Cloud Computing in SMEs

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Abstract – **Small and medium sized enterprises (SMEs) assure economic growth in Europe. Generally, many SMEs are struggling to survive in an ongoing global recession and are often reluctant to use research results and new technologies for business and learning. Cloud Computing offers many opportunities and could help companies to improve their business and use technology more efficiently. In this paper a short presentation of Cloud Computing and advantages for SMEs are given. The work in progress within the European project IN-CLOUD is presented in the paper. The results show that 70% of SMEs which answered to our research used Cloud services but they need more qualified staff in this field.**

Keywords-SME; Cloud Computing; European Cloud Computing Strategy; E-Learning; Erasmus +

I. INTRODUCTION

Small and medium sized enterprises (SMEs) assure economic growth in Europe, but the last financial crisis and the economic recession have hit SMEs hard in the EU28 and some of them have difficulties to survive and less resource to invest in new technologies [1].

Cloud Computing [2] offers many opportunities and can help companies to improve their business and use technology more efficiently. Some features i.e. on-demand services, broad network access, resource pooling, rapid elasticity and measured service distinguish Cloud from other computer networking models [3].

Cloud Computing could support SMEs' growth encouraging entrepreneurial practices at all levels [4]. But European SMEs are not making the best of the cost-effective solutions Cloud Computing has to offer i.e. avoiding large investments into hardware and software, entering the market more easily due to the cost-efficiency, attracting new customers by using new integrated Cloud Computing services. Universities/research can also benefit from cloud computing, as its storage capacity and economic viability ensure more efficient research management techniques in all fields. Cloud computing is thus an optimal solution for the innovation-driven alliance between universities and companies.

Cloud Computing reach interest in the corporate sector but some evidence a lack of professionals able to work in this field. According to the analyst firm IDC [5], in 2012 more than 1.7 million cloud computing jobs have remained unoccupied and the trend should lead to more than seven million cloud-related vacancies worldwide The European Commission has started several initiatives supporting the investment in entrepreneurship-boosting ICT and, in

September 2012 has adopted a strategy for "Unleashing the Potential of Cloud Computing in Europe". The European Cloud Computing Strategy [6] includes three key actions; the most relevant is the creation of a "European Cloud Partnership" providing strategic options to turn Cloud Computing into an engine for sustainable economic growth, innovation and cost-efficient public and private services.

In this paper, after a short presentation of Cloud Computing and advantages for SMEs, the objectives of the European project IN-CLOUD and the progress work within this project are described.

The general objective of the project IN-CLOUD is to foster a partnership between research, higher education institutions and the corporate sector, in order to help SMEs to use Cloud Computing and to qualify new professionals able to support competitiveness and growth of European Companies and Universities, thanks to the advantages offered by the Cloud Computing technology. The eight partners of the project are education and research institutions, SMEs organisations, public administrations coming from Germany, Greece, Italy, Portugal, Spain and UK. IN-CLOUD uses the results of the project Smart PA () oriented to the use of Cloud Computing in public administration and coordinated by one of the authors.

In this paper, after a presentation of cloud computing in SMEs, the research methods used and some conclusions of the work done so far within the project IN-CLOUD are given.

II. CLOUD COMPUTING IN SMEs

By using Cloud services SMEs can avail of opportunities that allow them to compete in an innovative ICT environment, and give a level playing field required to succeed in business [8][9]. In the discussion with experts and SMEs, the following advantages of Cloud Computing emerged [10] – Figure 1:

- Up-to-date low-cost software solutions
- Unlimited data storage
- Access to data from anywhere and anytime
- High levels of security protocol that ensures business and data protection
- Improved business performance
- Simplified data management

Examples of services SMEs could offer to their clients could be a combination of Business Services, Application Software Services, Infrastructure Services, Integration and Development Services – Figure 1.
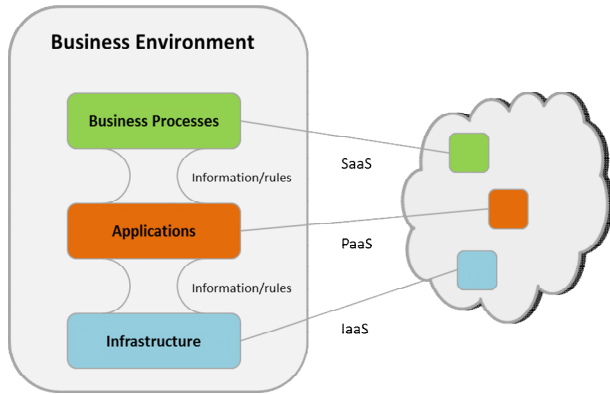
Figure 1.   Advantages of Cloud Computing

There are also a number of limitations or issues with Cloud Computing. One of the main issues is the reliability, security, private and ownership of data [11][12] as well as the accessibility of this on a 24/7 basis, particularly when the Cloud service Provider (CSP) has an outage. Many companies will have problems about the lack of control over their ICT systems and the impact of a CSP on these [13][14].

