Cloud Computing and Agile Organization Development

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In the 3rd millennium economy, defined by globalization and continuous reduction of natural resources, the economic organization becomes the main actor in the phenomenon of transformation and adaptation to new conditions. Even more, the economic environment, which is closely related to the social environment, undergoes complex metamorphoses, especially in the management area. In this dynamic and complex social and environmental context, the economic organization must possess the ability to adapt, becoming a flexible and agile answer to new market opportunities. Considering the spectacular evolution of information and communications technology, one of the solutions to ensure organization agility is cloud computing. Just like the development of any science requires adaptation to theories and instruments specific to other fields, a cloud computing paradigm for the agile organization must appeal to models from management, cybernetics, mathematics, structuralism and information theory (or information systems theory).

Keywords: *Cloud Computing, Agile Development, Enterprise Architecture, Project Management, Agile Methodologies, Information and Communications Technology (ICT)*

1 Objectives

This analytical-methodological and theoretical-practical endeavour constitutes an original scientific incursion into the philosophy and theory of cloud computing from the perspective of turning it into a real framework for ensuring agility in the development of economic organizations. Also, theoretical approach is supported by highlighting practical aspects regarding cloud computing market and the influence big actors of this market may have on the success of a cloud computing paradigm for organization development. The original approach brings forth the emergent production factors of the knowledge society, digital economy and globalization phenomenon. They include information, organization culture, and enterprise architecture in terms of business, information and technology.

2 Cloud computing philosophy

In the spring of 2001, in Claremont, California, Peter F. Drucker – considered one of the founders of modern science of management by business specialists and academics – talking about the "*challenge ahead*", said "*we may almost certainly say that the challenges we will have to face in the tomorrow's conditions are of management nature and concern the individuals. … those tasks cannot be performed by the state, but only by individual organizations – lucrative enterprises and non-governmental non-lucrative organizations – and individuals*" [1]

Tomorrow's economic conditions invoked by Drucker are visible even today and the social-economic entities mentioned are indeed the economic organizations and the individuals. The management philosophy of the contemporary organization includes both global market agility and modern paradigms that target directly the human resource (as primary production factor), like the anthropocentric model. Even more, when the agility approach is supported by the use of information and communications technology instruments, cloud computing becomes its structural foundation.

Cloud computing is a relatively modern ICT concept and represents an aggregation of distributed services for computation, applications, data access and storage. The cloud computing philosophy assumes that the entire ensemble is hidden to the user, which does not know the location and physical configuration of the systems that provide the services. Terminologically, cloud computing derives from a symbolic graphical representation of the

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global network as a cloud, used when technical details of the internet may be ignored (Figure 1).
In other words, cloud computing represents one of the significant tendencies of ICT evolution, bringing a new model for provision, management and security within the organization. Currently, there is no universally accepted definition of cloud computing. The national Institute of Standards and Technology (NIST) and Cloud Security Alliance (CSA) present a base for the definition, describing cloud computing as a model that provides access on demand, through a network to an array of shared configurable information resources (like networks, servers, storage space, applications and services). These are available immediately and with little management effort or involvement from the service provider. [2]

Fig. 1. Cloud computing concept

The main attributes that support cloud computing concept and philosophy from the perspective of using it as an infrastructure for agile organization development [3] are:

- abstract computation and information technology service oriented approach;
- virtual, dynamic, scalable and massive infrastructure;
- shared, configurable, flexible and dynamic resources;
- access via internet to all devices;
- platform with little or no management at all (self-managed);
- employment model based on self-service;
- billing based on consumption (measured/metered service).

The latest professional studies available highlight that over 70% of the economic organizations consider cloud computing a real technological option, while about 70% consider adopting it will lead to the flexibility of the business. Even more, over 60% of the organizations consider the cloud computing paradigm will lead to increased reaction speed of the business to the new market conditions, while 65% estimate that it will lead to increased focus on the main aspects of the business. [4]
Although there is a real growth trend, we may say that currently very few organizations use cloud computing, mainly due to lack of correct understanding of the architecture, payment model, different business environment and specific elements of each organization. [5]

3 Cloud computing technology

Built on the attributes supporting its philosophy, cloud computing technology consists of the convergence of five main vectors [6]: on demand service (the client may unilaterally reserve cloud resources); remote network access (heterogeneous clients access cloud resources

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through global internet); shared resources (cloud provider dynamically (re)allocates resources to clients according to their demands); capacity to scale resources (rapid scaling in both directions of cloud resources available to clients); service metering (implementation of a pay-per-use system).

