

From Enterprise Architecture to Cloud Computing: A Decision-Support Model for Functional Block Outsourcing

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Abstract: The Information Systems opening to the cloud computing has become a strategic choice for enterprises. In fact, the rapid evolution of competitiveness and innovation and the diversity of technologic offers incite IT decision makers to look for decision support tools helping them for the adoption of new solutions and services such as Cloud Computing. This article introduces a maturity assessment model of an information system architecture functional block that can be outsourced to the Cloud. Based on the best practices of enterprise architecture and information systems governance, the basic criteria of activities outsourcing, and the cloud computing adoption requirements, this model is built around four modules: the block scope identification, the outsourcing opportunity, the cloud computing architectural requirements, and governance and control. Thus, this model will provides new benefits for opened Enterprise Architectures to new technologies.

1 INTRODUCTION

The Business-IT alignment is a key success for companies seeking continuous improvement of competitive advantage and service quality, optimizing costs, and increasing productivity. In this sense, organizations are looking to focus on their business core and adopt task-shifting approaches savings efforts or expense.

Outsourcing is the practice of buying a product or a service that was produced or made internally by a provider, or an external source (Ordoobadi, 2003). IT outsourcing is an act of delegation or transfer of part or all IT power as well as decision-making related to, business processes, internal activities, and services to external providers which develop, manage, and administer these activities in accordance with agreed deliverables, performances, standards, and results (Dhar, 2012).

Considering technological market supply multitude, core skill activities mastery concerns, and new solutions evaluating expertise lack, enterprises have a major challenge deciding on outsourcing a component of their Information Systems (IS) to new solutions such as Cloud Computing.

Constituting a new service model, cloud computing is characterized by three service models:

SaaS (Software as a Service), PaaS (Platform as a Service), and IaaS (Infrastructure as a Service); and four deployment models: private cloud, community cloud, public cloud, and hybrid cloud (El Haloui et al., 2015; NIST, 2011). The cloud computing option enables to take advantage of its benefits such as reducing capital expenditures, efficiency of internal processes, employees productivity increase, customer service improvement, lower inventory costs, and better coordination with trade partner (Andrikopoulos et al., 2013; Gangwar et al., 2015). That is why IT teams quickly reacted to develop strategies that align and support the use of cloud in the company (RightScale, 2014). The Cloud is not a solution for everything, we need to identify the strategic sourcing methodology according to our maturity and our needs (Goel and Singh, 2015). We also need to understand the compatibility level of cloud technology with the existing architecture (Gangwar et al., 2015).

The literature study shows that there is a lack of support tools for the decision making about a functional component to cloud computing outsourcing based on the assessment of its maturity.

This article introduce a transformation model based on the maturity of the functional block (elementary functional component) of an IS

architecture. The remainder of this article is organized into five sections. Section 2 presents an overview of Information Systems Urbanization and its connection with the maturity framework. Section 3 presents a macro classification of outsourcing criteria identified from the literature review. Section 4 deals with the transformation concept and the Enterprise Architecture layers impacted by the transformation of a functional block. Section 5 presents our model. Section 6 summarizes related works. Finally, Section 7 concludes the article and provides some indications on future work.

2 ENTERPRISE ARCHITECTURE AND CMMI

Information Systems Urbanization (ISU) or Enterprise Architecture (EA) is a concept inspired by town planning and used in IS (El Haloui et al., 2015; Common framework, 2012; Longép , 2009). It refers to a meta-model allowing describing all the knowledge of an IS. It allows a company to develop an evolution plan of its IS in short, medium or long terms. ISU approach defines five views to the IS:

- **A Strategy View**, describing strategic missions and objectives of the IS;
- **A Business View**, describing processes, activities, and organization penetrated;
- **A Functional View**, describing IS use cases and information manipulated independently of technological choices;
- **An Applicative View**, describing software components (e.g., applications) kept as well as their interdependencies (flux, software architecture, etc.);
- **An Infrastructure View**, describing the physical resources and the deployment.

