

UNEXPECTED DIGITAL EXPERIMENT: CLOUD COMPUTING AS SOLUTION FOR ENTREPRENEURSHIP IN A POST-PANDEMIC WORLD?

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Abstract:

The recent events that have taken place globally, often characterized as facilitators of unexpected changes in almost all fields of activity, determined new key directions to be followed, the potential for their future support and development being also realized. During the COVID-19 pandemic, the entrepreneurial activity itself has undergone sudden shifts, conducted by the desire to survive in uncertain times. As a result, the main actors involved in the entrepreneurial processes have chosen either to focus on the existing business solutions expansion, or on the creation and adoption of new ones, both options offering, in fact, alternatives to the traditional business models.

On the other hand, the national lockdowns have led to an intensive digital transformation, especially of the entrepreneurial field, but not only. In this regard, cloud computing became a certain direction of interest for practitioners. Hence, an unforeseen digital trial resulted. While the pandemic accelerated the migration to cloud as a solution to survive in a different market context, the question is how the entrepreneurs will perceive this option in a post-pandemic world? Undoubtedly, the implementation of future action decisions involves the detailed analysis of the potential benefits and of the relationship between the involved inputs and the expected outputs.

Under these circumstances, the main aim of the present research is to highlight the significance of cloud computing during and post-pandemic, taking into consideration the entrepreneurial activity. In order to achieve the stated goal, both fundamental and empirical approaches were considered. The research results illustrate the discrepancies between the countries in terms of adopting cloud computing solutions for entrepreneurial activity, considering the evidence obtained during and post-pandemic. Additionally, the opportunities and challenges of cloud computing adoption were discussed.

Keywords: Cloud Computing, Entrepreneurship, COVID-19

JEL classification: L20, L26, O10, O3

1. Introduction

Characterized by Attaran and Woods (Attaran & Woods, 2019) as a revolutionary way to provide software and infrastructure solutions to companies around the world by harnessing the power of the Internet, cloud computing technology currently represents a key point of interest for the main actors of the business environment. In recent years, the use of cloud computing has become a new way of doing business, even if in the past there were views stating a slow trend in the adoption of Information and Communication Technologies (IT&C) in entrepreneurial activities. Incidentally, the adoption of cloud computing was seen as “a slow train coming” (Willcocks, L.P., Venters, W., Whitley, E.A., 2013).

Undoubtedly intensified by latest global events, uncertainty and risk have become prerequisites or even facilitators of change in almost all fields of activity. The COVID-19 pandemic has caused sudden changes in entrepreneurial activity, driven by the desire to survive in doubtful times. Specific actions undertaken under the influence of unexpected situations proved to be the only possibility to ensure the

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processes continuity, while their development potential for future implementation, beyond crisis contexts, was recognized.

In fact, the business environment was deeply affected by the coronavirus pandemic through the measures taken to stop its effects. The intensification of actions to prevent the spread of the virus involved, at the same time, changing the paradigm in terms of business models. The entrepreneurial activity, as one of the main pillars of the supply-demand market, had either to ensure the change of existing business models, or to lay the foundations for new ones.

The national lockdowns have led to an intensive digital transformation, especially of the entrepreneurial field, but not only. The stringency pressure represented a strong enabler for a higher request of online services (Alashhab, Z.R., Anbar, M., Singh, M.M., Leau, Y.B., Al-Sai, Z.A., Alhayja'a, S.A., 2020). In this manner, cloud computing became a certain direction of interest for practitioners. Hence, an unforeseen digital trial resulted, setting expectations especially on flexibility and lower costs (Markets & Markets, 2017). The adoption of cloud computing as a driving force in the entrepreneurial activity was perceived, on long term, as a lower cost and a higher added value (Alshamaila, Papagiannidis, & Li, 2013).