From the technological perspective of the provided service, NIST defines three main models of specific cloud computing services (this approach is unanimously accepted): software as service (SaaS), platform as service (PaaS) and infrastructure as service (IaaS) – Figure 2.

- Saas – *Software as a service* – is a model that allows the use of applications through a cloud infrastructure; the applications are available through heterogeneous devices, using a web-based interface (for example webmail); users cannot control or manage the infrastructure offered by the cloud provider.

Being one of the most used cloud services, the list of applications that may work in SaaS regime includes enterprise services (ERP), digital signature, CRM applications, management applications (specific to agile organizations – financial, human resources, sales, project management), search instruments etc. This model is recommended when the data is confidential to the organization.

- PaaS – *Platform as a Service* – is a model that allows users to develop or use applications using programming languages provided by the cloud or created by the user; access to existing or created applications as well as platform configuration elements/services (session management, device integration, testing environments, content management etc.) can be controlled.

In this model the applicability is limited considering application portability or the need to adjust the hardware-software combination to improve application performance. The model is useful for developing collaborative solutions by using cloud shared resources.

- IaaS – *Infrastructure as a Service* – is a model that provides clients the possibility to reserve processing, storage, network resources (which may be used to run any software, including operating systems).

Cloud clients/consumers do not control or manage the cloud infrastructure but control the operating system, storage space, installed applications and some network components (like computer-level firewalls). Services available in this model include: server hosting, web server, operating systems, bandwidth reservation etc. Generally, IaaS is employed when the organization does not want to invest in infrastructure and the growing business needs require significant ICT resources.

Beyond the NIST standard, with certain limitations and on a smaller scale, considering the rendered service, there are four sub-types of cloud computing:

- STaaS – STorage as a Service;
- DTaaS – DeskTop as a Service;
- DPaaS – Data Protection as a Service;
- BPaaS – Business Process as a Service.

Considering the type of infrastructure hosting, there are four ways cloud computing is implemented: ***public cloud*** (infrastructure is provided to the clients, but it is owned by the cloud service provider); ***community cloud*** (shared infrastructure between several organizations and supports a community with common interests; managements is carried out by the community or an external entity); ***private cloud*** (the infrastructure is exclusively used by a single organization, management being provided internally or by an external organization); ***hybrid cloud*** (the infrastructure is composed by two or more public, community or private clouds interconnected to ensure the portability of data and applications).

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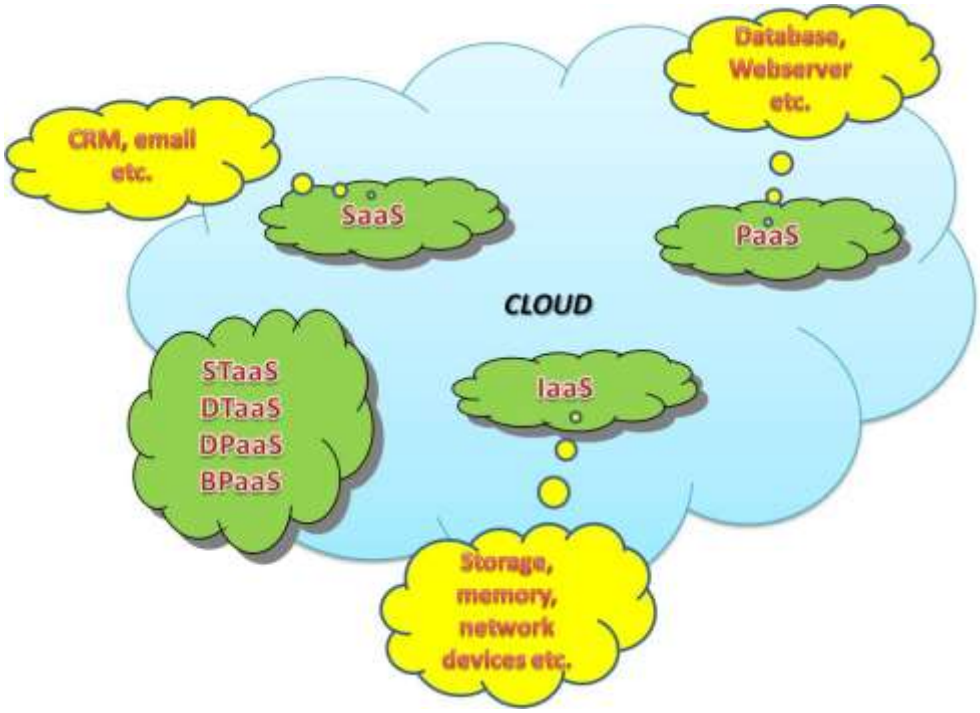

Fig. 2. Types of services provided by cloud computing

Each organization chooses from the diversity of cloud solutions available today the one that suits best its interests. From the point of view of economic organization agility, main choices are private or hybrid cloud (in spite of significantly higher costs).

