Implementation of Cloud Computing in Albania and Related Security Concerns

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***Abstract*—Cloud Computing Technology is one of the Information and Communications Technologies (ICTs) which was given the most attention to during this recent decade. Since the trend of Cloud Computing Technology is already well-oriented in the World, we will see how this trend is affecting Albania and how this technology has been adopted in the local market. To identify this, we have conducted a research method based on two theories: the diffusion of innovation (DOI) model, and the technology organization environment (TOE) framework. This paper will present three Cloud Technologies' cases implemented in Albania by public and private companies, as well the technical challenges and economic opportunities these implementations caused to the respective organizations. In the end, we will briefly present the results of the research, impacted factors, and the approach that should be followed by each player in order to have such technology more present in the Albanian market.**

Keywords- Cloud Computing; Security Concern; Regulation Normatives; Technological Challenges; Diffusion of Innovations (DOI); Technology Organization Environment (TOE).

I. INTRODUCTION

Cloud Computing technology is revolutionizing Information Technology (IT) services nowadays. Almost all major IT hardware and software companies are focusing on delivering these services. Following Amazon's $ 2 billion investment in IBM infrastructure-based services in March 2006 [15], all other global companies have followed this strategy by offering various services, such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Storage as a Service (StaaS) or Software as a Service (SaaS) [17]. As per such development, we can mention the services provided by Microsoft with Azure, or Google with G Suite and Oracle with Oracle Cloud [16]. All application development companies are trying, through customer requests, to switch all their services from their offices to the cloud platforms of their respective companies. Microsoft is performing this through pushing its customers to get Cloud Services during respective Enterprise Agreement renewal [19]. SAP has already announced that it will provide support for on-premise platforms up to 2025, and after this time it will interupt support services for customers who still have on-primise platforms. Consequently, all customers running SAP applications will have to migrate their on-premise services to the cloud by 2025 [18].

The focus of this paper is primarily to identify the adoption, and Implementation of Cloud Computing in Albania. In section 2, it is provided a general overview of Cloud Computing trend in the world, and in Albania. Section 3 is depicting a general overview of Cloud Computing implementations which happened in Albania in both public and private sectors. Section 4 explains the research method, based on the DOI model, and on the TOE theory framework. In section 4, the survey results, and the main reasons of low adaptability, and implementations in Albania have been provided. In the end, conclusions and future works have been depicted accordingly.

II. CLOUD COMPUTING TRENDS AND APPROACHES

Considering the above mentioned important and fast technological and commercial developments, all existing IT services will be shifted towards a centralized hardware and application development for all clients. Although the strategy from global companies and technology leaders is clear, most clients and local companies are not yet aware, and do not own a strategy on how to approach accordingly. Most national companies are attempting to primarily pursue the first two approaches; the 1st approach, being based on establishing a partnership with global companies, and become resellers of their services; and the 2nd approach, being based on making own investments and operating independently for similar services. Both ways have their pros and cons. Basically, becoming a reseller of a global company has its benefits because you do not have to invest in infrastructure, maintenance, human resources, or in the field of products and marketing, for the reason that all these items are granted from the provider. On the other hand, a disadvantage of this approach is the fact that the client is always the provider's client. In order to illustrate this case we can mention one example from 3G Ireland. This company became Microsoft Cloud Service Provider (CSP) and started selling Office 365 products. After a period of 1 year, it was identified that the revenue trend generated by this service was quite as low as not even covering the investment performed for marketing campaigns, or other product operations expenditures. In this regard, it was much evident that such service was not profitable enough for the company. As a result, the company's board of directors made the decision of terminating the service, and no longer marketing it. However, the existing 10,000 customers were

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not affected by this decision at all, as they were secured uniterrupted service, with the only understandable difference that the service provider was no longer 3G Ireland, but Microsoft. Another major disadvantage of this method are the small profit margins, which make such service in small markets to result as non-profitable, just like 3G Ireland did. In the second approach, companies decided to invest themselves for providing such services, which substantially has its own benefits raleted to the fact that: service is local, customers remain with the company, and there exists higher trust from customers, and faster access to services. The disadvantages of this method though are related to the fact that investment costs are very high, leading to the need of more resources, and higher operational costs (maintenance, and support staff). Furthermore, when it comes to small market countries, this kind of approach is explicitly not profitable because products will have expensive prices compared to global providers due to high TCO.

