industries". It is therefore necessary to juxtapose the dichotomy of the open and closed innovation approaches.

According to Chesbrough (2012), the traditional model of innovation may be viewed as 'closed' as "projects can only enter in one way, at the beginning from the company's internal base and can only exit one way, by going into the market". Closed innovation calls for "deep vertical integration" (Chesbrough, 2003a, p.29). Closed innovation is characterised by internal investments in R&D and in core competencies such as talent acquisition for the purpose of producing valuable innovations that may or may not make it to market. AT&T Bell laboratories have been cited as an 'exemplar' of the closed innovation model (Chesbrough et al., 2006, p.2). Enkel et al. (2009) propose that a "closed innovation approach does not serve the increasing demands of shorter innovation cycles and reduced time to market". Chesbrough (2003b) argues that 'erosion factors' such as the increased access to a mobile knowledge workforce "have rendered the internally focused model of closed innovation obsolete in most industries". In addition to this, the recent global economic downturn has resulted in organisations favouring more agile and less capital intensive technological approaches to their innovation strategies.

Open innovation represents a recent paradigm shift from the closed paradigm (Chesbrough, 2003a). It has been argued that organisations that actively engage in an open innovation process may be rewarded with valuable strategic innovations that furnish a competitive advantage (Lichtenthaler and Ernst, 2006). Chesbrough et al. (2006, p.263) outline the merits of a 'value network' with partnering organisations and that the ability of an organisation to capture value from early stage technologies is largely dependent on the willingness of the innovating company to "link other parties like customers, suppliers, complementors and competitors to the commercialisation process". An organisation's capability to create and capture value is enabled by utilising technology created by others, or by allowing others to use their technology (Chesbrough et al., 2006).

Van de Vrande et al. (2009) distinguish a number of 'technology acquisition' and 'technology exploration' practices and predict that in the future small and medium

enterprises (SMEs) will increasingly make use of open innovation processes and their networks in order to secure missing innovation resources. According to Van de Vrande et al. (2010), as open innovation is a consequence of managerial practices that encompass integrative innovation management activities such as business strategy, collaborative agreements and innovation partners, further research is required into the open innovation domain with regard to external technology acquisition and cooperation.

To capture the concepts of open and closed innovation, we consider an innovation layer composed of two innovation sub-layers, open and closed. However, we propose that there are more pathways to value creation through openness in innovation in contrast to a closed innovation approach. As a consequence, the open innovation layer is awarded a more prominent visual sizing in our framework model. Thus, another proposition is presented:

**Proposition 3**: In contrast to a closed approach, openness in innovation facilitates more pathways for the attainment of value with cloud computing.

# 3 Research Approach

The study will adopt a case study approach for the operationalisation of the framework in order to construct a visual mapping of routes to value. The study will initially involve a single in-depth case study of a multiple cloud partnering project ecosystem. Empirical data will be collected over an 8 month period from August 2013 to March 2014. The primary data collection sources will entail face-to-face semi-structured interviews, questionnaires, documentary evidence and observation of work practices. Relevant documentary evidence such as emails, budgets, and meeting minutes, will also be collected. We will use a triangulation approach (Denzin, 2006, Morse, 1991) in order in order to facilitate the validation of the data obtained.

## 3.1 The Case

The initial case is a multinational information technology corporation that provides technologies and software solutions to consumers and enterprises. The corporation has been developing software in Ireland since the 1970s and currently offer a number of cloud offerings which encompass private, managed and public cloud services. The corporation also provides a cloud partner ecosystem which permits their partner organisations to enhance their own cloud offerings in an attempt to attract new customers and gain entry into new markets. The cloud partner ecosystem consists of a set of tools, documentation, support and best practices provided by the case corporation. In this study we propose to analyse five partnership projects within the case corporation.