These issues may inhibit an SME's decision to migrate to a Cloud Computing environment. In addition, there are other factors which may influence the decision which the authors discuss with companies like the followings:

- The lack of understanding of the infrastructure, cost, and appropriateness to the needs and scenarios of several companies from different business environments.
- Inadequate skill levels of users, managers, and entrepreneurs to use Cloud.
- The readiness of SMEs to adopt Cloud Computing from a business perspective.
- Less time to test Cloud services.

Cloud computing requires also new skills which are the bases for the development of didactic units within our project IN-CLOUD i.e.,:

- Business and financial skills
- Technical skills: depending on how much of the cloud will be built and managed in-house
- Enterprise architecture and business needs analysis
- Skills to work with the business, speak the language of business, as well as work with IT professionals
- Project management skills
- Contract and vendor negotiation working with CSP
- Security and compliance
- Data integration and analysis skills
- Mobile app development and management, being driven by the need to provide services that can be accessed by any and all devices, be they laptops or smartphones.

Besides advantages within business, Cloud Computing can be used for improving learning both in SMEs as well in Education. In the following we present E-Learning. E-Learning could address issues of time and cost in SMEs, by allowing employees to access learning resources remotely. The learning material is easy to keep updated; the trainers can integrate multimedia content which facilitates understanding and motivate the participants, but this form of learning is not used efficiently in SMEs.

Masud and Huang presented in [15], besides the general characteristics of an E-Learning system, a system architecture that combines the capabilities of learning with advantages of Cloud Computing services. Some aspects which could be improved by using Cloud Computing to implement E-Learning are scalability of E-Learning systems at the infrastructure level, development and assigning of resources only for determined tasks, need to configure and add new resources making the costs and resource management less expensive [15].

Pocailu and Vetrici described in [16] a plan for implementing an E-Learning system based on Cloud Computer architecture and the positive effects of using Cloud Computer technology are discussed.

Two main characteristics of Cloud Computing which could be an alternative to traditional ICT centres and could improve the E-Learning approaches in SMEs are the use of resources "on demand" and the transparent scalability so that the computational resources are assigned when they are necessary without the necessity of infrastructure understanding by the users. Costs related to computer infrastructure maintenance disappear [17]. The authors of the paper coordinated national and international projects about E-Learning methods and platforms. The experience of these projects will be used in the following projects.

Figure 2 shows the architecture of a platform for E-Learning with integrated Cloud services [18].
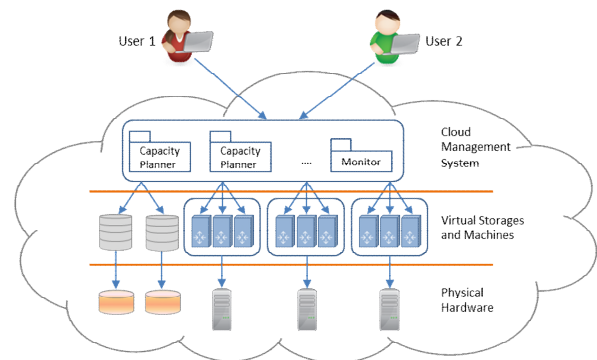

Figure 2.   The architecture of a cloud computing platform for E-Learning [16]

III. RESEARCH METHODS

The IN-CLOUD project intends to operate pursuing the objectives of the European Cloud Computing Strategy [4] with the general objective of – fostering a partnership between 2 research institutions, 4 Universities, and 3 SMEs associations from 5 European countries, in order to qualify

new professionals able to boost the competitiveness and growth of European Companies and Universities, thanks to the advantages offered by the cloud computing technology.

The advantages of working in cooperation with companies are:

- The needs of the companies and the requirements for qualifications could be taken into consideration at the beginning of the developments
- Testing of the didactic units and platform developed in the project could be conducted during the project period
- Exploitation of the results is ensured.

The used methods in the project IN-CLOUD to reach the objectives are the following:

- Analysis of the situation of the use and desire of ICT and Cloud Computing methods in SMEs of partner countries
- Analysis of the labour market requirements and of the necessary skills for SME staff in order to use Cloud Computing
- Development of qualification profiles for SME staff and Cloud Professionals
- Pilot actions to train SME staff based on the qualification profiles.

