THE IMPACT OF CLOUD COMPUTING IN PROMOTING ECONOMIC GROWTH THROUGH SMES IN THE UNITED STATES

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ABSTRACT

Cloud Computing, being one of the most recent innovative developments of the IT world, has been instrumental not just to the success of SMEs but, through their productivity and innovative contribution to the economy, has even made a remarkable contribution to the economic growth of the United States. To this end, the study focuses on how cloud computing technology has impacted economic growth through SMEs in the United States. Relevant literature connected to the variables of interest in this study was reviewed, and secondary data was generated and utilized in the analysis section of this paper. The findings of this paper revealed that there have been meaningful contributions that the usage of virtualization has made in the commercial dealings of small firms in the United States, and this has also been reflected in the economic growth of the country. This paper further revealed that as important as cloud-based software is, some SMEs are still skeptical about how it can help improve their business and increase their bottom line and hence have failed to adopt it. Apart from the SMEs, some notable large firms in different industries, including information and educational services, have adopted cloud computing technology and hence contributed to the economic growth of the United States. Lastly, findings from our inferential statistics revealed that no discernible change has occurred in innovation between small and big businesses in the adoption of cloud computing. Both categories of businesses adopt cloud computing in the same way, and their contribution to the American economy has no significant difference in the usage of virtualization.

KEYWORDS

Cloud computing, SMEs, Economic growth.

1. INTRODUCTION

The role that cloud computing plays in our everyday world can never be overemphasized. It has revolutionized the entire world by making services such as servers, electronic mail, internet facilities, data storage, and retrieval more readily available for usability than they were prior to this period. Cloud computing is an elusive concept without a clear understanding of what it is and what it is not [1]. However, he asserted that cloud computing is the action that justifies offering information technology services on demand over the internet from a remote location. These services performed by cloud computing include smart storing and retrieving of data via the internet rather than making use of the traditional means of personal computers, laptops, or even mobile devices and other computer peripherals. Cloud computing is defined as a computing paradigm that enables simple, constant, on-demand access to a common pool of easily changeable computer resources that can be easily made available and released with little managerial interaction with the service provider [2]. On the other hand, the term SMEs stands for

small and medium-scale enterprises, and throughout this study, they will be referred to as SMEs. Meanwhile, the United States' Small Business Administration has it on record that SMEs make up over 99% of all United States' businesses and employ over 60 million workers, which represents about 47% of the private labor force [3].

Small businesses are regarded as the foundation of a country, and hence many of them adopt cost-effective means of operation so that they can enjoy financial advantage over their competitors [4]. This cost-saving feature of cloud computing is why SMEs have made it their preferred choice. This gesture will ensure their continuity in business and, by extension, make a meaningful contribution to the economy they are operating.

The commercial model for cloud technology is well-established. and widely employed in Europe, where they have optimized their effects on the country's wealth and growth in GDP due to their valuable features [5]. Some notable European countries, such as France, Italy, Germany, England, and Spain, have adopted cloud computing as a mode of operation in their business environments according to their unique economic characteristics. These countries have consequently reaped a significant economic benefit from adopting this ICT development [6]. Cloud computing has significantly contributed to the Gross Domestic Product (GDP) of the five nations mentioned above [7], and it was discovered that an estimated amount of €763 billion was generated while using cloud computing between 2010 and 2015.

A report published by the United States International Trade Commission revealed SMEs involvement in United States service and goods exportation. In addition, the report describes how SMEs have contributed to the American economy in no small measure, even to the extent of creating employment opportunities [8]. This paper was comprehensive enough to explain the role of SMEs in making meaningful contributions to the American economy. However, it was silent on the contribution of cloud computing and its application by the United States' small businesses. To this end, this study evaluates how cloud computing is influencing US SMEs' ability to expand economically.

1.1. Rationale for the Study

This study has not only added to the body of existing literature but has also suggested important and cost-effective ways in which SMEs can operate in an attempt to improve their operations and increase their bottom line. This, in a way, will directly affect the United States economy, making it possible for it to achieve its macro-economic objectives of economic growth, reduction in unemployment, equitable distribution of wealth, and many more. Though as important as cloud computing is, there have been some factors mitigating its full adoption by some firms. This paper revealed these factors so that one can have a rationale behind why some SMEs have opted not to adopt them in their businesses. To this end, this study will be instrumental to the SMEs owners, the SMEs managers, and the cloud computing world in a way to improve their IT services, and most importantly, the United States government.