The factors that significantly influence the decision to adopt cloud on a large scale, and implicitly the ripening of this concept, which is bound to revolutionize business environment in the near future, are security concerns, ensuring conformity with current accepted interoperability standards, integration of cloud service with internal organization systems.

4 Cloud computing market

Initially, cloud computing solutions were designed for small and medium organizations, providing them with a way to increase agility with low costs. Lately, more and more large organizations analyze the possibility of quick integration of new solutions and use of cloud computing. Still, cloud computing remains best suited for small and medium organizations (Figure 3).

According to statistics provided by independent consultants (http://talkin-cloud.com/talkin039-cloud-top-100-cloud-services-providers/top-100-cloud-services-providers-list-2013-ranked-0, by Joe Pantieri, July 30th, 2013) top ten cloud computing service providers (by sales) are:

1. SalesForce
2. Amazon (Amazon Web Services – AWS)
3. Microsoft
4. Oracle
5. Google
6. SAP
7. IBM
8. Terremark
9. Rackspace
10. NetSuite

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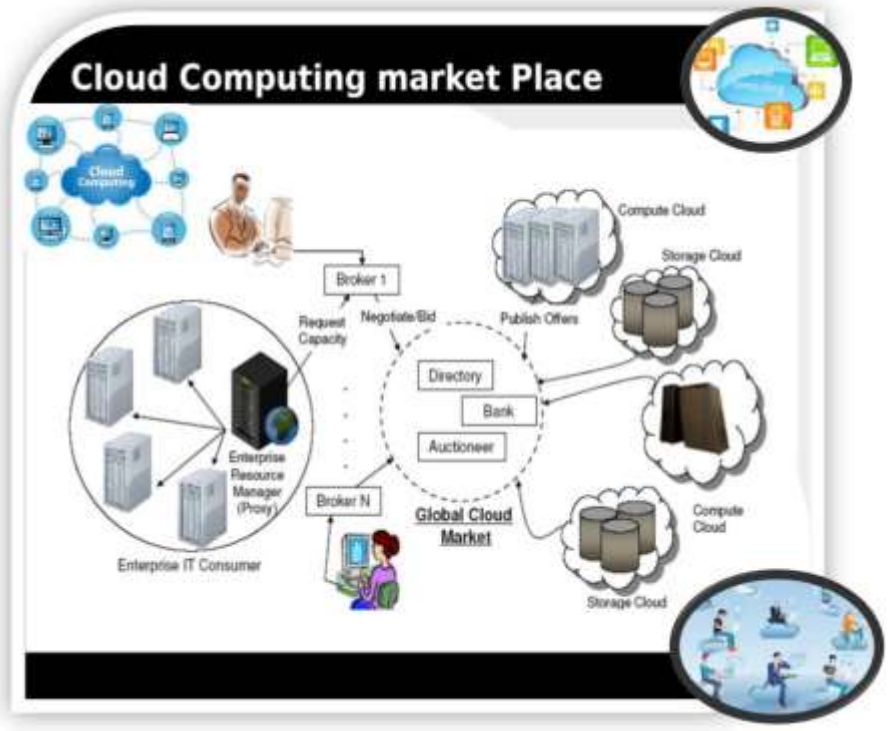

Fig. 3. Cloud computing market

Remarkably, 9 of the first 10 providers are from USA (with a global operation space) and only 1 (SAP) is from Europe. Regarding the type of services provided, these companies rank higher or lower, in a dynamically changing hierarchy. Romanian market has a slow evolution. The state of "Romanian cloud" is presented in a study regarding the adoption of cloud computing in Romania (http://www.clubitc.ro/cloud-solutions/de-ce-e-important-studiul-cio-council-pentru-analiza-adoptiri-cloudului-in-romania/, by Radu Crahmaliuc, IT analyst, July 2013):

- 39% of organizations don't use any type of cloud application or service;
- 7% use public cloud (due to very low costs);
- 36% use private cloud solutions (due to high security);
- 18% use hybrid services.

One of the key findings is that over 60% of the organizations use cloud services and the growth rate is about 10%.

