ORGANIZATIONS ARE GOING TO THE CLOUD: WHICH COMPETENCES FOR THE IT MANAGER?

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ABSTRACT
Cloud Computing (CC) is emerging as a new trend for managing IT resources within organizations. It also raises a broad range of issues from technically-oriented to organization-oriented related to cloud evolution and migration. It invites consideration of new models of governance for systems, service and organization. In order to take advantage from the opportunities offered by this technology, IT governance processes must be updated and aligned with the requirements emerging from CC adoption. As a consequence of this phenomenon, from the perspective of resources and organizational capabilities, CC requires a rethinking of the individual competences of IT managers to fill the gaps related to cloud adoption. In this paper we address the issue of identifying this gap by analyzing the impact of CC on both the activities of IT managers and the competence areas characterizing their professional profile. The results of this study provide guidelines for the development of training programs for IT managers. Furthermore, the final discussion contribute to the debate on contingency relationships between CC configurations, individual competences, absorptive capacity and organizational capabilities.

KEYWORDS
Cloud Computing, IT Manager, Individual Competence.

1. INTRODUCTION
Cloud Computing (CC) is emerging as a new trend for managing IT resources within organizations. This shift in the “geography of computation” from locally installed resources to internet computing affects all levels of the computational ecosystem, including software developers, IT managers, and hardware manufacturers (Hayes 2008). With respect to business organizations CC represents a possible means to improve productivity and competitiveness, and to support the firm core business (Armbrust et al. 2010, Buyya et al. 2008). In order to take advantage of the opportunities offered by CC, both public and private companies must consider the need to update their current IT governance capabilities by adapting them to the new requirements associated with CC adoption. In fact, roles, activities and processes within the IT functions are influenced by this technological change. At the same time organizations are requested to develop absorptive capacity for this innovation through the development of individual skills and competences (Sabini & Spagnoletti 2010).

From the perspective of resources and organizational capabilities (Dosi et al. 2000), the increasing adoption of this technology, requires a rethinking of the individual competences of IT managers (who are responsible of the information systems functions within organizations) in order to include the new skills required by CC. The overall scope of IT managers competences is requested to move from the traditional ways of planning, implementing and managing IT, towards innovative IT governance processes embracing
the management of inter-organizational relationships. With this assumption the IT manager role must take into account the relationships between IT infrastructure, business processes and strategic decisions. In fact, to understand clouds and make investment decisions, organizations have to enlarge the focus from cloud technology to cloud strategy (Iyer and Henderson J., 2010).

Nowadays the IT manager role and its related skills are often drawn upon widely accepted frameworks developed and maintained by practitioners associations whose goal is also to manage competence certification programs. Some certifications due to their large adoption and diffusion are changed into real reference standards (CWA 2010). Among these certification schemas, the “European Certification of Informatics Professionals” (EUCIP), provides 21 profiles for classifying IT professional figures by specifying detailed individual competences and skills for each profile.

The aim of this paper is to investigate the competence requirements of IT managers acting in CC contexts. Our conceptual analysis is based on the identification of the competence areas, among those listed in the “IS Manager” EUCIP profile, that are influenced by the presence of CC. Since different configuration of CC are available, we start the analysis with a brief introduction about the possible forms of CC. Then we motivate the choice of the EUCIP framework as a tool for conducting the analysis and we illustrate the relationship between the EUCIP structure and the IT governance processes. Afterwards we discuss the results of the analysis in two steps. Firstly we evidence the updated mapping between required skills and IT governance processes in case of CC adoption. Secondly we focus on the relationship between CC configurations and the required skills for IT managers. Finally we close the paper with a brief discussion on research impact and further research.

2. CLOUD COMPUTING

The definition of Cloud Computing (CC) usually includes both the cases in which software applications are delivered as services, often referred to Software as a Service (SaaS), and the cases in which hardware and systems software that provide those services are located over the Internet (Za et al. 2011). The services offered by the supplier of CC steadily increase in number and in type (Buyya et al. 2008). Generally these services range from simple virtual systems to high level services that include all the IT infrastructures and applications of an organization. Three main categories have been identified by Sotomayor (2008) for distinguishing the different configuration of CC services: (i) Public cloud (PCC) – based on the standard cloud computing model, in which a service provider makes resources, such as applications and storage, available to the general public over the Internet; (ii) Private cloud (PrCC) – an infrastructure made only for a single organization, and it can be managed internally or by a third-actor and hosted internally or externally; (iii) Hybrid cloud (HCC) – a combination of two clouds (private or public). An additional category of CC, namely Community Cloud, has not been taken into consideration for the purposes of this study.

