The economic impact of cloud computing technology on new business and employment in Romania

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Due to the current global economic situation, all the companies are now involved in searching effective ways of improving efficiency and profitability (C. Christauskas and R. Miseviciene, 2012). Many researchers like Gatautis et al., 2009, Melnikas, 2008, Zavadskas et al., 2010 and C. Christauskas and R. Miseviciene, 2012 claim that the digital technologies are used to improve the decision making process for businesses. As shown by the recently published studies, the latest trend in information technology is "cloud computing".

Expert Group (2012) considers that the responsibility for the confusion regarding the definition and the characteristics of the "cloud computing" concept, lies with both the high number of existing cloud providers that promise different capabilities and the fact that terminology used and the framework of the cloud coincide with other fields, such as, Data Centre Clusters, Grids, High Performance Computing and Web Services as well.

Moreover, Expert Group (2012) supports the idea of establishing a common definition for the cloud which would separate the concept and its characteristics of other fields. In the short term, this would enable a better understanding of the cloud concept

and, in the long term, the establishment of recommendations for best practices. The current definitions of this concept reflect, in particular, the current status and capabilities without highlighting the long-term essential characteristics or their full potential in various fields.

As Expert Group (2012) has stated, we can see that most definitions related to the "cloud computing" concept describe it as another means of providing services, resources or servers on the Internet. In this respect, a suggestive example might be the Oxford Dictionary definition of cloud computing:" the practice of using a network of remote servers hosted on the Internet to store, manage, and process data, instead of using a local server or a personal computer."

The most famous definition of "cloud computing" is provided by the National Institute for Standards and Technology (NIST) in 2009 and updated in 2011: "CLOUD computing is a model for enabling ubiquitous, convenient, on demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This CLOUD model is composed of five essential characteristics, three service models (Software / Platform / Infrastructure as a Service), and four deployment models, whereas the five characteristics are: on-demand self-service, broad network access, resource pooling, rapid elasticity, and measured service. The deployment models include private, community, public and hybrid CLOUD".

Expert Group (2010) details the modalities for providing cloud services, as follows:

a) Infrastructure as a Service (IaaS or Infrastructure as Service) - provides enhanced virtualization capabilities. Resources may be provided by two types of service interface:

- Date and Storage Clouds: allow reliable access to data with dynamic potential size, balancing resource access or quality requirements defined. (examples: Amazon S3, SQL Azure)
- Compute Clouds: provide access to computing resources. (Examples: Amazon EC2, Zimory, Elastichosts)

b) Platform as a Service (PaaS or Platform as Service) - provides computing resources via a platform on which applications and services can be developed and hosted. Examples: Force.com (United States), Google App Engine, Windows Azure.

c) Application as a service (Software as Service or SaaS) - provides implementations of specific business functions and processes are provided with specific cloud capabilities. Example: Google Docs, Salesforce CRM, SAP Business by Design.

The deployment models of cloud architecture are the following:

a) *Private cloud* - is owned by a private or rented organization. Its functionality is not exposed directly to the customer. Example: eBay.

b) *Public Cloud* – the cloud infrastructure is accessible to the general public or a large industry group and belongs to a cloud service provider (Zissis and Lekkas, 2010). Examples: Amazon, Google Apps, Windows Azure.

c) *Community Cloud* - In this case, the cloud infrastructure is shared by several organizations and supports a specific community with common concerns (Zissis and

Lekkas, 2010).

d) *Hybrid Cloud* – the cloud infrastructure is made up of two or more clouds that remain unique entities but are bound as the standard and proprietary technologies that enable data and application portability.

Etro (2009) states that the positive association between innovation in IT&C and competition is well known and the decision makers recognize its double meaning of operation: on one hand, the competitive fields of activity have a tendency to adopt the innovations in IT&C earlier than other fields and, therefore, become more productive, on the other hand, the adopting of IT&C innovations by a field of activity specifically encourages the competition. Besides, Etro (2009) provides as example an observation from the e-Business Watch study of the European Commission in 2008, which reveals that, although there is an obvious causal relationship between increasing level of competition continuously and deployment and implicitly using the IT&C technologies by companies, the opposite could also be possible. In this respect, Etro (2009) points out that the use of IT&C technologies and Internet has a strong impact on certain fields of activity (particularly on the banking sector), thus reshaping the competitive scenario for an age of Information.