Considering the almost forced migration to the cloud as a survival solution in a different market context, guided by needs and conditions specific to this, the existence or preservation of this option in a post-pandemic world can be questioned. Indubitably, in order to ensure sustainable and efficient processes, future action decisions must be drawn up in the light of the detailed analysis of their potential advantages, but also taking into account the relationship between the involved inputs and the expected results.

Starting from the aforementioned aspects, the goal of the present research is to highlight the significance of cloud computing during and post-pandemic, in view of the entrepreneurial activity. In this regard, the article was designed to firstly illustrate the state of art related to the cloud computing adoption during the pandemic. Secondly, an evaluation of the post-pandemic situation was accomplished, implying an empirical model that assumes the relationship between digital economy and cloud computing ecosystem.

2. Methodology

As the main aim of the present research consists in bringing to the fore notable aspects related to the impact of cloud computing on the entrepreneurial activity, during and post COVID-19 pandemic, the methodology was properly designed. Therefore, a review of the specialty literature focused on cloud computing effects on entrepreneurship became mandatory, taking into consideration the topic under analysis. Starting from the existing arguments, logic-deductive reasoning was adopted to provide a perspective on cloud computing, assuming the view on the post-pandemic world.

To support the exposed arguments, an empirical study was performed, based on a regression model developed in order to highlight the impact of the digital environment on adopting cloud computing at the European level. To test the proposed model, data provided by European Commission through Digital Economy and Society Index (European Commission, 2022) were considered, but also data related on the Cloud Computing Ecosystem Index, developed by MIT Technology Review (MIT, 2022). The lack of data on cloud ecosystem for 2022, but also the limited access to resources and information related to other countries, beyond the direct control of the authors, narrowed the selected sample to 20 out of 27 EU countries.

In the light of the established goal, the statistical hypotheses were formulated as follows:

Hypothesis H₀: *For the selected sample, there is no relationship between the Digital Economy and Society Index and Cloud Computing Ecosystem Index.*

Hypothesis H₁: *For the selected sample, there is a significant relationship between the Digital Economy and Society Index and Cloud Computing Ecosystem Index.*

The empirical demonstration was performed by using the IBM SPSS 21 statistical software, the provided features fulfilling the pre-established research requirements for the present study.

3. General Considerations Regarding Cloud Computing and the Entrepreneurial Sphere

Over time, the term “cloud computing” has often been used to characterize the process involved by providing services hosted on the Internet. Considering the entrepreneurial area, cloud computing targets two key directions, namely the providers and their final customers. In fact, at entrepreneurial level, the image of cloud technology consumer is embodied both by the economic entities and by the consumers of their services, as far as the two actors mentioned use cloud services or products, but in different ways. In this regard, it was recognized the capacity of cloud computing to disrupt the entrepreneurial activities through the remote actions (Ojala, 2016).

Taking into account the previously mentioned aspects, a bidirectional situation is depicted, which aims to facilitate services hosted on the Internet as a demand of the end consumer, as well as a need of services providers, resulting in increasing their performance and competitive advantages.

However, discussing the adoption of cloud technologies by organizations, often debated concepts such as Software as a Service (SaaS), Infrastructure as a Service (IaaS) and Platform as a Service (PaaS) must be understood. These represent, in fact, the most popular cloud computing service models, whose individual implementation or by association is intended to gradually reduce the use of on-premise software within companies. The main characteristics related to the operation of the three mentioned models can be summarized as follows:

- **Software as a Service (SaaS):** The Software as a Service model represents the most popular option among companies on the cloud market, involving the delivery to users of services managed by a third-party provider. In this situation, the client does not have the role of monitoring or managing the cloud infrastructure, SaaS being predominantly focused on the interface with the end user, who have the possibility to use and manage the cloud-built software (Mohammed & Zeebaree, 2021).
- **Infrastructure as a Service (IaaS):** The Infrastructure as a Service (IaaS) model involves providing cloud services characterized by increased automation and scalability. The consumer cannot manage or control the underlying cloud infrastructure, but has control over the deployed applications, storage and operating systems (Miyachi, 2018).
- **Platform as a Service (PaaS):** As per Miyachi (Miyachi, 2018) the Platform as a Service model implies the fact that the consumer can control the deployed applications and, additionally, the configuration settings for the application hosting environment, but cannot manage the underlying cloud infrastructure, including the operating systems, network, servers, and storage.