Given the nature of CC and the derived new concepts of hardware and software usage, it is clear that the IT function is not the sole organizational unit influenced by this technology. For instance, in Armbrust et al.
(2009) are highlighted some benefits related to CC adoption: the illusion of infinite computing resources available on demand (eliminating the need to plan far ahead for provisioning); the elimination of an up-front commitment (allowing companies to start with small dimensions and to increase hardware resources only when this becomes a necessary condition); the ability to pay for the use of computing resources on a short-term basis as needed (e.g., processors by hour and storage by day) and to release them as needed, rewarding conservation by letting machines and storage go when they are no longer useful. To better deploy the benefits coming from the adoption of this technology, the choices involve different organizational levels and different organizational functions. Although all these aspects are relevant and require further investigation (for instance on the influence of CC on the individual competences of business managers) this topic is out of the scope of the present paper which concentrates on the IT manager figure.

3. IS COMPETENCE FRAMEWORKS

In this section we present an evaluation of the more used competence certifications, in order to provide a classification tool for measuring typologies and competence levels needed for the CC governance. The most popular competence frameworks in the European context (i.e. EUCIP, e-CF, CIGREF, SFIA, etc.) have been compared (CWA 2010b) taking into account both the level of detail in the competence taxonomy and the possibility to evaluate new competences needed for the CC governance.

For this work we choose the EUCIP\(^1\) (European Certification of Informatics Professionals) schema for performing a conceptual analysis of the individual competence influenced by CC, since EUCIP has a very detailed number of items, it is focused on practitioners working in industry, government and public organizations and it has been recently updated for regarding new technologies (such as CC). This schema has been developed by CEPIS (Council of European Professional Informatics Societies), an organization that collects several associations of professionals from different European countries.

The EUCIP schema is made up two levels of certification: EUCIP CORE and EUCIP ELECTIVE. The former is articulated in 3 areas of basic knowledge according to the 3 macro phases of IT governance processes (plan, build and operate). The latter divides the possible specializations of IT professional figures in 21 + 1 (this one is strongly focused on the skills required by an IT administrator) professional profiles. In particular, the Core level certifies a broad knowledge of the fundamental ICT aspects useful for undertaking a path for an ELECTIVE profile certification. The core competences allow the specialist to have the necessary awareness of potential benefits and critical aspects of new technologies. In this way, it provides a common language to support a dialogue between IT specialists and IT management. Therefore, this certification seems to be suited not only for IT specialists, but also for managers with the aim of understanding and managing the potential benefits of technological innovations. The EUCIP Core certification is articulated in the following areas:

\(^1\) http://www.cepis.org/eucip
Plan Area (A) – This area refers to the analysis of requirements and to the planning of the use of ICT within an organization.

Build Area (B) – This area includes processes for specification, development and testing, and maintenance of Information Systems.

Operate Area (C) – This area concerns installation, supervision and maintenance of ICT systems.

On the other hand, EUCIP Elective level certifies the specific competences referring to one of 21+1 professional profiles defined by the EUCIP programme. Among these profiles there is the “IS Manager”, defined as who “is expected to have a broad competence both in ICT and in organizational issues related to an effective and efficient use of information in a business environment. Skills of planning and innovating must be combined with a steady service-oriented approach and the ability to react and solve practical problems using available resources”\(^2\). This profile is composed by 20 macro-areas of individual competences, for a total of 254 items (specific skills on a very small task).

### 4. COMPETENCE REQUIREMENTS OF IT MANAGERS

In order to analyze the abilities needed by the manager for correctly developing, implementing and deploying CC, we have carried out a conceptual analysis. The aim of the analysis is finding the relation between the taxonomy of individual competences based on a selected EUCIP Elective profile (IS Manager) and IT governance processes (plan, demand management, definition and control of SLA, new technology implementation, and IT alignment with core business). Consequently on the basis of this comparison, some of the competences have been put in relation with the possible CC configurations (PCC, PrCC e HCC). Considering the IT governance processes, we have also the possibility to investigate on the impact level of CC adoption on CIO activities.