The first output of the IN-CLOUD, which started at the end of 2015, consists of a report that is the basis for the development of the other project activities. It includes a description of the Cloud Computing, an analysis of the awareness of the existing cloud computing technologies and services in the private and public sectors, a needs' analysis of technologies and services connected to Cloud Computing in the public and private sectors, an analysis of the professional skills required in the area of Cloud Computing and an analysis of the labour market actual situation and prospective of employability. The first design of didactic units that can satisfy the identified didactic needs will be also proposed as a result of this output.

The sent questionnaire contains questions about general company information, software usage and cloud computing. It was created with the help of Survey Monkey, an online survey development cloud-based company. It provides free, customizable surveys, as well as a suite of paid back-end programs that include data analysis, sample selection, bias elimination and data representation tools. Each partner searched for studies, publications, reports and projects about cloud computing.

We will present some results of the questionnaire including answers of all partner countries. 70% of 260 SMEs which answered use private or hybrid Cloud services. The following diagrams show some answers.
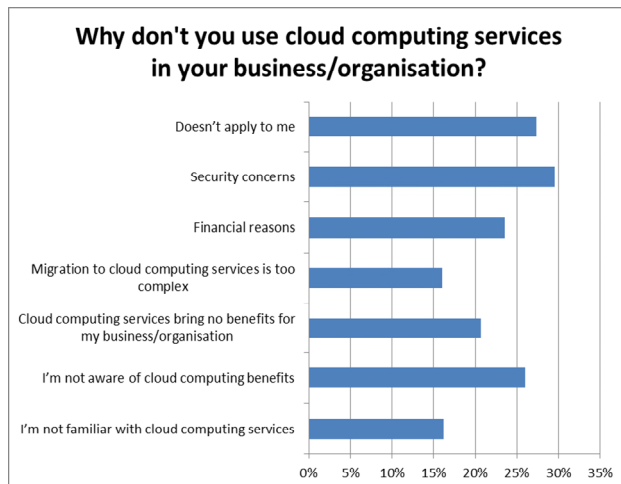

Figure 3.   Results from the questionnaire on cloud computing made in all partner countries

Security stands as the top barrier for Cloud adoption which reflects that business are reluctant to trust in Cloud security capabilities.

Another problem is that also due to lack of information SMEs are not familiar with benefits of Cloud.
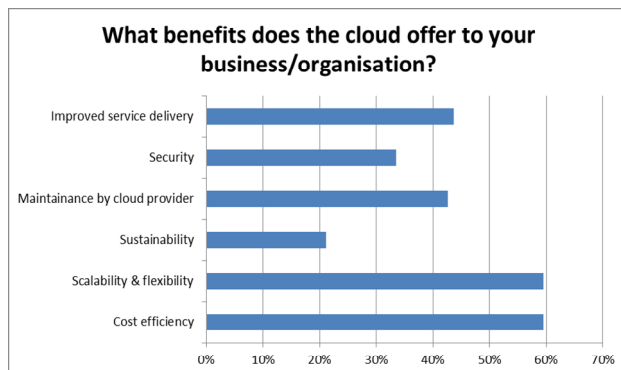

Figure 4.   Results from the questionnaire on cloud computing made in all partner countries

Scalability, flexibility and Cost efficiency seem to be the top motivators for companies to use the Cloud.

The project IN-CLOUD also researches the economic impacts of cloud computing on different types of SMEs. The first conclusion is that it depends on region and sector; the IT sector mainly will have the most advantages. This impact in Europe will depend on how service providers, governments and managers understand it. European cloud services providers need to offer competitive prices.

A set of didactic units and a set of VET Qualifications with instruments to validate them are in the development as well as an E-Learning platform with Cloud Computing Services and training material including practical applications for companies.

The qualifications are:

- Certified Cloud Professional for Business

- Certified Cloud Professional for Public Administrations
- Certified Cloud Professional for Education
- Certified Cloud Technology Professional

The profiles include core units of learning outcomes, ECVET points acquired, the related performance description/occupational standard, key activities, knowledge and skills, competences to be achieved during the qualification process.

For the qualification process different methods will be used based on the experience of the project partners:

- E-Learning platform with online modules, forum, exercises
- Videos with staff from companies
- Showcases with successful cloud implementations in SMEs

The IN-CLOUD project partners would like to cooperate with national governments in order to ensure an appropriate legal environment, procurement practices and energy prices. It will also depend on the willingness of managers to adopt the new practices necessary to exploit the technical and economic advantages of cloud computing.