Many authors (including Etro, 2009) consider that one of the existing main snags in terms of entering a new market is the high cost of entry, often associated with hardware and software costs. The "cloud computing" technology enables potential competitors that want to enter on any market to achieve a fixed cost economy associated with hardware and/or software and the related initial investment in IT, by turning them into variable costs reducing barriers to entry and promoting the creation of businesses and, therefore, job creation. The significance of such a mechanism is well-known in the economic policies, especially for Europe, where SMEs have a crucial role in the production structure. Etro (2009) considers that, although SMEs demonstrate flexibility in adapting to the requirements of changing markets, their small size makes them less able to cope with high input costs.

The majority of positive effects of the "cloud computing" technology are closely related to the speed of adoption, this being practically a decision maker in promoting its adoption.

A recent study of International Data Corporation (2008) analyzed the role of IT cloud services on five major product segments representing about two-thirds of a company's IT spending. The target segments were business-type applications (SaaS), software infrastructure, software for the development and deployment of servers and storage. From a total of 383 billion dollars that companies have spent in 2008 for the above mentioned IT services, only 4% (16.2 billion dollars) can be classified as cloud services. As concerns 2012, the total forecast was 494 billion dollars, from which the estimated amount for cloud services was 42 billion, or 9% of total estimated costs. In fact, it is estimated that the majority of cloud spending will remain allocated to business-type applications, with a slight increase of data storage investments.

The creation of new companies can be performed with a fixed initial investment. Since this initial fixed investment is expressed in terms of final products, it is obvious that it requires implicitly the use of labor, hardware and software resources[1] , as well.

[1] Olteanu Cosmin, „E-Mail Server and Traffic Control Management in 2012 ", "Manager" nr. XVI, p.122-129, Bucharest University Publishing House, 2012, ISSN: 1453-0503

Once a new company enters the market, it competes with a certain number of competitors in order to choose the level of production. In the Cournot - Nash equilibrium, the global production is inversely proportional to the equilibrium price and it's positively influenced by the number of companies.

The costs of entry and the IT-related costs arise gradually as a result of the creation/extinction of companies and the investment/impairment process. Together they determine the structure and evolutionary dynamics of the market in terms of the number of active companies in the sector, the production of each company and the point of equilibrium for each sector, for each period.

Etro's (2009) study was based on data coming from the official statistics of EU and focused on the following aggregated sectors:

- Production
- Wholesale and retail trade (WRT)
- Hotels and restaurants (HR)
- Transport Storage and Communication (TSC)
- Real estate renting and business activities (REB)

Etro (2009) claims that the increasing the marginal cost of production is endogenous and depends on the companies' technological options that decide the amount of hardware and software resources used in production according to their needs. The key factor for adopting the "cloud computing" technology represents the generated cost savings. Authors, such as Dubey and Large (2007), estimate significant cost savings for businesses that activate in the "services" sector based on Carr's statement (2003) that about half of companies' capital expenditures are related to IT&C.

In 2006, the European Commission's e–Business report highlights that 5% of the total costs are costs in IT. Etro (2009) supports the idea that the average budget for IT&C exceeds 5% of the total fixed costs of production. Of course that only part of the IT&C cost represents fixed costs and that only part of these costs will be reduced even after the adoption of the "cloud computing" technology as an alternative to existing solutions.

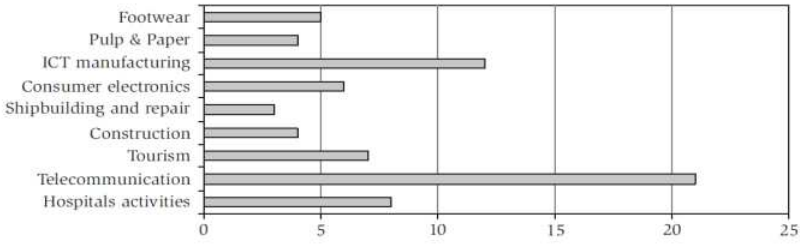

Figure 1. Average share of the ICT budget as % of total costs (by sector).