However, despite the overall above picture, many telecommunication companies such as Deutche Telekom, Telefonica, Telecom Italia, etc., have extensively implemented their cloud services platforms in many countries around the world. Moreover, upon UK's exit from the EU, such companies have accomplished to make USA-based companies like Microsoft, Google and Amazon host their Cloud infrastructure on their premises for services they provide in the European Union market. Most of Google, Microsoft or Amazon platforms are now hosted at Telefonica' Data Centers or Deutche Telekom' Data Centers all across Europe.

A. World trends

Cloud Computing is winning a huge significance nowadays by influencing almost all technological developments in the field of information technology. All countries are experiencing quite a significant and explosive situation where international companies established in the USA, such as Amazon, Google, Microsoft, etc., strongly operate in the markets around the world with their Cloud Computing services. Worth mentioning is the fact that after the substantial investment realized by Amazon back in March 2006, the current $100 billion Cloud Computing market is controlled by Amazon at 33% and they are generating $33 Billions of revenue a year from Cloud Computing services. Additionaly, this market is followed by Microsoft Azure with 18% and Google Cloud with 8%. We can clearly distinguish the created advantage from such companies in global market share. In the top-8 list there are as well two Chinese companies such as Alibaba Cloud and Tencent Cloud, where both own 7% of the widespread market. The Chinese case is clearly related to the potential of the domestic market which is reflecting in such positioning on respective global market shares [1].

B. Situation in Albania

It is worth noticing that in Albania Cloud Computing technology is not yet finding widespread support and application among users and providers of information and telecommunication services. This situation is characterized by several factors that directly influence the development of such technology:

- Firstly, the Albanian market is considered small and therefore demand is extremely trivial.
- Secondly, required investments (CAPEX) for Cloud Computing technology are relatively substantial and do not justify the low market demand.
- Thirdly, there is no legal regulatory framework in place to protect and stimulate the development of such technology within the Albanian territory.

Despite the above mentioned, in Albania some improvement is needed to be done when it comes to Internet Services. At first, the Albanian Government has to call for the development of broadband internet access from all licensed operators throughout the country. This is a key component for the provisioning of Cloud Computing services. Although the number of Fixed Telephony lines has almost doubled from 2015 to the 4th quarter of 2019, this is still not enough, as many houses, and rural areas have no internet access at all [2].

Significant progress has been carried out by Mobile Telephony operators with the implementation of 4G Services, but even such development lacks full coverage of the entire territory. Such services were only deployed in high density residential areas, mainly in the big cities. Regarding 5G Technology, licenses have already been acquired by all operators, but its implementation has not started yet. There is no information regarding any implementation start-up, nor any timeline on when all the country's territory will be covered by the 5G technology. Furthermore, noteworthy is the fact that the absence of broadband fixed-line telephony services in rural and remote areas has made it impossible to offer private Wi-Fi services. To support our claim we can mention the fact that in one of the most important tourist attraction located in the northern part of country, the Albanian Alps, called Tamara, the mobile telephony signal coverage, and the 3G were enabled as late as the end of year 2016 [3]. Although the fiber optic infrastructure is being established altogether, for this area, fixed broadband telephony services are not yet present. To sum up, without spread developmet of Internet Access and Broadband Services we cannot pretend to have high demand, and need for Cloud services in Albania.

Although the indicators of providing Cloud Computing services are not at their optimum in the current domestic market, there is an expectation of market reaction and interest for the upcoming years. This will come as a result of the Albanian businesses' own demand for such services (example Hotels, Agricultures Companies, etc.). This spirit will be further intensified by the current brain drain situation (the migration of IT specialists to European Union countries), and this lack in Human Resources will drive businesses to choose such services as a feasible, and effective option. However, globalization and pricing policies set by big players are negatively affecting developing countries, like Albania and are not favorizing respective demand coming from these countries. Price differentiation for these countries is imperative in order to boost service

request as well as to extend usage of Cloud Computing technology throughout the country.

