The Influence of Cloud Computing Concept on Organizational Performance and Structure

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The paper deals with the organizational aspects of the "Cloud Computing" concept implementation. It is focused upon management and organization, rather than on the technical, ICT aspects of this concept. The impacts of "cloud computing" upon the organizational straucture are primarily seen in the new organizational networking platform, via new functionalities this concept offers to the organizational network broker. The implementation of the communication and coordination functions, and the control function in the "cloud" have proven to facilitate the responsive instead of an ad-hoc network expansion. The impact upon organizational performacces is analysed within the scope of variable and fixed costs of the ICT infrastructure, as well as of transactional and opportunity costs of operations costs. An example is presented of the manner in which "cloud computing" reduces opportunity costs, increases profitability and reduces the losses of customers. The implementation of this approach is found to allow for a higher level of capital utilisation, a lower sensitivity to business riskss, lower transaction costs as well as a better focus upon directly profitable activities of producing measurable outcomes, rather than upon the activities of support and subsidiary activities. Thus a theoretical frame was used to demonstrate a positive impact upon the development of organizational structure and organizational performances.

1. Introduction

Information and communication technologies are increasingly becoming an issue of interest of the top management, [1] and a source of competitive advantage of the business systems. Four types of systems are identified in which information and communication technologies are strategically implemented: [2]

- systems that share information through technologically based systems with buyers/consumers and/or suppliers and change the nature of the relationships;
- systems that are more effective in integrating the use of information in the process of new value creation;
- systems enabling the organization to develop, produce, place on the market and deliver new or improved information-based products or services;
- systems supporting the managers with development and strategy implementation information, especially by integrating the relevant internal and external information obtained from the analysis.

The concept of ICT strategic implementation is based on the assumption that economic performances are directly associated with the management's competence to create strategic feedback between the market position of the organization and the design of the adequate support (for achieving goals). In this context, an instrument to achieve a dynamic competence is not a set of sophisticated technological functionalities, but

organizational competencies to improve the technology and make it better in comparison with the competitiors'. [3] In other words, no ICT application, however sophisticated and advanced it is, can ensure competitive advantage nor does it by itself mean a strategic implementation of ICT in the organization. The real benefit from the implementation and the essence of the strategic implementation is achieved by the organization's ability to make a long-term use of the ICT based functionalities. [4] Hence companies today largely draw on the ICT sector and it frequently happens that the failure of IT infrastructure means a complete breakdown of all the organizational functioning operations. It is for this reason that a very important item in the company's budget is investing into the ICT, both for the acquisition and for the maintenance of the ICT, for maintaingin the functioning of applications and services, as well as for the development of their new functionalities.

It is in such an environment that the development of new paradigms of ICT implementation in the organization is expected. Most attention is currently focused upon the "Cloud Computing" concept, defined as the "Model that adequately ensures access to the shared set of computer resources (e.g., networks, servers, memory space, applications or data processing services) that can be conFigured, promptly protected and used with a minimum effort by the organizational management or interaction with the entity providing the services". The model is characterised by five attributes: autonomous use of services at request, broad access to

the network, joining resources, fast flexibility (of response to user claim) and measuring of service delivery; it can be used as private, public, hybrid and joined; three manners of service provision are described: software as service, platform as service and infrastructure as service. [5] The world is now at an analogue turning-point: to adopt or not to adopt the "cloud computing" concept and practically set a section of the entire information infrastructure out of the physical area of the company and hire someone other to maintain it, as once was the case with electrical energy. A large number of provider companies, among them the largest informatics companies that offer the "cloud computing" services show that this concept should be counted on in the very near future and that therefore companies have to make their best efforts to technically, but even more important – organizationally and operationally prepare for its implementation and getting the economic maximum from its advantages.