As previously mentioned, the presented models can be individually implemented, a situation characteristic of small companies, but also through association, the option applied nowadays by many of the large economic entities. Regardless of which of the methods is chosen, the implementation of the process itself is of a much higher complexity, the previously listed aspects being only meant to depict a general overview of the most frequently encountered cloud computing models.

Undoubtedly offering multiple benefits, cloud computing was and continues to be perceived in most cases as an opportunity for the business environment. As per Donepudi (Donepudi, 2016), some of the main advantages gained by companies that successfully implemented cloud computing technology include simplifying operations, increasing scalability, capital investment savings, improving the exchange of information and sustainability facilitation.

From possibilities such as the outsourcing of data and services, to the ubiquitous and real-time connection capacity between key points that ensure the efficient running of the economic entity processes, cloud computing currently represents an increasingly targeted direction for implementation. However, the resistance to change, as well as the limited ability to shift the working paradigm in some economic entities, could represent real challenges, being recognized, among others, as barriers in the adoption of cloud technology.

4. The COVID-19 Pandemic Effects on Cloud Computing Adoption

The national lockdowns caused by the COVID-19 pandemic determined imperative changes both with respect to individuals' behaviors and on the entrepreneurial activity. Under the immediate influence of the related unprecedented circumstances, the capability of transferring the traditional on-site activity to the online environment was essential and possible only by using ICT tools (UNCTAD, 2021). The digital transformation and the online transfer of a significant part of daily social and economic activities can be considered the most obvious changes, while this trend was mainly adopted in the countries with a high level of income (OECD, 2021).

Information provided by Synergy research group (Synergy Research Group, 2020) in the first quarter of 2020, revealed a 28% increase in worldwide enterprise spending for cloud infrastructure services and SaaS compared to the third quarter of 2019. The boost of the global cloud computing market has thus been observed since the early phase of the COVID-19 pandemic, the technology itself being recognized as a lifeline in many cases. Similarly, according to Gartner, the evolution of using cloud computing was accelerated by the COVID-19 pandemic and this fact can be revealed by the permanent trend in increasing the revenues in this sector (Gartner, 2022).

Almost a year after the onset of the COVID-19, and its recognition as a pandemic, Forbes characterized, with an optimistic view from the perspective of the addressed topic, the global health crisis as being a de facto catalyst in the process of establishing cloud computing flexibility and value, also determining the increased adoption of these technologies (Aggarwal, 2021).

In fact, the increase in the adoption of cloud computing can be directly associated with the recurrent lockdowns globally imposed, which have forced even the met of individuals ordinary needs through less familiar ways. An O'Reilly report, based on a worldwide survey, shows that almost 90% percent of respondents were, during 2021, cloud computing users (Loukides, 2021). In general terms, at the European Union level, it is expected that digital economy will contribute to a 14% growth in GDP by 2030 (Amiot, E., Palencia, I., Baena, A., de Pommerol, C., 2020).

Certainly, the impetuous operating costs reduction need due to the increased constraints during the coronavirus pandemic, as well as the need to maintain efficiency considering the new consumer behaviors, represented an advantage in the process of business migration to cloud computing.

Even though cloud adoption has been overall accentuated during the COVID-19 pandemic, discrepancies between countries have been observed. Referring to the use of cloud computing services by businesses, recent EU statistics (Eurostat, 2021) reveal that in 2021, in Sweden, the Netherlands, Finland and Denmark, at least 65% of businesses used cloud computing, while in Romania, Bulgaria and Greece, less than 25% of enterprises have adopted and implemented the technology in question.