2. LITERATURE REVIEW AND HYPOTHESES

Cloud computing is an ICT paradigm where a network offers a scalable design based on virtualized services that may be dynamically scaled [9]. With this, services in the cloud world are distributed worldwide and vary in kind. It is not expected of the customer to become proficient in dealing with the support staff of the cloud computing infrastructure. Networks, apps, and infrastructure are considered tools in cloud computing technology.

The cloud technology comprises three service representations, which consist of SaaS, IaaS, and PaaS. [10,11]. Clients can set up software they have bought or built themselves using encoding scripts, libraries, and services, along with the devices that those providing cloud services offer on the cloud infrastructure, by using PaaS. Software as a Service (SaaS) enables clients to use the software already built by those providing cloud services and housed on a cloud computing platform. While the IaaS service model makes it possible for clients to enjoy services such as processing, storing, networking essential computer resources, and many more, this service makes it possible for clients to fix and run any type of application, including programs and operating systems.

2.1. The Rise of Cloud Computing

Cloud computing can be linked with the advent of "Virtualization" in the 1970s, which came as a process of creating a virtual machine that functions exactly like a physical computer [12] and has its own operating system. As time went on, the idea of virtualization changed along with the internet, and in the 1990s, we saw the rise of virtual computers, which made it possible for the development of contemporary cloud computing infrastructure.

The cloud is now a very potent computing technology available to individuals and businesses worldwide. It only takes a few clicks to share computer resources, provide a wide range of services, and store and access apps. Furthermore, cloud computing is an essential business paradigm when seen through a more business-oriented lens. It can assist businesses in growing and saving money while also fostering a competitive climate that offers more job possibilities and challenges to businesses across Europe and beyond [5].

The economics and business plans of SMEs have been impacted by cloud computing through the ways in which cloud computing has affected SMEs' operations as they strive for sustainability and profitability [13]. To this end, cloud services give small businesses new ways to work and collaborate by giving them more flexible options in real-time and enabling them to have access to the information and communication capacity they require on demand. All these make cloud computing an affordable substitute for costly and resource-intensive internal IT solutions, in addition to expenditures on software and hardware.

There is no universal definition for SMEs; however, this paper will employ the definition of Downing and Graciain their report, where they shed light on the definition of SMEs by identifying some common parameters used in the definition of SMEs. These parameters include the volume of assets of the enterprise, the amount of labor employed, the level of annual turnover, and the capital investment of the enterprise [3]. To this end, the most direct definition of SMEs is provided by the Small Business Administration's (SBA) Office of Advocacy, which mentioned that businesses with fewer than 500 employees are termed small and/or medium.
Furthermore, the United States International Trade Commission Report, categorized SMEs as those whose annual revenue falls within $7 million or less, while those SMEs in the computer services industry have an annual revenue threshold of about $25 million. While farming activities that are considered SMEs have an annual revenue threshold of $250,000.

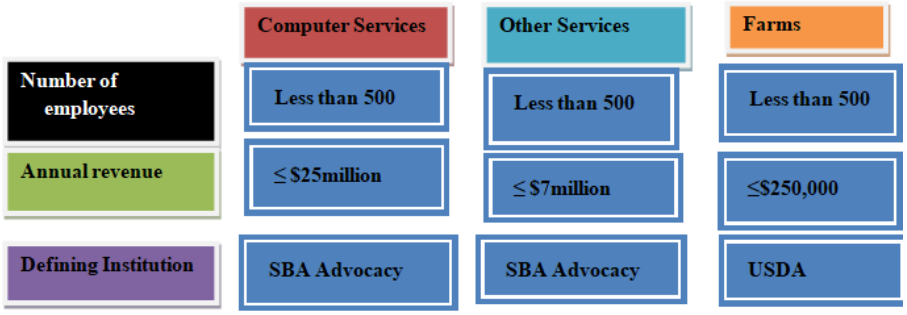

Fig 1: Definition of SMEs by consideration of annual revenue & Number of employees

- SBA⟶ United States Small Business Administration".
- USDA"⟶United States Department of Agriculture".

Source: "United States International Trade Commission (2010)".

According to Fig. 1, small businesses that are into manufacturing were not captured by the figure. The reason is that they have similar parameters of measurement as the SMEs that are under other services.