Organizational adjustments are much more necessary for the "cloud computing" success and improvement than technological advances. All the technologies that support "cloud computing" (visualisation of computer resources, online datafile storage, Web services, Web applications, connection to the Internet, etc.) are already present and are tested in the market to a larger or smaller degrees. What is not entirely incorporated on the market, however, is their implementation itself, so that it would be possible to use them and thus partly or entirely replace the information resources of the company. Hence this paper will analyse the changes that are to be introduced on the organizational and business levels in order that organizational efficiency and effectiveness be improved.

2. Differences between the classical and "cloud computing" approach to information and communication technologies in the organization

The rise in the strategic importance of the ICT described in the introductory part requires that an increasing amount of organizational resources are allocated for the ICT needs, for the development of infrastructure that has to meet the needs of flexibility, scalability and organizational change. The costs related to hardware, software, labour force and associated services have constantly been rising globally since 2001[6], and have become an important item in the company's budget.

Consequently, it has become a trend among the managers responsible for the information systems (Chief Information Officer, CEO) that informatics-related jobs that do not support the major competency of the organization are outsourced from other firms for an adequate financial remuneration. Outsourcing these jobs raises the efficiency of the organization itself, in two ways. Firstly, the costs are reduced, since the organization no longer has additional specific investments to perform information tasks it is not expert in, but uses specialised services of other organization that, due to the "economy of scope", are able to perform these same jobs at significantly lower costs, thereby being in a position to offer such specialized services at reasonable prices. Besides, the efficiency of the service user organization is increased in that it narrows the scope of its own activities, which allows it to focus upon what is of crucial importance for it and thus improve its own business performance. It is for these reasons that "cloud computing" largely differs from the traditional approach, which is shown in the following table:

Traditional approach	„Cloud computing" approach
Hardware is within the organization that also maintains it.	Hardware is with the service provider (public cloud) or partly with the provider (hybrid),or is entirely within the organization (private cloud).
Information resources (hardware and software are permanently available in the same quantity of resources, in "smooth" business conditions as well as in the moments of highest demand, i.e., greatest workload on the system.	Information resources (hardware and software) are used in the form of service, whose capacities increase or decrease with the demand or organizational needs.
When resources are idle, traditional methods are used such as money returns or compensations.	Services are paid on a short-term principle in order to avoid unnecessary payments , for unused resources, which is not the case when infrastructure is physically owned.

Traditional approach	„Cloud computing" approach
Organization pays for the maintenence of functionality of infrastructure, covers the disparities induced by unforseen circumstances, and is responsible for replacing obsolete components.	Using the "cloud" resources the organization abstracts all its worries and is focused only upon the amount of resources it uses and benefits and and price per unit of resources contracted with the provider of "cloud" services.
Organization is responsible for and pays for depreciation.	Organization has no concerns about infrastructure depreciation in the "cloud".
Slow introduction of new capacities into production (selection, purchase and installation), lasting several months or a year on average.	Capacities are expanded within a couple of seconds, by a couple of clicks.
In modern business conditions, there is a high risk of large fixed (capital expences resulting into the situation of capital being "trapped" in the means of production.	Business risk is by far lower due to extremely low capital costs that are transferred into operations costs, organization owns more money to do its "core" activity.