The profiles of the five projects shall differ in terms of the service model and deployment model utilised. The case study interview process will compromise two parts. Part 1 will deal with the evaluation of **proposition 1** and **proposition 2,** and the theme of the semi-structured interviews will focus on an account of a cloud partnering project and the value creation opportunities offered by cloud services among cloud partners. Interviewees will be persons with strategic management positions within the company and from partnering companies, and will provide an opportunity to explore different cloud deployment and service partnering environments. The interviewees will be encouraged to tell the story of the project from idea conception to commercialisation in order to facilitate in the elicitation of an in-depth narrative. Part 2 will focus on **proposition 3**, with semi-

structured interviews concentrating on an account of the partnering organisations' approaches to open innovation in a cloud computing ecosystem. This part will encompass such topics such as the expected benefits, benefits derived, challenges encountered, knowledge transferred, managerial approach, tools utilised, traditional innovation approach utilised by each company prior to the project, partner selection process and organisational relationship with each partner. The research findings will enable us to define categories of circumstances under which value creation is likely to be greater. Figure 1 depicts a potential pathway to value.

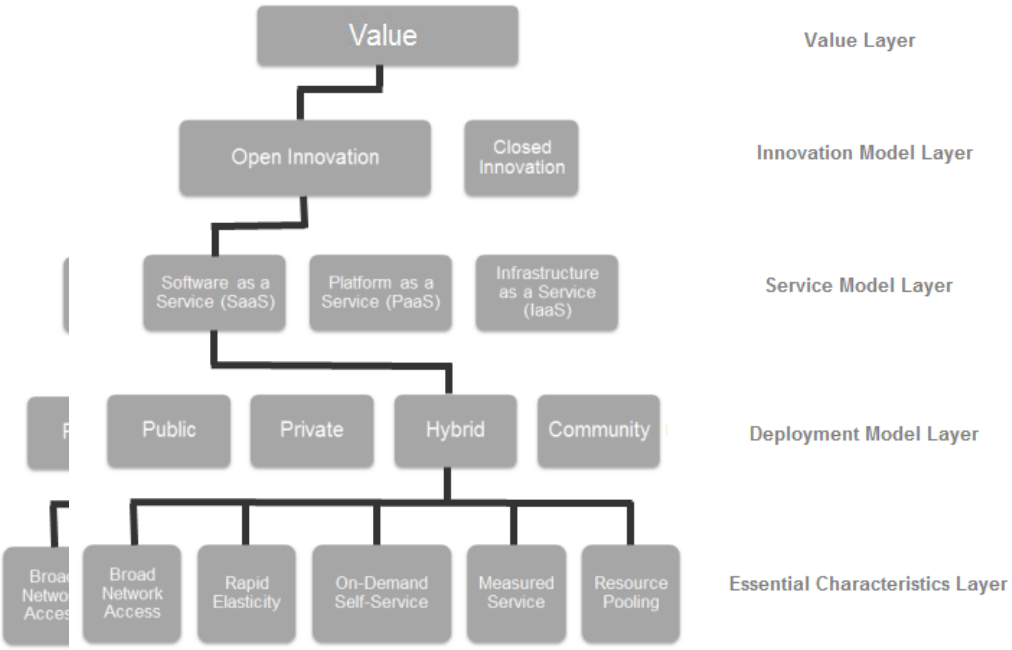


Figure 1: Conceptual 5-4-3-2-1 Framework Model

# 4 Future Steps

This paper outlined research in progress aimed at exploring the applicability and validity of utilising cloud computing as a means of attaining value through open innovation in a multiple-project environment. Each project will be examined in the context of the cloud computing innovation framework. When completed the research hopes to make a number of contributions. First, it will provide an empirical validated version of the framework proposed in this study. The contribution of this framework will be threefold. It will be tailored towards a cloud computing partnering ecosystem. Second, the study will identify which cloud computing components are more conducive to innovation than others, thus awarding them a more prominent sizing in the framework. Finally, the study will provide insight into the innovation value of discrete components of the conceptual framework that facilitate the creation of an innovation pathway through the model, a 'visual map', that an organisation may traverse in order to facilitate the attainment of value.

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