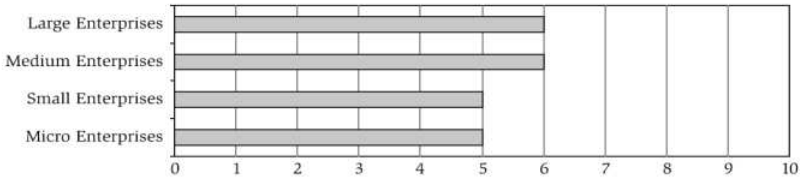

Figure 2. Average share of the ICT budget as % of total costs.

In Etro's study (2009) it's estimated that the introduction of the "cloud computing" technology could create, on average, about one million additional jobs in Europe, mainly in countries like Britain, Germany, France, Italy, Poland and Spain. Certainly this growth will decrease over time due to the fact that the structural characteristics of the economy lead to employment to the natural level, which is affected to a lesser extent by reducing fixed costs. However, the short-term impact of the crisis that has not yet been overcome can help limit the rising unemployment in a significant way. Etro's (2009) forecasts for reducing unemployment in European countries due to the introduction of the "cloud computing" technology are of 0.5% on the short-term and of 0.2-3% in the medium term.

A gradual development of the "cloud computing" technologies reduces fixed costs required to enter a sector and also increases the incentives to enter, thereby increasing the competition in the sector and the level of production. The increased labor demand induces an upward pressure on wages which forces employees to work harder. Current and expected production growth affects consumption/economic behavior. In the short term, the demand for creation of new companies requires an increase in savings that can induce a temporary negative impact on consumption, but in the medium and long term, positive impact on production leads to an increase in consumption to a higher level than the steady state.

Etro (2009) estimated that an impact is expected to occur in aggregated sectors of wholesale and retail (plus 156 000 companies in the medium term under fast adoption) and estate and other business activities (plus 144 thousands of new SMEs). This effect is permanent in Etro's (2009) vision and will tend to expand over time as more profound in countries where SMEs spread is stronger or if ICT adoption was rapid. Etro (2009) estimated that in Italy over 81,000 new SME will be created under rapid adoption of the new ICT technologies, in Spain over 55 thousand new SMEs will be created, in France over 48,000 new SMEs will be created, in Germany over 39,000 new SMEs will be created, in the UK over 35,000 new SMEs will be created and in Poland will be created over 32 thousand new SMEs.

Romanian Ministry of Communication and Information Society (MCSI) representatives asserted, as part of a Market Watch interview that took place in 2011, as a result of the communications market analysis and development perspectives, that "Romania is ready to migrate towards the cloud computing technology, mainly on the strength of the high speed internet connection, the refurbishment investments, as well as of the competent personnel, prepared to implement and use cloud computing based services".

In another press release, the Ministry of Communication and Information Society official claimed, in 2011, that "in 2-3 years, the cloud computing technology could be implemented at a large scale, not only in Romania, but anywhere around the world".

The same precognition comes from Yugo Neumorni, CIO Council president, claiming that in 5-7 years, the cloud computing technology could gain a large commercial utilization in Romania, detained, however, by the problems caused by the European Union legislation, which could pose difficulties for Romania in adopting this technology.

The research and market analysis company IDC Romania conducted a study

upon the cloud computing Romanian market ("Romania Cloud Services 2011 – 2015 Forecast and 2010 Competitive Analysis"); the results show that the cloud market in Romania is expected to grow at least 5 times faster than the general IT market, the fastest growth being expected for PaaS services, while the lowest, for SaaS services.

In the short term, the situation in Romania is shown in the table below:

SMEs created	Slow Adoption	Fast Adoption
Manufacturing	251	1296
Wholesale and Retail Trade	877	4534
Transports, Storage and Communication	137	706
Hotels and Restaurants	88	453
Real Estate and Business Activities	358	1850
Total	**1710**	**8840**

In the medium term, the situation in Romania is shown in the table below:

SMEs created	Slow Adoption	Fast Adoption
Manufacturing	286	1476
Wholesale and Retail Trade	1000	5161
Transports, Storage and Communication	156	804
Hotels and Restaurants	100	516
Real Estate and Business Activities	408	2105
Total	**1949**	**10061**

In absolute terms, the biggest impact will target the manufacturing sector and also hotels and restaurants, and this is not surprising, given the large number of employees in these aggregated sectors. Generally speaking, the impact on employment is more limited in comparison with the impact on business creation for a simple reason. One of the main advantages of cloud computing technologies is the change taking place in the market structure by founding multiple companies, as well as, increasing the competitiveness level (along with a reducing the prices). This change of market's structure along with a higher efficiency determines a re-allocation of jobs, which does not increase by more than the number of employees.