Table 1 *Differences between traditional and "cloud" IT approaches*

3. Impact of "cloud computing" on organizational structure

The organizational structure of the companies that use the "cloud computing" services are oriented towards networking instead towards classical hierarchal structures, [7] since the networking structure allows for a considerably higher level of autonomy of these business units. Such companies support flexibility of structure in that they implement the shared service model. The model has a core unit in charge of coordination, however, it also sets goals, the overall strategy, and supports other business units with its administration, financial, and systems support services. [8] Such a manner of functioning relieves business units of these jobs, as well as of the time and costs incurred in their performance, so that they can fully concentrate upon the operations that earn profit to them and hence to the company as a whole. The focus upon a small number of activities brings the advantages of the economy of scope, changing the business processes in the organization. In addition to their impact upon business processes and organizational structures, information and communication technologies affect numerous other aspects of business operations, such as managerial style [9], management orientation [10], power distribution in the company [11], or the company size [11]. The impact upon the structure is achieved through growth as well, in that the organizations take care that their structures remain flexible. This is achieved by forming new business units meant to meet new needs of the environment, and if the size of this section of organization grows to such an extent that it hinders an efficient and effective functioning, the core unit undertakes the role of coordinator of the particular business operations for the newly-created business units, as illustrated in the Figure below. Such a manner of business doing results in a growing scope of "outsourcing" activities that is sometimes viewed as even irrational and ungrounded [13].
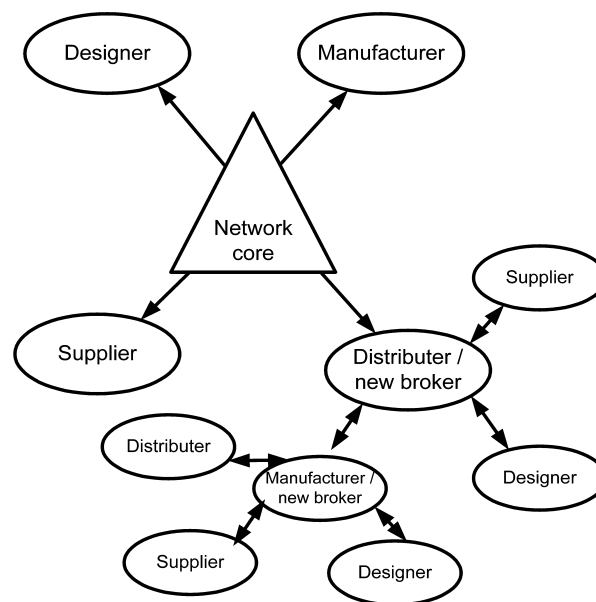

Figure 1 *Model of responsive and agile organization [7]*

The rise of ever more modern concepts of network and virtual organizations brings forth varied opportunities for the "cloud computing" concept implementation. Special attention is paid to metasystem and coordination functions, since their efficiency makes a precondition for an effective implementation of this system. Setting these function into a "cloud" makes it possible for the core to build a firm ICT platform, establish and maintain a dynamic network structure. [8]

Varied intelligent and simulation systems allow for the relevant data to become easily accessible to the companies – network participants, whereby they are in a position to get an insight into the status of the operations that are under way at any moment, which, on the other hand, highlights the need for a high quality of coordination and communication.

Different forms of Business Intelligence (BI) and Business Process Management (BPM) are used for that purpose. On one hand, they allow for the data transparency and visibility, however, they also control the data and information that circulate through and between companies. BI and BPM offer the opportunity of tracking the status of every task or goal in the real time. To achieve a higher quality performance, analysis of the collected data companies also implement the Complex Event Processing systems (CEP) that select specially important and critical information. It should be noticed that cloud-based systems are characterised by well defined Application Program Interfaces (API) that allow for implementing a Service-Oriented Architecture (SOA) for the purpose of developing the network and implementing the best practices. All these are reflected in creating efficient networks, and they in turn offer broad opportunities to the participant companies, since their implementation can result in considerable savings due to the realization of the economy of scope.
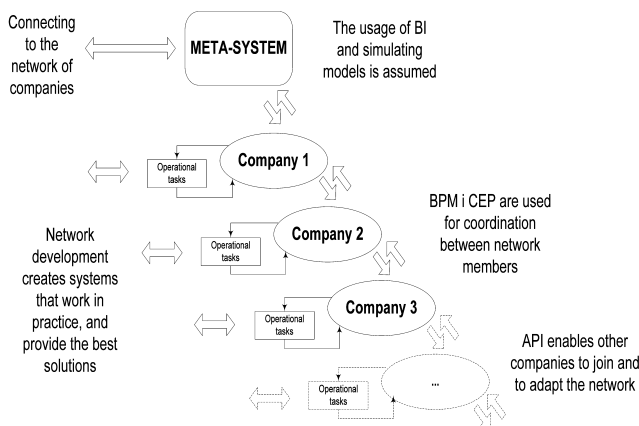