For this aim we have started building a matrix (Table 1), intersecting the 20 macro-areas of IS Manager profile with the IT governance processes. In the cells, the symbol “√” is present if the individual competence is needed by CC and the symbol “♦” is present if not. In this way we have the possibility to give a first glance to the number and the type of competences involved.

From the observation of the matrix it is possible to see that the individual competence really influenced by the CC are only a fraction of the total number available outlined in EUCIP for IS Manager profile. It is also interesting that in the 10 macro-areas considered relevant for the governance of CC, 6 attain to the “Plan area (A)” of EUCIP schema, but placed in relationship to the IT governance processes, usually considered in “Build area (B)” and “Operate area (C)”. These first results show how the adoption of CC requires, to the CIO and to his collaborators, to acquire competences of strategic planning and of demand management aimed at exploiting existing infrastructures and resources (exploitation of resources already present in the organization, in opposition to exploration).

\(^2\) [http://www.cepis.org/media/IS_Manager_V31.pdf](http://www.cepis.org/media/IS_Manager_V31.pdf)
The involved competences (marked with the symbol “√”) have been placed in a second matrix showed in table 2, allowing to analyze the relevance of each one of them, according to the three category of CC (respectively PCC, PrCC and HCC). In this way, starting from a given type of CC architecture, it is possible to understand how the individual competences can be combined in different ways, taking into account both their type and relevance. Each individual competence is signed by symbols that indicate the level (from one to three: “+”, “++”, “+++”) of relevance with respect to the governance of different CC category.

### Table 2. Type of CC vs ICT governance processes

<table>
<thead>
<tr>
<th>Type of CC</th>
<th>Plan</th>
<th>Demand management</th>
<th>SW Design, implementation, maintenance</th>
<th>System and network operational</th>
<th>Definition and control of SLA</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCC</td>
<td>A2.02+++</td>
<td>A4.01 ++</td>
<td>A5.01 +++ B1.12 +</td>
<td>B1.14 ++ C7.02 +++ A7.04 +++ A7.05 +++ B1.15 +</td>
<td>A1.03 +</td>
</tr>
<tr>
<td>PrCC</td>
<td>A2.02+</td>
<td>A4.01 +++</td>
<td>A5.01 +++ B1.12 +++</td>
<td>B1.14 ++ C7.02 + A7.04 +++ A7.05 +++ B1.15 +++</td>
<td>A1.03 +++</td>
</tr>
<tr>
<td>HCC</td>
<td>A2.02++</td>
<td>A4.01 ++</td>
<td>A5.01 +++ B1.12 ++</td>
<td>B1.14 ++ C7.02 ++ A7.04 +++ A7.05 +++ B1.15 ++</td>
<td>A1.03 ++</td>
</tr>
</tbody>
</table>

### Figure 1. Relevance of IS Manager Competences in different CC scenario
An example could be the area A2.02 (Information System Management; item: “know negotiation techniques and negotiation metrics for ICT vendors”) that is influenced in different ways in the hypothesis of PCC and PrCC. This can be explained by the idea that the knowledge of negotiation techniques can be much more important and critical in PCC adoption than in PrCC; in fact, the knowledge of negotiation techniques is a competence related to the IT planning and its relevance is different in the PCC or PrCC implementation (the HCC is in the middle). This particularity can be better seen in the diagram in figure 1: the competences concerning activities addressed to the inward of the organization are less relevant for the PCC, while the opposite happens for that pointed outside (the HCC in the average is in the middle between PCC and PrCC).

5. CONCLUSION

The implication of this study are mainly related to practice guidelines based on the contingency relationship between CC configurations and individual competences. In fact, practitioners can find in it the basis for the development of training programs addressing the gap in terms of individual competences of IT managers when they move to CC. Thus, as a first contribution, this study has an impact on HR managers, IT managers and IS professionals.

Another element that must be taken into account is related to the influence of CC on IT governance processes and the extent to which this phenomenon is conditioned by institutional forces. In fact CC can be considered as the current fad in information systems and competence requirements of IT managers must be informed by fashion waves theories (Baskerville & Myers 2009).

Finally the exploration of the relationships between IT resources, individual competences, absorptive capacity and organizational capabilities represents a further future direction of research whose methods for empirical analysis and data collection can be based on the framework adopted in this paper.

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