In a time when in the region, and around the world it is largely articulated that Cloud Computing is the technology of the future, at a summit organized in Zurich, Switzerland by HP company in October 23rd, 2012, it was claimed that the income generated from Cloud Computing for Swisscom (the largest IT company in Switzerland) was 5-6% of the total revenue, and the forecast for the following three years was that this figure would go up to 7-9%. So, this figure is viewed as very small, and the investment return for this technology is very low in comparison with other technologies such as NGN New Generation Networks (Voice-Internet-TV), with a rough estimation of 20% [14].

III. CLOUD COMPUTING IMPLEMENTATIONS IN ALBANIA

Currently some ongoing investments are being made in Albania. These investments are related to both public and private sectors. In the following sections we will depict general information for every case and some high level information respectively:

A. Public Sector – Services provided by National Agency for Information Society

In 2008, the Albanian Government started the implementation of Cloud Computing technologies for its purposes. This implementation was designed, and followed by the National Agency for Information Society (NAIS) [4]. The project implementation was carried out in partnership with the Infosoft Systems Company; the hardware systems devices used were those produced by HP Company, and the softwares used the applications platforms of Microsoft Company [6]. The Cloud Computing model implemented in this project was that of Private Cloud. The main objectives of this project consolidated the government IT resources into a single agency, reduced costs and improved the IT services of state agencies and ministries.

Although initially it was thought of a little structure and minimal use, it has already turned into a big and very important platform, which holds more than 100 different applications, such as public websites, intranets, government existing applications, etc. [7]. This implementation was enabled in order to centralize, and standardize the infrastructure used before in all state institutions of the country. In this regard, all ministries and state agencies receive better, and more qualitative service, and moreover it makes them only focused on services to citizens, not to the infrastructure, and its maintenance.

B. Private Sector – Services provided by ALBtelecom

Regarding the private sector, it is worth mentioning the most significant implementations to have attempted to join the global trend, and provide Cloud services locally in Albania. In April 2013, for the first time in the Albanian market, the implementation of a real public cloud infrastructure was launched. This implementation was carried out by ALBtelecom, and it was aimed for the entire range of businesses in Albania; starting from SOHOs, and ending with large businesses. This infrastructure was providing guarantee, quality, and faster delivery time of the given service through two data centers, one in Tirana, and the other in Elbasan, (as stated by Mr. Vahap Yeroglu, CIO of ALBtelecom) [12]. According to the publications [9], [13], this platform offered hosting of all kinds of applications, to all customers, ranging from websites to specific applications, such as those for the sales management, human resources management, Customer Relations Management (CRM) and finance management. Through this infrastructure ALBtelecom is able to offer private cloud services as well, customize the types of services for specific customers. It is reported that infrastructure can hold up to 30,000 clients [10]. The offering of this technology makes ALBtelecom the first private company in Albania to give this service recipients the opportunity to keep the data service within the Albanian territory.

C. Private Sector – Services provided by Vodafone Albania

On April 19th, 2013, Vodafone launched its new service, called Vodafone Cloud, in the Albanian market. This service enabled all prepaid and postpaid subscribers saving their personal data such as photos, videos, contacts and various files containing important information for these customers. This type of service could be accessed from different devices, such as computers, or smartphones, with various operating systems installed. The initiative undertaken by Vodafone became an ongoing strategy of Vodafone Group, offering the cloud Services to all its subscribers in all subsidiaries of the company. It is worth mentioning the fact that although Vodafone Albania has implemented some initiatives to provide the Cloud technology, they have been group-borrowed efforts from other countries rather than direct investments made in Albania. In this context, at group level, Vodafone has signed a contract with Microsoft for the provision of cloud services. As a result, Vodafone becomes Cloud Services Provider of Microsoft. Moreover, recently Vodafone has as well signed an agreement with Amazon to be Amazon Web Services Provider, at group level [8].