As an aerial city view, the functional layer of this framework is structured into zones (Domains) which are subdivided into neighborhoods (Functional areas) that are composed by blocks. A block is a uniform and consistent set of business objects and features. The block is a functional element whose granularity is the thinnest of the IS. It corresponds to a functional entity replaceable, modular information system (Common framework, 2012; Longép , 2009). The Block is the basic functional component of a functional IS architecture.

The Capability Maturity Model Integration (CMMI) models are collections of best practices that help organizations improve their processes. These models are developed by a group of experts from

industry, the US government, and the Software Engineering Institute (SEI) (CMMI, 2010). The CMMI model is presented in staged or continuous representations. Continuous representation use allows to reach "capacity levels" while staged representation use allows to reach "maturity levels" (Basque, 2010). CMMI enables an organization to identify the areas that will bring the greatest return on investment and show where immediate action will have an impact (Kent Crawford, 2006).

For our purposes, the aim is to measure the maturity of a functional block to be outsourced to cloud computing. The qualification criteria of this basic component will be identified through the following sections.

3 ACTIVITIES OUTSOURCING: LITERATURE REVIEW

The literature study on activities outsourcing approaches and models enabled to identify the key factors and the criteria adopted for an activity outsourcing. Table 1 summarizes the main characteristics extracted from studied activities outsourcing models helping an organization to make a decision.

The review of different factors and criteria of outsourcing leads to identify the major points of view on which an activity outsourcing should be based on. These criteria can be categorized into four main groups as follows:

- At the strategic view: Need to examine the strategic importance of the activity as well as its competitive value (an activity in the business core must remain internal).
- At the economic view: The cost of external production must be competitive compared to internal one. Also, it is important to address the hidden costs.
- At the environment and quality view: Need for availability of providers, competition, technology efficiency, skills and expertise of external providers, and therefore market maturity to be able to outsourcing,
- At the risk view: requirement to master risks of subcontracting dependency, competition, information security, loss of management control, and outsourcing process in general.

The criteria families identified may be supplemented or adapted depending on the context and according to the company's business.

Table 1: Activities outsourcing factors and criteria.

Analyze view point	Outsourcing Factors and Criteria	References
Strategic	Company's Competitive advantage	Wernerfeldt, 1989; Barney, 1991
	Business core activities compared to non-business core activities	Gardiner and Monroe, 1994; Ordoobadi, 2003
	Activity strategic importance	Brandes, 1994
	Outsourcing as a mode of governance	Jahns et al., 2006
	Operational feasibility study, strategic analysis	Lakhal, 1998
Economic	Policy approach and the cost-based approach	Ford et al., 1993
	Saving production and transaction costs	Quinn and Hilmer, 1994; Dartina, 1994
	Carrying out activity cost	Brandes, 1994
	Cost and return on investment analysis	Lakhal, 1998; Ordoobadi, 2003
Risk	Risk costs involved in outsourcing.	Williamson, 1975; Williamson, 1985
	External provider(s) dependency Risk	Brandes, 1994
	Information security, Concerns and loss of management control	Wang et al., 2008
Environment and quality	R & D capacity, managing capacity, and competition degree.	Kurokawa, 1997
	Outsourcing proper implementation	Lankford and Parsa, 1999
	Volume and company experience, change in product specifications frequency, and market suppliers competition	Walker and Weber, 1984
	Quality and maturity of technological process and its role in the competitiveness	Welch et al., 1992; Kurokawa 1997
	Case-Based Reasoning	Mclover and Humphreys, 2000
	Good quality of service and good relationship	Wang et al., 2008

The literature review of outsourcing of activities has identified a set of methods, models and factors. This constitutes the basic elements for taking a rational decision for IT outsourcing. However, these criteria still not yet complete for global visibility for outsourcing a component of the IS architecture to cloud computing. Other criteria will be identified in the following sections.