5 Organization agility: limits of cloud computing model

In a continuously changing global market, organization agility is a key element in gaining strategic advantage. This may be ensured by achieving an agile architecture of the organization, lowering the time for development of new processed and increasing flexibility of existing processes. The need for agility and ensuring the versatile character of the organization are premises for lowering the time to answer client requests and extend the client pool. Thus, the organization may account lower costs for adaptation to market changes and therefore increased revenue.

Agile organization requires agile architectures, techniques, methods and instruments in order to react fast to change requirements. The path towards an agile business requires continuous control of own business process dynamics, human resources and informational system. The literature and economic practice records three main approaches (still in use today) for achieving organization agility:

- Business Process Management (BPM) to orchestrate independent functionalities;
- Service Oriented Architecture (SOA) for

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the architecture of design and implementation of these functionalities;
- Decision Management (DM) for management of organization decisions.

In the context of cloud computing paradigm – as an original element of scientific research – the enterprise architecture must be perceived as a rigorous description of its structure, decomposition in subsystems, relations between systems, relations with the external environment, and principles that must be observed during design and evolution of the organization. There are three architectural levels for a level 21st economic organization: business architecture, information architecture and technological architecture. Considering the meaning of each architectural level, we can fiind significant elements of the cloud computing paradigm at least in the informational and technological levels (Figure 4).

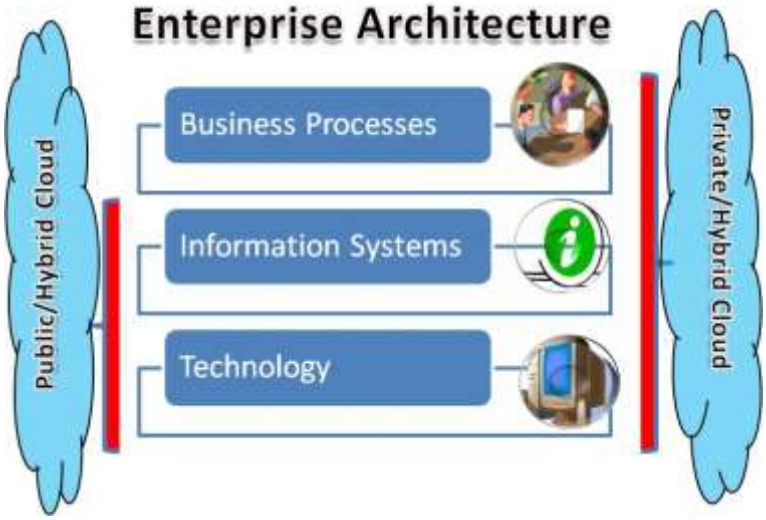

Fig. 4. Architecture levels in cloud computing

Thus, the business architecture will exhaustively and systematically describe the main business processes of the organization and the information architecture will describe the applications, data and the way they integrate. Technological architecture concerns technologies accepted for operating platforms, networks, various applications, collaboration, data representation and manipulation, integration, security and systems management.

Beyond the positive aspects of the cloud computing paradigm for agile organization development, we must consider the limitations of this model. They are mainly related to *confidentiality* issues. Once the data and applications are placed in a cloud, there is a risk that the parties that have access (cloud computing providers for example – software, hosting, and communications) will easily monitor every operation (unfortunately there are persons with malicious intents). Even more, there are *legal risks*: for example, not knowing where the business data is physically stored may lead in involuntary export/import of data or software. What is legal in a country (national legislation) may be illegal where the data is stored.

Also, the organization that adopts cloud computing may be exposed to *security risks* - there is a significant number of risks assumed when the business data are "somewhere", on a hard disk in an unknown country, where persons beyond control may access them. There are also *availability* problems: to a certain extent, redundancy may prevent it and ensure access to data at any moment, but there may be cases when the cloud computing provider can be forced to fully stop the operations (bankruptcy, official inquire etc.) completely cutting the organization from accessing its own data and applications. Maybe future solutions will erase these limitations and concerns.

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6 Organization agility through cloud computing

Implementation/adoption of the proposed cloud computing paradigm to achieve economic organization agility must be carried out within the boundaries of the architecture principles (table 1), which concern mainly the quality standards (for management, hardware, software etc.). Also, an important role belongs to the specific frameworks – descriptions of the architecture components as well as external components belonging to the environment where the architecture is designed, developed and implemented (clients, market, industry, opportunities, competition, authorities). Cloud service models (as form of implementation) must be tuned to the specifics of architecture models, in terms of principles, services, standards, concepts, components, visualising models and configurations). Among the architectural models the following stand out: Zachman model as taxonomy for business information systems (patented model); TOGAF (The Open Group Architecture Framework) as model for organization/owner; FEAF (Federal Enterprise Architecture Framework) and DoDTRM (Department of Defense Technical Reference Model) for defense industry [7].