IV. THEORETICAL BACKGROUND

The most well-known theories about technology adoption at company level are the DOI model, and the TOE framework [20]. Although there are studies where some authors have conducted respective research in one of such methods, or both of them, we will consider the second option to be more effective, and accurate [21], [27].

A. Diffusion of innovation (DOI)

DOI is a theory that examines how, and in which way new technologies, especially IT ones are adopted, and accepted among different communities and cultures [22]. This theory suggests that it is principally based on features of the technology, and on the perception of users regarding the system. Roger analyses the spreading of innovation, and has suggested some characteristics which influence the

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adoption of innovation, such as: relative advantage, complexity, and compatibility [24].

Relative advantage is the degree to which an innovation can bring benefits to an organization. Compatibility refers to the degree to which an innovation is consistent with existing business processes, practices, and value systems. Complexity considers the degree to which an innovation is difficult to use [25].

B. *Technology, organization, and environment (TOE) framework*

The process by which a company or organization adopts and implements technological innovations is influenced by the technological context, the organizational context, and the environmental context [23].

The technology context refers to characteristics of the technologies which are available for possible adoption by the organization, and the current state of technology in the organization. The organizational context consists of the organizational structure, the presence of innovation – enabling processes such as informal communication, and strategic behavior of top management, as well the size, and slack resources of the organization. The environmental context mixes nearby market elements, such as competitive pressure and regulatory support [26].

V. RESEARCH METHOD

We will base our research method by combining the DOI model, and the TOE framework, once they complement each other, which seems to be a better solution to this analysis, since it combines different contexts, as previously mentioned [29].

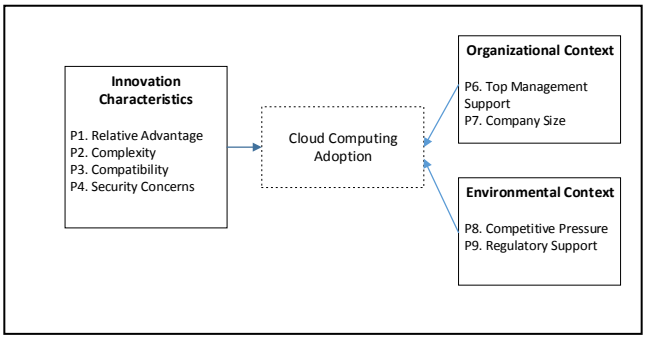

Figure 1. The research method.

The research method Fig. 1 includes the context of innovation defined in the DOI theory, and the two contexts presented on the TOE framework. The technology context was not included in our study due to the fact that such domain is quite complete, and easily deployable.

A. *Inovations Characteristics*

Considering the adoption, and implementation of Cloud Computing, we believe there are 4 variables in the context of the characteristics of innovation: relative advantage, complexity, compatibility, and security concerns [30].

- Relative advantage

  Rogers [22] has defined relative advantage as the degree to which an innovation is perceived as being better than the idea it supersedes. In our analysis we will propose: P1. Relative advantage will positively influence Cloud Computing implementation.
- Complexity

  Rogers has defined complexity as the degree to which an innovation is perceived to be relatively difficult to understand and use. In the same spirit, we will propose: P2. Complexity will negatively influence Cloud Computing implementation.
- Compatibility

  Rogers has defined compatibility as the degree to which innovation fits with the potential adopter's existing values, previous practices, and current needs. In this regard, we will propose: P3. The high compatibility will positively influence Cloud Computing implementation.
- Security concern

  With shared computing resources, security is a critical issue in Cloud Computing. Moving to cloud, a new security layer will convince companies or not. In this regard we will propose: P4. Security concerns will positively influence Cloud Computing implementation. [28]

B. *Organizational Context*

The organizational context is defined in terms of resources available to support the adoption of the innovation [31].