4 INFORMATION SYSTEM'S TRANSFORMATION

A Functional block of an urbanized IS architecture is constructed through a project which constitutes a transformation to the target company IS architecture. This action impacts some elements on the IS architecture (Common framework, 2012). The elements which are concerned by this transformation are as follows:

- At the strategy view : financial resources and strategic priorities
- At the business view : Business process
- At the Functional view: Functional Areas

- At the Applicative view: Applications and associated platforms
- At the Infrastructure view: physical equipment (hardware, network ...).

Other impacts are also cited (Common framework, 2012; Wang et al., 2008) which concern the transformation of an IS component such as legal, political, economic, financial, and security impacts. We identify that the transformation by internal or external realization of a functional block requires to take into account these elements at different layers concerned of the target IS architecture. The aim is to ensure the agility and the easy integration or dissociation of each IS architecture block. It is therefore important to help IT decision-makers wishing to start a transformation of a part or all of there is.

5 PROPOSED MODEL

Through the study of different outsourcing models, cloud adopting models and IS transformation approach we concluded that there is no one which

support organizations decision about outsourcing a functional component of its urbanized IS architecture to a cloud computing platform. Figure 1 provides an overview on the position of the proposed model. This model is a maturity assessment and decision support tool for the opening of enterprise IS on cloud computing (El Haloui et al., 2015). It will assess the ability (maturity level) of a functional block to be outsourced to Cloud as well as the projection of its governance in a cloud environment such as piloting its exploitation and mastering its inter-provider migration and consider a possible return to the inner-platform.

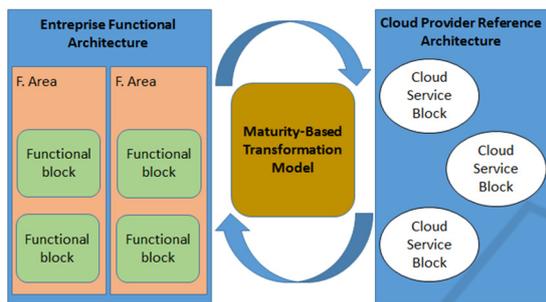


Figure 1: Maturity-Based Transformation Model (El Haloui et al. 2015).

Layers and evaluation criteria that constitute this model are based on the main factors and criteria of outsourcing raised from the studied models and methods (Ordoobadi, 2003; Boukherrroub et al., 2012), joined with the good practices of EA and IS governance (Cobit, ITIL) as well as the CMMI Maturity repository. The objective is to provide to enterprises a simple way helping to decision making in order to outsource a functional block to the cloud.

Our model is structured in assessment modules, these modules are made up of layers or views. Each view is checked through a set of criteria. The decision matrix will be based on the level of coverage of assessment criteria. The identified assessment layers are illustrated by the Figure2.

Our proposed model is structured around four assessment modules:

- **Scope identification module:** this module focuses on the verification of the correct definition of the functional block and processes to outsource, identifying its interactions with other blocks and the delimitation of data repository handled by the block.
- **Outsourcing opportunity module:** this module is based on the assessment of the strategic importance of the block-related activities, assessment of outsourcing economic gains,

checking the context of the company and the availability of desired suppliers as well as the market maturity, and reviewing the risks related to this outsourcing.

- **Cloud requirement module:** this module consists of checking in advance the ability of the block against business, functional, applicative, and infrastructure requirements of a cloud environment.
- **Governance and control module:** this module consist in a checklist for the capacities of monitoring, support, control of quality, and continuous improvement by projection of outsourcing.

At each layer of a module, the evaluation criteria are structured on objectives to fulfill by a functional block. It enable to measure its maturity for outsourcing. As an example, Table 2 presents a set of criteria required by the outsourcing opportunity module.

The elaborated model is a structured approach based on standards and best practices in the field of IT as well as the best approaches of outsourcing. This model allows to highlight the main stages as well as the assessment layers of a functional block intended for cloud computing. This structuring in assessment modules and layers adds value to existing methods by providing a simple, global, and proactive vision for better decision making in the case of IS opening to Cloud.