Figure 2 *"Cloud" concept-based business structure (network) [7]*

4. Impact of "cloud computing" on organizational performance

Outstanding among important impacts of the "cloud computing" concept on the organization is the impact upon organizational performances through reduced operational costs. Companies can strengthen their business operations in that they can satisfy three oper-

ations standards [7]: low capital costs, variable operational costs, and scalable computer platform. These impacts are important not only for the companies where ICT serves as back-up for the largest number of key activities, but also for those companies that implement the ICT primariliy in the supporting and subsidiary activities. Thus operations can be "outsourced" for any organizations that may be in need for ICT resources [14] with variable costs. The pressure of the financial crisis upon business since 2009 has diminished the prospects of large capital investments. The demand to provide the infrastructure that will be adjustable to the company needs to such an extent that the fixed costs of its development practically become variable can be satisfied by implementing the "cloud computing" concept in the manner presented in the Figure below:
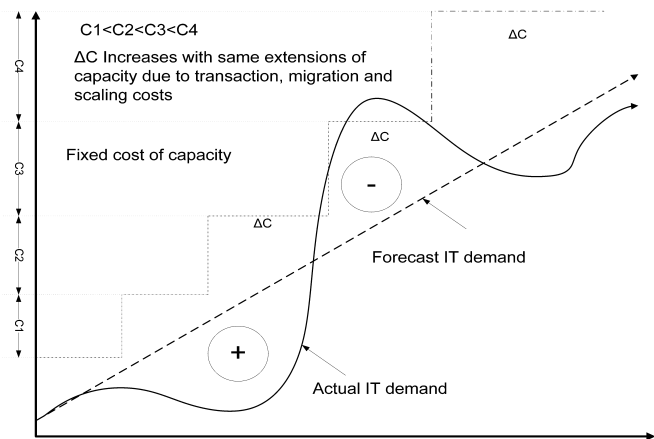

Figure 3 *Traditional model of fixed costs [7]*

The danger of substantial fixed investments into infrastructure is especially present in the ICT field, since technological change make technology obsolete much faster than in other industries. The transition from investing into the company's own infrastructure to new business competencies, i.e., outsourced resources is opportune for the company due to the fact that services are charged on the consumption-based pricing model, popularly titled "pay by the drink model". [15] In the traditional model of IT costs presented in Figure 1, the cost of IT capacities presented by a steplike dash-dot line is fixed, with significant deviation from real demand for IT resources presented by a full line. It sometimes happens that there is a surplus of resources as regards the demand (dot +), again, sometimes the available capacities are not sufficient to meet the current demands for IT resources. The total of the deviations of these lines shows either the loss due to idle capital investments or a potential problem in service provision that may cause even larger business losses. Additional costs that do not directly affect the ICT infrastructure functionality are marked as ΔC and are caused by an in-

creased number of transactions or by their complexity, by migration costs or by system scaling and growth at the same ICT infrastructure capacity expanding values.

The business supported by the "cloud computing" concept instead by the classic ICT resources is characterised by the costs being adjusted to the offer in a much more flexible manner; some authors compare this to hiring a taxi instead of buying a car or "outsourcing" a delivery service instead of buying a truck for the purposes of delivery in person. Given that in case of ICT service delivery the marginal costs of delivering one more service or a digital delivery of contents to one more user are extremely low, practically equal zero value [16], a model of free offer of contents is developed, financed by charging the consumers of advanced, premium service. Among them are services such as Google documents, Google mail, Google calendar, etc. The user no longer needs to think about software for electronic mail, or data archives to select, when he has a service available at no cost, or if he can chose advanced services at the prices that are variable compared to their use or if they are in the form of subscription many times reduced compared to fixed investments. Thus the development of new business functions, e.g., distant learning programmes at a higher education institution is possible without employing fixed investments [18], which integrates organizational benefits and benefits in performances. Small firms can use powerful, high class ICT services since they practically pay marginal costs of using resources increased for the commission paid to the provider. [19] On the other hand, service providers have the economy of scope [20] and the economy of scale if they implement the same platform to provide a variety of diverse services.