- Top Management support

  Top management plays an important role because Cloud Computing implementation may involve integration of resources, and reengineering of processes. In this regard, we will propose: P5. Top management support will positively influence Cloud Computing adoption.
- Company size

  A determinant factor in Cloud Computing implementation is company size. It is understandable that big companies have more advantages than smaller ones, considering the big number of resources, from human and technological aspects. In this regard, we will propose: P6. Firm size will positively influence Cloud Computing adoption.

C. *Organizational Context*

Environmental context includes the company's competitors, and the regulatory environment.

- Competitive pressure

  Competitive pressure has long been recognized in the innovation diffusion literature as an important driver on the technology diffusion. It refers to the level of pressure felt by the firm from competitors within the industry [20], [32]. With the implementation of Cloud Computing, companies greatly benefit from a better understanding of market visibility, greater operation efficiency, and more accurate data collection. In this

regard, we will propose: P7. Competitive pressure will positively influence Cloud Computing implementation.

- Regulatory support

This refers to the support given by the authority in order to encourage the increase of Information Systems (IS) innovations in companies. Governments could facilitate the adoption of Cloud Computing by creating rules to protect businesses in the use of this system. In this regard, we will propose: P8. Regulatory support will positively influence Cloud Computing implementation [30].

VI. Survey results, Security and Privacy Concerns and Missing Regulatory Support

In order to verify this research method, a survey was taken, among 250 IT community members all around Albania. 55% of the people were from the private sector, 30% from public sector, and the rest, i.e. 15% freelancers, and employees of non-profit organizations.

The main result from this survey was the fact that Cloud computing is not usually adopted, and implemented in Albania. One of the main reasons according to outcomes was the fact that there exists a big concern regarding security, and privacy. It consist of the fact that users think their data may be used for unknown purposes, without them being aware, without prior consent, or approval. Due to this concern, it is worth noting that the security and privacy of users' data on cloud platforms is regulated differently in different countries. Currently, in Europe the law on the protection of personal data, called General Data Protection Regulation (GDPR) applies to all US companies operating in Europe. By this law, all these companies are obliged to store, process and transmit the data of European users within the bonderies of the European Union. Consequently, all companies have been forced to build and operate their own computing infrastructures in the European Union countries for the services provided to European citizens.

In Europe, the general structure related to data protection and freedom of movement was established by Regulation (EU) 2016/679, (General Data Protection Regulation) [6]. National displacements realized by each Member State, assume considering national law as a guiding criterion. The European Commission, and the European Institutions have taken decisions, and carried out informative campaigns through explanatory, and orientation documents. The content of these documents (as in the case of the European Network and Information Security Agency (ENISA), [15] which speaks for the basic nature of the legal structure) have been adapted by all global companies operating in Europe.

In Albania, the law does not predict exactly what obligations (processing, transfer, and security) should be applied to the data located in the cloud. Currently there is only the law on personal data protection [9] which does not contain, nor treat the above mentioned features for Cloud Computing. Albanian legislation on personal data protection does not make it mandatory to process, store, and transmit data of Albanian users within the territory of Albania, but is more in line with the European laws on personal data protection, allowing Albanian users to use the services of international providers operating under the terms of the European Union. In this way, the economic activity of the Albanian operators as well as the revenues that the state institutions can benefit from providing, and receiving these services within the territory of the country are directly affected. In this regard, Albanian legislation has a huge missing regulatory framework which doesn't help adoption, and implementation of Cloud Computing inside the country's territory.

VII. Conclusions

Although Cloud computing can be seen as the new phenomenon which is set to revolutionize the way we use the Internet, there is much to be cautious about. There are many new technologies emerging at a rapid rate, each of which embracing technological innovations, with the potential of making humans lives easier. However one must be very careful to understand the limitations, and the security risks posed in utilizing these technologies. Cloud computing is no exception. Almost all large information technology companies such as Microsoft, Google, Amazon, Oracle, IBM, etc. provide opportunities of cooperation with local companies in order to use local cloud platforms of these companies for meeting legal obligations in the respective countries. With their support, local companies realize spending cuts, taking subsidies for infrastructure, and increasing the base number of customers consequently generating more revenue.