Certain gaps between countries regarding the use of cloud computing were also registered. A short analysis of the European Union situation can illustrate the discrepancies between the member states in terms of cloud adoption. For example, in 2021, countries like Sweden (75%), Finland (75%), Netherlands (65%) and Denmark (65%) registered the highest values in adopting cloud computing (Eurostat, 2021). At the opposite pole, we can find Bulgaria (13%), Romania (14%) and Greece (22%), where the rate of firms adopting cloud was significantly low. According to the available data and other previous studies, the situation is influenced by the size of the firms. Therefore, it was demonstrated that small firms perceive cloud computing as beneficial for their activities. In general, an increase in the size of the company is strongly connected with an accommodation of the existent requirements related on business environment, like cloud computing use (Gupta, P., Seetharamana, A., RaJ, J.R., 2013).

The disparities in the geographical areas of the world regarding the adoption of cloud computing during the pandemic could represent the result of several barriers that affected the process. The main obstacle is noticeably represented by the countries' ability to digitally progress, referring to aspects such as the digital skills of human capital, infrastructure, connectivity, and other well-known key dimensions of technological transformation.

From the entrepreneurial perspective, the Statista results (Statista, 2022) on the subject, highlight, following the questionnaire at the organization level in the period 2020 - 2022, the lack of qualified

personnel as the biggest obstacle in increasing the adoption of the cloud. Other significant challenges in the adoption of cloud computing by organizations, identified for the aforementioned period, include compliance with authorities and legislation, data security, as well as the risks of data loss and leakage.

5. Results and Discussions - Cloud Computing After the Pandemic

Adaptability and innovation were fundamental in surviving during the pandemic (Lungu A.E., Bogoslov, I.A., 2020; Lungu, A.E., Bogoslov, I.A., Stoica, E.A., Georgescu, M.R., 2021), and one essential trend was expressed by cloud computing adoption. Thus, significant changes were identified in the entrepreneurial activities not only during the pandemic, but also in the post-pandemic world.

Assuming the research main goal, namely turning the spotlight on cloud computing adoption after the recent pandemic, a regression model was proposed, considering the digital economy's impact on cloud ecosystem, based on 20 European member states (apart from Croatia, Cyprus, Estonia, Latvia, Lithuania, Malta, and Slovenia). Under these circumstances, the Cloud Computing Ecosystem Index was set as a dependent variable and the DESI Index as independent (Table 1).

Table 1: Variables Entered/Removed

Variables Entered/Removed ^a			
Model	Variables Entered	Variables Removed	Method
1	DESI ^b	.	Enter
a. Dependent Variable: Cloud Computing Ecosystem			
b. All requested variables entered.			

For the selected sample, with a risk of 5%, it can be stated that there is a very strong correlation between the independent and dependent variables. Accordingly, 73.3% of the variance in terms of cloud computing ecosystem can be explained by the independent variable, namely DESI Index. The Adjusted R square is 71.80%, and the standard error of the estimation model is 0.28372 (Table 2).

Table 2: Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.856 ^a	.733	.718	.28372
a. Predictors: (Constant), DESI				

Taking into consideration the ANOVA table (Table 3), the significance of the proposed model can be observed, assuming the impact of the digital economy in adopting cloud computing ecosystem (the significance coefficient < 0.05).

Table 3: ANOVA

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.971	1	3.971	49.334	.000 ^b
	Residual	1.449	18	.080		
	Total	5.420	19			
a. Dependent Variable: Cloud Computing Ecosystem						
b. Predictors: (Constant), DESI						

Considering the obtained coefficients (Table 4), the equation of the proposed model is the following: $Cloud\ Computing\ Ecosystem = 5.376 + 0.042DESI$. Hence, the constant is 5.376, when the independent variable (in our case, DESI Index) is zero. Increasing with one point in DESI Index, will conduct to an increase in adopting cloud-computing ecosystem with 0.042 if all the other conditions remained constant (b1 coefficient).