IV. CONCLUSIONS

Small and medium sized companies remain vital for grow and innovation in the European economy but need support i.e. cooperation with research and education institutions in this context. Such cooperation is important to ensure the survival of these companies and encourage them to grow. In today's business world, SMEs are competing with a larger number of companies, many of these are multinationals; they have a greater number of staff and a wider pool of skills. SMEs should be helped to acquire the relevant strategic skills as quickly as possible to remain ahead of the competition by using latest technologies such as Cloud Computing for business and learning because most of them would like to use Cloud services.

In this context the steps within this project will cover the testing of the qualification units and the development of the E-Learning platform. The E-Learning platforms developed by the authors within other projects aimed at SMEs like ReadiSME and Archimedes will be the basis for it.

We are convinced that the project developments will help SMEs to increase innovation. The companies proved high motivation to qualify in the use of new technologies like Cloud Computing and E-Learning methods.

REFERENCES

[1] European Commission, "Annual Report on European SMEs 2013/2014: A Partial and Fragile Recovery", p. 10. http://ec.europa.eu/growth/smes/business-friendly-environment/performance-review/files/supporting-documents/2014/annual-report-smes-2014_en.pdf, 2014. Accessed on December, 28, 2015

[2] National Institute of Standards and Technology, NIST, "The NIST Definition of Cloud Computing," http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf, 2011. Accessed on December, 28, 2015

[3] Lucchetti, R. and Sterlacchini, A. "The adoption of ICT among SMEs: Evidence from an Italian Survey". In: Small Business Economics 23, pp. 151-168, 2004

[4] https://ec.europa.eu/digital-agenda/en/european-cloud-initiative. Accessed April 2016

[5] IDC Report, "1.7 Million Cloud Computing Jobs Remain Unfilled, Gap Widening". http://cloudtimes.org/2013/01/09/idc-report-1-7-million-cloud-computing-jobs-remain-unfilled-gap-widening/. 2012. Accessed on December, 28, 2015

[6] European Commission, "European Cloud Computing Strategy," https://ec.europa.eu/digital-agenda/en/european-cloud-initiative/. 2012. Accessed on December, 28, 2015

[7] www.smartpuba.eu

[8] Layo, I. "Cloud computing advantages for SMEs," http://cloudtimes.org/2013/09/18/cloud-computing-advantages-for-smes/. 2013. Accessed on December, 28, 2015

[9] Ouf, S. and Nasr, M. "Business intelligence in the cloud," in IEEE Third International Conference on Communication Software and Networks (ICCSN2011). pp. 650-655, 2011.

[10] Hamburg, I. "Improving e-Learning in SMEs through cloud computing and scenarios". In: Gradinarova, B. (ed.): E-learning – instructional design, organizational strategy and management. Rijeka: InTech: pp. 481-498, 2015

[11] Cavalcanti, G. "Barriers to implementation of information and communication technologies among small- and medium-sized enterprises," The digital divide through the business lens, MBA., California State University, Fresno, pp. 57, AAT 1444963, 2006

[12] Shiels, H., Mclvor, R. and O'Reilly, D. "Understanding the implications of ICT adoption: Insights from SMEs, Logistics Information Management," 16 (5), pp. 312-326, 2003

[13] Hamburg, I. and Marian, M. "Supporting knowledge transfer and mentoring in companies by e-learning and cloud computing," ICWL 2012 International Workshops, KMEL, SciLearn, and CCSTED, Sinaia, Romania, September 2-4, 2012; revised selected papers. Heidelberg: Springer: pp. 231-240, 2012

[14] Fernández, A., Peralta, D., Benítez, J.M. and Herrera, F. "E-learning and educational data mining in cloud computing: an overview," Int J Learning Technol, 9(1), pp. 25-52. 2014.

[15] Masud, A.H. and Huang, X. "Esaas a new education software model in e-learning systems." in M. Zhu (ed.), ICCIC 2011, Vol. 235 of CCIS, pp. 468-475, 2011

[16] Pocatilu, P. and Vetrici, M. "Using Cloud computing for E-Learning Systems," Proceedings of the 8th WSEAS International conference on data Networks, Communications, computers, Italy, 2009

[17] Hamburg, I. "Learning as a service – a cloud-based approach for SMEs." Service computation 2012: The Fourth International Conference on Advanced Service Computing, pp. 53-57, 2012

[18] Sulistio, A., Reich, C. and Doelitzscher, F. "Cloud infrastructure and applications – cloudia". In: Jaatun, M.G. , Zhao, G. and Rong, C. (Eds.): CloudCom, Vol. 5931 of Lecture Notes in Computer Science, Springer, pp. 583-588, 2009