We have shown here that Albania has already hit the road towards the Cloud Computing era. Although implementations are few in number, they are very important from the technological and economic viewpoints.

In the Albanian legislation, currently there exists an open space for legal obligations to be met by companies for storing, processing, and securing of data that are residing in cloud computing platforms.

The lack of national laws for personal data protection has made the provision, and development of cloud computing services even less demanding, and with a shift towards Europe's service, mainly in Germany. The government's approach damages both corporations, and consumers. It creates an unfavorable climate for the provision of cloud computing services in the country by not providing legal obligations, and national security. Being in such conditions, Albanian customers prefer to get Cloud Computing services outside of Albania, for the sole reason that foreign companies are not interested in the Albanian data. But on the other hand, they do forget something crucial: data are the future gold, and should be taken care of as such.

This study was intended to explain the process of technology adoption, and to identify factors that affect the adoption of Cloud Computing in Albania. The model was designed based on the DOI and the TOE theory framework. The theoretical research carried out resulted in a set of contexts that may influence the adoption of Cloud Computing: characteristic innovations, organizational, and

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environmental context. The study is a contribution in defining the model of research, and development in the dimensions that constitute it, as well it is a resource for all companies, and researchers that may use the conclusions of this study to expand their knowledge in this field, eventually developing other externalities for such emerging technology in Albania.

REFERENCES

[1] F. Richter "Amazon Leads $100 Billion Cloud Market", Statista, Feb 11, 2020. [Online]. Available from: https://www.statista.com/chart/18819/worldwide-market-share-of-leading-cloud-infrastructure-service-providers/, [retrieved: 04, 2020].

[2] Electronic and Postal Communications Authority (AKEP) "Statistical Indicators of Electronic Communications Market", Q4, 2019, Published on 11.02.2020. [Online]. Available from: https://akep.al/wp-content/uploads/2019/01/Raport-T4_2019.pdf, [retrieved: 05, 2020].

[3] M. Cakmak, ALBtelecom, and Eagle Mobile CTO "Work on fiber optic coverage, telephone signal and 3G services in the Kelmend area begins" ALBtelecom Mag, pp. 2-4, Jul 2016.

[4] E. Alite and J. Imami, ISTI 2014 "Technical Challenges and Economic Opportunities of Cloud Computing Implementations in Albania", Tirana, pp. 2-5, Jun 2014.

[5] E. Hasa "Albania consolidates government IT with HP and Microsoft cloud solution" *HP Case Study – Government of Albania*, pp. 1-3, January 2013.

[6] E. Hasa "Albania Standardizes Government IT with Cloud Services, Lifts Productivity 70 Percent" *Microsoft Case Study – Government of Albania*, pp. 2-5, February 2012.

[7] Albtelecom Press Release "Interview with Deputy General Director of Albtelecom and Eagle Mobile, Mr. Vahap Yeroglu", Tirana, Albania, pp. 1-2, January 20, 2014.

[8] A. Mucobega "ALBtelecom Unique Services E-Cloud", Tirana, Albania, pp. 1-2, April 8, 2013.

[9] Eagle Magazine "Albtelecom's Cloud Computing", Tirana, Albania, pp. 1-4, April, 2013.

[10] Telecompaper.com "Albtelecom brings cloud computing services to Albania", Tirana, Albania, April 10, 2013.

[11] Official Document, Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation). [Online]. Available from: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32016R0679, [retrieved: 05, 2020].

[12] E. Alite and O. Shurdi, ISTI 2015 "Implementation of Cloud Computing platforms in Albania. Data Security and financial impact for storing them within national boundaries", Tirana, pp. 2-5, June, 2015.

[13] Act, No. 9887, date 10.03.2008, changed with Act No. 48/2012 "For protection of personal data", [Online]. Available from: http://www.inovacioni.gov.al/files/pages_files/ligji_nr_9887_date_10_03_2008_i_ndryshuar_me_nr__48__2012__per_mbrojtjen___.pdf, [retrieved: 05, 2020].