Research methodology

Our research approach consisted in checking the perception of both MSc students enrolled to research and professional masters organized by the Faculty of Accounting and Management Information Systems and teaching staff who is teaching Accounting

in Academy of Economic Study as regards the usefulness of adopting the "cloud computing" technologies by more and more Romanian companies.

Thus, the questionnaire developed by the research team and distributed in the period November 2012 - February 2013 both electronically and in classic format aimed the following categories of respondents:

A. Graduates of Accounting;

B. Universities' graduates without accounting profile;

C. Teachers who are teaching Accounting in ASE, as analysts, CECCAR members and so on.

Results achieved

Following the initial processing of the statistical data achieved by the interview technique, 372 usable responses were obtained from the teaching staff of Faculty of Accounting and Management, ASE Bucharest and the MSc students enrolled to research and professional masters organized by the Faculty of Accounting and Management Information Systems. The distribution of responses by category of respondents is as follows:

- The graduates with an "accounting" (category A) provided 109 usable responses, representing 29.3% of the total;
- The graduates without an "accounting" specialization (category B) provided 232 usable responses, representing 62.4% of the total.
- The teachers provided 31 usable responses, representing 8.3% of the total.

As a result of processing the data obtained by the questionnaire we could draw the following conclusions:

A. Understanding of the cloud computing concept of: 57.3% of respondents said they are familiar with the concept of "cloud computing", the remaining 42.7% saying they do not know this concept;

B. The field in which the respondents are working: 18.3% of respondents are working in banking, 26.6% work in the accounting field, 18.3% work in the IT field, 18.3% work in services, and 18.5 % are not working at all;

C. The reduction of fixed costs following the adoption of the "cloud computing" technology: 55.9% of respondents who know this concept believe that its adoption will significantly reduce fixed costs, while 44.1% believe that its adoption will not affect fixed costs. Over 50% of respondents that are working in IT, services, accounting and banking agree that the adoption of this technology will reduce fixed costs;

D. Usefulness of adopting the cloud computing technology by the Romanian companies: 58.3% of respondents who know the technology "cloud computing" believe that the adoption can be beneficial for Romanian firms, while 44.1% believe that the adoption of this technology will adversely affect the Romanian companies. Respondents working in IT (58.9%) and services (58.9%) appreciate the utility of adopting this technology in a significantly higher extent compared to respondents working in accounting (57%) or in banking (57.5%);

E. The impact of IT outsourcing on jobs available: 49.5% of respondents who know the "cloud computing" technology believes that its adoption will have a negative impact on existing jobs, while 50.5% believe that the adoption this technology will create jobs, especially in the short term. Respondents who are working in banking (52.5%) and those

working in services (51.2%) think that the adoption will impact negatively on existing jobs, while respondents working in accounting (46.4%) and those working in the IT (46.1%) believe that the adoption of this technology will create jobs, at least, in the short term.

Conclusions

The main reason for adopting the "cloud computing" technology as an alternative to the existing IT solutions is the cost savings generated. Our survey's purpose consisted in checking the perception of both MSc students enrolled to research and professional masters organized by the Faculty of Accounting and Management Information Systems and teaching staff who is teaching Accounting in Academy of Economic Study as regards the usefulness of adopting the "cloud computing" technologies by more and more Romanian companies.

The study' results pointed out that the majority of MSc student are really convinced that adopting the "cloud computing" technology by more and more Romanian companies could have a benefic impact in terms of reducing the fixed costs, and at the same time, a disturbing impact in terms of reducing drastically the number of jobs in the long-term.