Table 4: Coefficients

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.376	.319		16.838	.000
	DESI	.042	.006	.856	7.024	.000

a. Dependent Variable: Cloud Computing Ecosystem

The empirical results highlight the significance of a digital economy and society in adopting a cloud computing ecosystem in entrepreneurship, being also consistent with the previous results, that argued an increase in adopting ICT in the market process. According to a report provided by International Finance Corporation of World Bank, the adoption of cloud computing in the business environment was conditioned on the existence of a digital ecosystem (Strusani and Hounghonon, 2020).

Therefore, it can be stated the fact that the integration of cloud computing at economic entities level is not only a key direction to follow in crisis conditions, but also lays the foundations for future actions. In fact, the use of cloud computing has become a significant trend to follow in the post pandemic economic world. Moreover, there is expected that, by 2025, the data stored in cloud will over 100 zettabytes, which means almost 50% of the produced data. For an accurate picture regarding the evolution of cloud-computing usage, by 2015, the data stored in cloud was only 25% of the total amount of produced data (Morgan, 2020). This leads to an increase of using cloud-computing platforms. A report provided by Statista highlighted the worldwide market share of leading cloud infrastructure service providers in the 3rd quartile of 2022 year (Richter, 2022), according to which the most important cloud providers are Amazon, Microsoft and Google. Therefore, the cloud-computing become a game changer of business environment and, simultaneously, a new place for developing entrepreneurial activities.

The previously mentioned aspects are also justified by the constant efforts made in order to increase digitalization, which consequently leads to the adoption of cloud computing in the entrepreneurial sphere. Since most of the steps undertaken by the economic world highlight the transition to digital transformation, an intensified adoption of cloud computing is expected in the future.

6. Conclusions, Limitations and Future Research Directions

We can state that the COVID-19 pandemic changed the entrepreneurial point of view in terms of adopting a cloud computing strategy. The new reality forced the entrepreneurs to adapt their activities by using information and communication technologies, but also different tools connected with the online environment, like platforms and cloud. Cloud computing was, in fact, the means by which, regardless of size, experience or recorded performance, small or large companies managed to maintain their activity in a period of crisis. The adoption of cloud technologies was, however, a novelty for many firms, the need for a paradigm shift being therefore observed.

The current study, involving both theoretical and empirical research, brings its contribution to the scientific research sphere by highlighting the following aspects:

- The COVID-19 pandemic period led, through the measures taken to limit the spread of the virus, to the intensification of the adoption of cloud computing in the entrepreneurial environment. Actually, the existing unfavorable context determined the increase in the use of digital technologies and, consequently, the adoption of cloud technologies.

- Not all the world economies managed to integrate cloud computing at the same pace during the COVID-19 pandemic, a situation that can be maintained in the future, the influencing factors being numerous and quite varied.
- The trend of adopting cloud computing at the entrepreneurial level in the post-pandemic period is indisputable, suggested both through the perspective of the technology's capacity to facilitate the activities carried out by economic entities, as well because of the continuous increase in digitalization. At the same time, the digital transition represents a pillar of interest for world economies, which contributes to maintaining or even increasing the integration of cloud computing at the level of companies.

Considering the previously summarized information, the present study outlines the image of a post-pandemic entrepreneurial world in which cloud computing overcomes the barrier of an alternative solution, becoming an integrated part of the companies' activities and not only that. Contributing to ensuring the satisfaction of the needs of the modern consumer, cloud computing represents and will continue to denote a competitive advantage in the entrepreneurial sphere.

Even though the current research can be considered a starting point in understanding the evolution of cloud computing adoption in the entrepreneurial activity during and after the pandemic, the identified limitations are mainly related to the narrowed number of countries included in the conducted empirical study. Therefore, future research directions include considering a larger cluster of countries on which the analysis will be carried out, as well as using several additional research methods, in order to provide a greater degree of relevance of the results obtained.

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