[14] J. Joseph, "PSTN services migration to IMS are SPs finally reaching the tipping point for large scale migrations?," *2010 14th International Telecommunications Network Strategy and Planning Symposium (NETWORKS)*, Warsaw, 2010, pp. 3-6, doi: 10.1109/NETWKS.2010.5624927.

[15] M. Siegel, F. Gibbons "Amazon enters the Cloud Computing business" - Standford University School of Engineering, pp. 8-9, May 2008.

[16] E. Jones "Cloud Market Share – a Look at the Cloud Ecosystem in 2020" [Online]. Available from: https://kinsta.com/blog/cloud-market-share/, [retrieved: 05, 2020].

[17] N. Drake and B. Turner "Best cloud computing services of 2020: for Digital Transformation" [Online]. Available from: https://www.techradar.com/best/best-cloud-computing-services, [retrieved: 05, 2020].

[18] D. Howlett "SAP announces critical changes in maintenance policy post 2025 - is it enough?" [Online]. Available from: https://diginomica.com/sap-announces-critical-changes-maintenance-policy-post-2025-it-enough, [retrieved: 05, 2020].

[19] Metrix Data 360 "Negotiating a Microsoft Enterprise Agreement: What to Expect" [Online]. Available from: https://metrixdata360.com/negotiate-microsoft-enterprise-agreement/, [retrieved: 05, 2020].

[20] T. Oliveira and M. F. Martins "Literature Review of Information Technology Adoption Models at Firm Level". The Electronic Journal Information Systems Evaluation, 14**,** pp.110-121, 2011.

[21] T.R. Leinbach "Global E-Commerce: Impacts of National Environment and Policy" edited by Kenneth L. Kraemer, Jason Dedrick, Nigel P. Melville, and Kevin Zhu. Cambridge: Cambridge University Press. *The Information Society,* 24**,** pp. 123-125, 2008.

[22] E.M. Rogers "Diffusion of Innovations, 5th Edition", Free Press, 2003.

[23] L. G. Tornatzky and M. Fleischer "*The Processes of Technological Innovation",* Massachusetts, Lexington Books, 1990.

[24] K. Zhu, S. Dong, S.X. Xu and K.L. Kraemer "Innovation diffusion in global contexts: determinants of post-adoption digital transformation of European companies", European *Journal of Information Systems,* 15**,** pp. 601-616, 2006.

[25] S.K. Lippert and C. Govindarajulu "Technological, Organizational, and Environmental Antecedents to Web Services Adoption" *Communications of the IIMA,* 6, pp. 146-158. 2006.

[26] K. Zhu, S. Xu, and K.L. Kraemer "Internet Technology Diffusion at the Firm Level: Empirical Evidence from Asia-Pacific Region, Europe, and North America" *In:* International Conference on Information Systems: International Symposium on Asia-Pacific, Washington DC, 2004.

[27] H.F. Lin and S.M. Lin "Determinants of e-business diffusion: A test of the technology diffusion perspective" *Technovation,* 28**,** pp.135-145, 2008.

[28] R. Schneiderman "For Cloud Computing, the Sky Is the Limit", *Signal Processing Magazine, IEEE,* 28, pp. 15-18, 2011.

[29] M. Espadanal and T. Oliveira "Cloud Computing Adoption by firms", MCIS 2012 Proceedings. 30, pp. 3, 2012.

[30] M. Espadanal and T. Oliveira "Cloud Computing Adoption by firms", MCIS 2012 Proceedings. 30, pp. 4-6, 2012.

[31] C. Low, Y. Chen and M. Wu 'Understanding the determinants of cloud computing adoption" *Industrial Management & Data Systems,* 11, pp. 1006-1023, 2011.

S. C. Misra and A. Mondal "Identification of a company's suitability for the adoption of cloud computing and modelling its corresponding Return on Investment" *Mathematical and Computer Modelling,* 53, pp. 504-521, 2011.