In case the company decides in favour of "cloud computing" approach to supply the required ICT resources, the infrastructure required for the ICT resources is much easier to adjust to real needs. The variable costs model shown in the example of the Amazon cloud service is more appropriate for the changeable market conditions since it ensures that sufficient resources are available at any time to meet the current demand, while, on the other hand, the costs are higher if the demand is higher, and, consequently, smaller if the demand is lower, which is in perfect accordance with the positive business of the company. As can be seen in Figure 1, the difference between the capacity consumption and the real demand is considerably smaller, and the real demand does not exceed the capacities due to the flexible nature of the "cloud computing" resource usage. It is in this manner that the efficiency of business operations is improved, since there is no failure in satisfying the clients' needs nor losses due to in-

adequate estimates, which further means that the necessity of long-term planning of ICT capacities is eliminated. Besides, the invested capital is employed in a considerably better way since the focus is upon customers themselves, meeting their needs and requirements while simultaneously minimizing the errors.
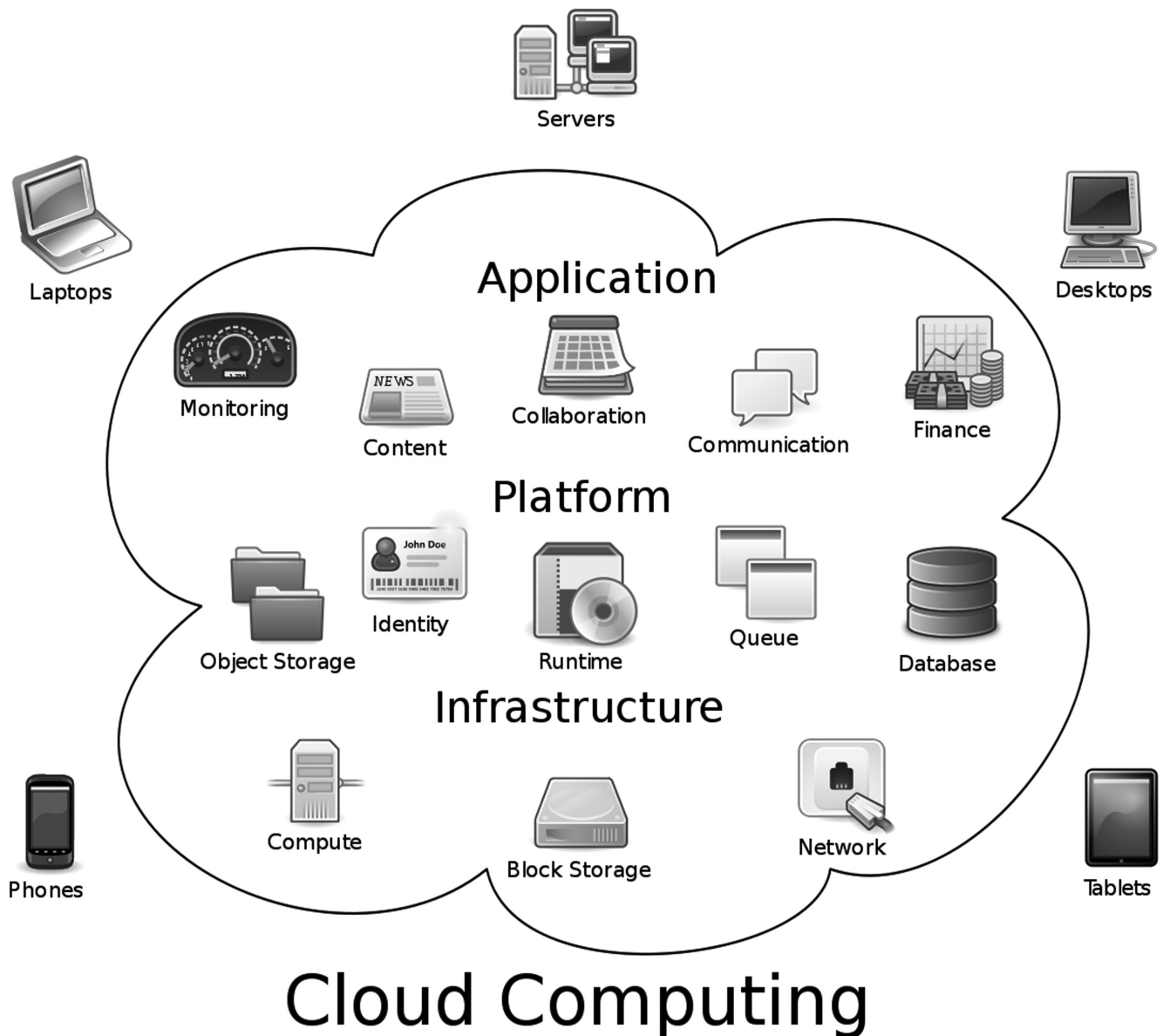
Figure 4 *Capacity vs. implementation ratio*
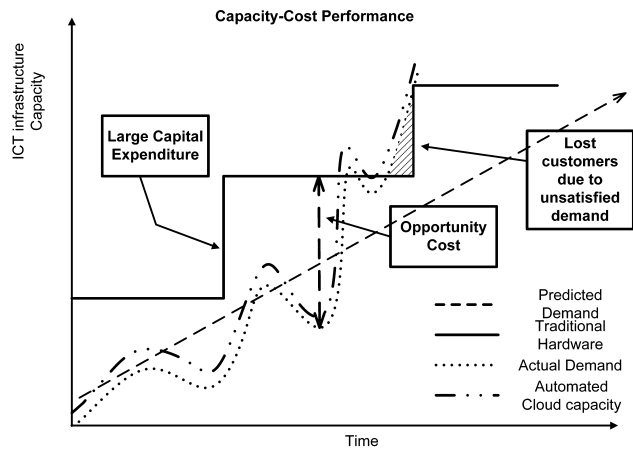
(Amazon Web service documentation) [21]