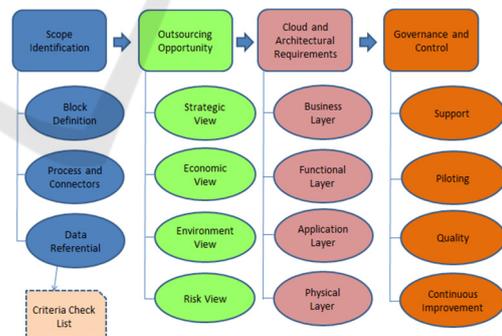


Figure 2: Transformation Model - Assessment Layers.

The scope of this paper is limited to the presentation of the components of our model and the introduction of criteria check list. The identification of maturity level, the decision matrix, and the validation on a practical cases will be the subject of future work.

Table 2: Example of criteria check list.

Module	Layer Id	Layer	Criterion Id	Criteria
Outsourcing Opportunity	2.1	Strategic View	2.1.1	The sub-process is qualified not core of competency activity
			2.1.2	Product or service outsourcing added value to customers is identified
			2.1.3	Outsourcing is aligned with the strategic choice of the company
	2.2	Economic View	2.2.1	External realization (acquisition) cost is qualified cheaper than internal one
			2.2.2	Declining fixed costs is enhanced
			2.2.3	Technologies, material, and human resources investment optimization is projected
	2.3	Environment View	2.3.1	Checked outsourcing market maturity (availability of suppliers, competition, ..)
			2.3.2	Production process more developed than the internal one (technology, skills, resources, ..)
			2.3.3	Mature regulatory and legal context
	2.4	Risk View	2.4.1	Information security controlled
			2.4.2	Handled management control loss risk
			2.4.3	Managed skills and expertise loss risk
			2.4.4	Mastered employees trade union or moral risk
2.4.5			Mastered response flexibility to product / service request fluctuations risk	

6 RELATED WORKS

(Khajeh-Hosseini et al., 2011) proposes a decision support model that focuses on potential cost saving from using Public IaaS. This tool enables to get a vision on cost gains in terms of price and indirect costs generated by profit and risk management. However, it does not deal with the functional aspect of a company IS architecture and it does not address organizational and piloting aspects of an activity in Cloud Computing.

(Gangwar et al., 2015) propose a model that aims to identify factors influencing the adoption of cloud computing in organizations based on the integration of TAM (Technology Acceptance Model) and the Framework TOE (Technology Organizational Environmental). This approach enables to identify that the competitive advantage, the technological compatibility, the complexity, the organizational structure, the preparation, the engagement of top management, and the resources training are the main factors influencing the adoption of Cloud Computing. However, this model focuses on factors influencing the adoption of cloud computing but do not address a partial IS outsourcing or the maturity of an IS system component candidate for Cloud outsourcing.

(Wang et al., 2008) proposes a multi-criteria

method based on AHP and ELECTRE III method developed for IS outsourcing. This approach uses economic, strategic, quality assurance, and risk management criteria to classify potential providers. But it does not address the organizational aspect nor cloud computing requirements.

Most of available works are interested in cloud adoption or applications migration to cloud and the different types of solutions available. However, they have very little interest to a prior assessment of the ability of an IS functional block to be outsourced to the cloud and that by offering organizations a proactive visibility on this transformation.

7 CONCLUSIONS

The elaboration of the functional architecture of the information system is an essential step in the system evolution and the integration of new technologies. The outsourcing of an information system component or the adoption of a solution such as cloud computing requires a prior evaluation of this action in order to retain a thoughtful and flexible choice. The model presented constitutes a conceptual basis of a simple and convenient tool helping professionals to assess a building block of the information system. The purpose is to identify

this block's maturity to be outsourced to the cloud. Future work will include the finalization of evaluation criteria completion, maturity matrix and decision-making and the evaluation of the model on practical cases.

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