Table 1. Architectural principles for clouds

	Principle	Requirements (Enterprise Architecture must …)
1	Brand promotion	help organization to increase the client satisfaction and popularity of the brand
2	Financial sustainability	help the organization to acquire new financing sources
3	Business consolidation	help the organization to conduct business in a rigorous manner
4	Expansion to new markets	help the organization expand on new markets and adapt fast to their characteristics
5	Rapid reaction to market / clients requirements	help the organization to introduce new products to the market in the shortest time in order to satisfy the continuously changing client requirements
6	Establishing the partners / stakeholders	help the organization to replace or add a supplier in the shortest time and with minimal costs
7	Simplification of processes	help the organization to simplify the business processes, reducing their duration
8	Cost efficiency	help the organization lower the transaction costs while preserving or improving the quality
9	Global approach	help the organization to establish and preserve connections with stakeholders at remote locations
10	Architecture scalability	allow the organization to rapidly add specific functionalities in a manner with a high degree of compatibility efficient cost allocation
11	Architecture reconfiguration	Support the organization in reconfiguring for new business requirements, fast and cost-efficient
12	Architecture unification	help the organization to create an consistent and well-designed network infrastructure

Adoption of / migration to cloud computing must be attuned to the business development tools. Among them, in the context of agile development, an important role belongs to the agile application development and economic project management (Figure 5). Most popular methodologies are:

- Scrum
- eXtreme Programming (XP)
- Crystal methodologies
- Dynamic Software Development Model (DSDM)
- Feature Driven Development (FDD)
- Lean Software Development (LSD)

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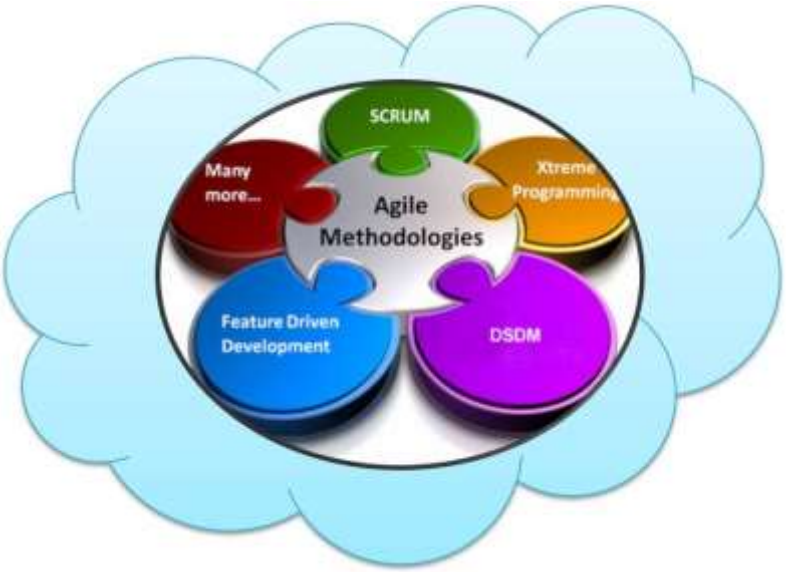

Fig. 5. Agile methodologies under cloud computing

No matter what cloud implementation is chosen (public, private, hybrid), application of agile methodologies may be managed through specific open source software. There are a lot of available such software, among some are based on cloud computing, like OnTime from AxoSoft (www.axosoft.com), which implements Scrum under Windows, MacOs, Linux and ensures functional web in IE7, FireFox2, Safari3 and Chrome.

Another solution that implements Scrum and XP agile project management is provided by www.sprintometer.com as freeware (developed by practitioners in agile projects); it is simple, fast and user friendly. The features of this software make it easy to maintain an updated Sprint Backlog (features to be achieved in the current sprint/iteration/step), while providing a better vision on the team progress.

7 Conclusions

This paper is an original approach to the adoption of cloud computing paradigm in order to achieve economic organization agility in a continuously changing global market. In the hostile environment of the information and knowledge society the economic organization, as main actor of the global economic play, must adapt on the fly by flexibility/agility/versatility both for development and, mostly, for survival. The theory proposed and applied through the means of agile instruments, architectures and methodologies joins consecrated solutions for business intelligence mentioned in the paper: BPM, SOA and DM. beyond theoretical aspects, we highlight concrete directions for analysis, design and implantation of the cloud framework as support for business stimulation and gaining strategic advantage on the market. The proposed model highlights the limitations of the cloud computing, which the authors believe will be overcome in the near future.

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