REFERENCES:

1. **Federico Etro**, *The Economic Impact of Cloud Computing on Business Creation, Employment and Output in Europe*. An application of the Endogenous Market Structures Approach to a GPT innovation
2. **Colciago, A. and F. Etro**, 2008, *Real Business Cycles with Cournot Competition and Endogenous Entry*, WP 135, University of Milan, Bicocca, Dept. of Economics.
3. Economist, 2008, *Where the Cloud Meets the Ground*, Report, October 25th, 387.
4. **Etro, F.,** 2004, *Innovation by Leaders*, The Economic Journal, 114, 4, 495, 281-303.
5. **Etro, F**., 2007a, *Endogenous Market Structures and Macroeconomic Theory*, Review of Business and Economics, 52, 4, 543-566.
6. **Etro, F**., 2007b, *Competition, Innovation and Antitrus*t, New York and Berlin, Springer.
7. **Etro, F**., 2008a, *Stackelberg Competition with Endogenous Entry*, The Economic Journal, 118, 1670-97.
8. **Etro, F.**, 2008b, *Growth Leaders*, Journal of Macroeconomics, 30, 3, 1148-72.
9. **Etro, F.**, 2009, *Endogenous Market Structures and the Macroeconomy*, New York and Berlin, Springer.
10. **Etro, F.,** 2010, *Endogenous Market Structures and Strategic Trade Policy*, International Economic Review, forthcoming.
11. **Etro, F. and A. Colciago**, 2007, *Endogenous Market Structure and the Business Cycle*, WP 126, University of Milan, Bicocca, Dept. of Economics.
12. European Commission, 2007, The European e-Business Report, 2006/07. *A portrait of e-business in 10 sectors of the EU economy*, 5th Synthesis Report of the Sectoral e-Business Watch, Brussels, European Commission.
13. European Commission, 2008, The European e-Business Report 2008. *The Impact of ICT and ebusinesson firms, sectors and the economy*, 6th Synthesis Report of the Sectoral e-Business Watch, Brussels, European Commission.

14. International Data Corporation, 2008, IT Cloud Services Forecast – 2008-2012: *A Key Driverfor Growth*, mimeo, October 8, http://blogs.idc.com/ie/?p = 224

15. **John F. Gantz Stephen Minton, Anna Toncheva**, Cloud Computing's Role in Job Creation, March 2012

16. **Christauskas, C., & Martinkus, B.** (2004). *Information System for Accounting*. Folia Oeconomica: Accounting Change in the Period of Economic Transformation in Poland and Lithuania, 173, 15-22.

17. **Davidaviciene, V.** (2008). *Change Managment Decisions in the Information Age.* Journal of Business Economics and Management, 9(4), 299-307. http://dx.doi.org/10.3846/1611-1699.2008.9.299-307

18. **Diskiene, D., Galiniene, B., & Marcinskas, A.** (2008). *Management Attitudes in the Context of Global Challenges: the Lithuanian Survey*. Transformation in Business & Economics, 7(15), 21 - 38.

19. **Galiniene, B., & Marcinskas, A.** (2007). *Factors Determining the Quality of Business Valuation Services in the Transformation Context.* Transformation in Business & Economics, 6(12), 38-50.

20. **Miseviciene, R.** (2009). *New Framework for Teaching of Accounting Systems.* Information Technologies' 2009: ISI proceedings of the 15th International Conference on Information and Software Technologies, IT 2009, 273-281.

21. **Misevicius, P. V., & Miseviciene, R.** (2004). *Evaluation of Computerized Accounting Systems for Small and Medium Enterprises in Lithuania.* Inzinerine Ekonomika-Engineering Economics(1), 32-38.

22. **Zavadskas, E. K., Kaklauskas, A., & Banaitis, A.** (2010). *Application of E-Technologies for Regional Development: the Case of Vilnius City*. Journal of Business Economics and Management, 11(3), 415-427. http://dx.doi.org/10.3846/jbem.2010.20

23. Expert Group, *Advances in Clouds. Research in Future Cloud Computing*, Public version 1.0, European Commision, Information Society and Media, May, 2012, available at: http://cordis.europa.eu/fp7/ict/ssai/docs/future-cc-2may-finalreport-experts.pdf, accessed on January, 27th, 2013.

24. "*The future of cloud computing – Opportunities for cloud computing beyond 2010*", Expert Group Report, European Comission – Information Society and Media, 2009

25. European Commission, "*ICT and e-Business for an innovative ans sustainable economy*", 7th Synthesis Report of the Sectoral e-Business Watch, pp. 22-25, 2011

26. Market Watch, *„Cloud Computing – Catalog de Soluţii, Tehnologii şi Bune Practici"*, Fin Watch, 2011