5. Conclusion

In addition to technological change, the "cloud computing" concept causes organizational change too. As early as 1960s, the pioneering works of Woodward and the ASTON group have established the interdependence between technology and organizational structures, however, few are the papers that explore this interdependence in more detail. This paper gives a short theoretical framework of the "cloud computing" approach and illustrates its difference as regards the classical approaces in the ICT infrastructure provision. The paper procedes to describe the impacts the concept has on organizational structure, with the prevailing platform for organizational networking through new functionalities this concept opens to the organizational network broker. Implementing the communication and coordination, and also the control in the "cloud" if necessary is found to facilitate a responsive rather than ad-hoc network expansion. Following this, the impact upon organizational performances is analysed using a theoretical framework of variable and fixed ICT infrastructure costs as well as opportunity costs of business. The implementation of this approach ensures a higher-level utilization of capital, lower exposure to business risk, and consequently lower transaction costs and a better focus upon the directly profitable activities of producing measurable outputs, rather than upon the activities of support and subsidiary activities, which improves organizational performances.

Servers

Laptops

Desktops

Application

Monitoring

Content

Collaboration

Communication

Finance

Platform

Identity

Object Storage

Runtime

Queue

Database

Infrastructure

Compute

Block Storage

Network

Phones

Tablets

Cloud Computing

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