SME businesses are so important in fighting poverty, and their contribution to the advancement of any economy can never be overemphasized [14]. The arrangement for this is such that when the SMEs become successful, especially in the continuous production of goods and rendering of services, automatically economic growth will be born. By extension, this will result in the creation of job opportunities for the people in such economy. Increase in job opportunities will consequently increase disposable income that will in turn fuel demand for products and services. An increase in demand for goods and services will make money available for SMEs, and the end product of all these is a rise in the state of well-being of citizens.

It is expedient to bring the following fact to this research paper that 99.9% of businesses in America are categorized under the SMEs and there are about 33.2million of them across the nation of the United States. About 17.3 million net new jobs were generated by SMEs between 1995 and 2021, while of the known American export value, about 32.6% is produced by SMEs. It is also interesting to know that 38% of SMEs' in the United States utilized specialized software in their business operations [15].

2.2. The Concept of Economic Growth

This means an increase in the GDP of a nation. A report by the United States Congress' Joint Economic Committee staff, asserted that economic growth is essential for raising living standards[16]. Even seemingly insignificant variations in economic growth over an extended period of time have a significant effect on the living standards and income levels of various players in an economy. The US' average yearly growth rate of its per capita GDP during the past 125 years has been a consistent 1.8 percent [17]. The conventional belief that the U.S. economy is nearing its long-run steady-state balanced growth path is, in fact, supported by the stability of U.S. economic growth rates.

In their study, Valliere & Peterson showed how economic growth has been impacted by entrepreneurship as measured by the establishment of new enterprises [18]. Additionally, they

discussed how entrepreneurship's defining traits—innovation and firm creation—have emerged as key drivers of national economic growth in developed nations.

When it comes to looking for the right metrics to measure economic growth, the gross domestic product is the most significant variable [19]. This factor is widely and easily used when it comes to developed countries like the US but using it as a metric to measure economic growth in less developed nations is seriously challenging as it is often wrongly calculated due to a lack of an enviable database in the archives of government of these nations.

In terms of its contribution to various indicators of economic growth, the cloud computing sector is performing fairly well, despite being relatively new to the American and global economies. Beyond its ability to save costs for businesses, cloud computing benefits the economy in many ways and has helped small businesses flourish by empowering them to perform ICT functions without the need for a fully functional IT department.

There is a strong association between the productivity of the United States' firms and the IT components that facilitate cloud computing according to Hooton & Kaing [20]. To this end, it suffices to say that the dominance of American enterprises on the list of cloud computing service providers is indicative of their pioneering nature. According to information from a 2021 study by Synergy Research Group, Amazon, Microsoft, and Google collectively control over 60% of the global cloud business, with the United States being represented by these three companies. With the possibilities of what the IT world is predicted to offer through the cloud computing sector, this number may only increase dramatically. This optimism can only lead to the US economy expanding and to more optimism about the country's potential to lead the globe in almost every area.

2.3. Hypothesis Testing

In an attempt to validate the contribution that the SMEs have made in contributing to the US's as a nation through cloud computing adoption and its inherent innovation coupled with the application of this innovation from cloud computing by even larger firms, two hypotheses in their null form were formulated for this study:

Hypothesis 1 (HO1)

“There is no significant difference in innovation between SMEs and large firms in the adoption of cloud computing."?

Hypothesis 2 (HO2)

“There is no significant difference between the economic growth rate of the United States prior to and after the cloud computing era”?

2.4. Theoretical Framework

Two essential theories will be the basis on which this study stands. These include the 'Technology-Organization-Environment (TOE) and the Diffusion of Innovation (DOI)’. These two are extensively examined in the paragraph below.

2.4.1. Technology-Organization-Environment (TOE)

TOE theoretical framework is the examination of how businesses and organizations embrace new technologies and the acceptance of this innovation by businesses is as a result ofthree essential factors as the theory suggests [21]. This includes “technological”, “organizational” and “environmental” factors [22,23]. The “technological dimension”is the IT structure currently available and utilize in an organization. While the company size, level of formality and bureaucracy, degree of centralization, managerial structure as well as the human, material and financial resources at the disposal of the organization make up the organizational dimension of this theory. The environmental factors are the external factors that serve as either threats or opportunities to the survival of the organization. The TOE theoretical framework is diagrammatically captured below as a subset of the integrated theoretical framework.

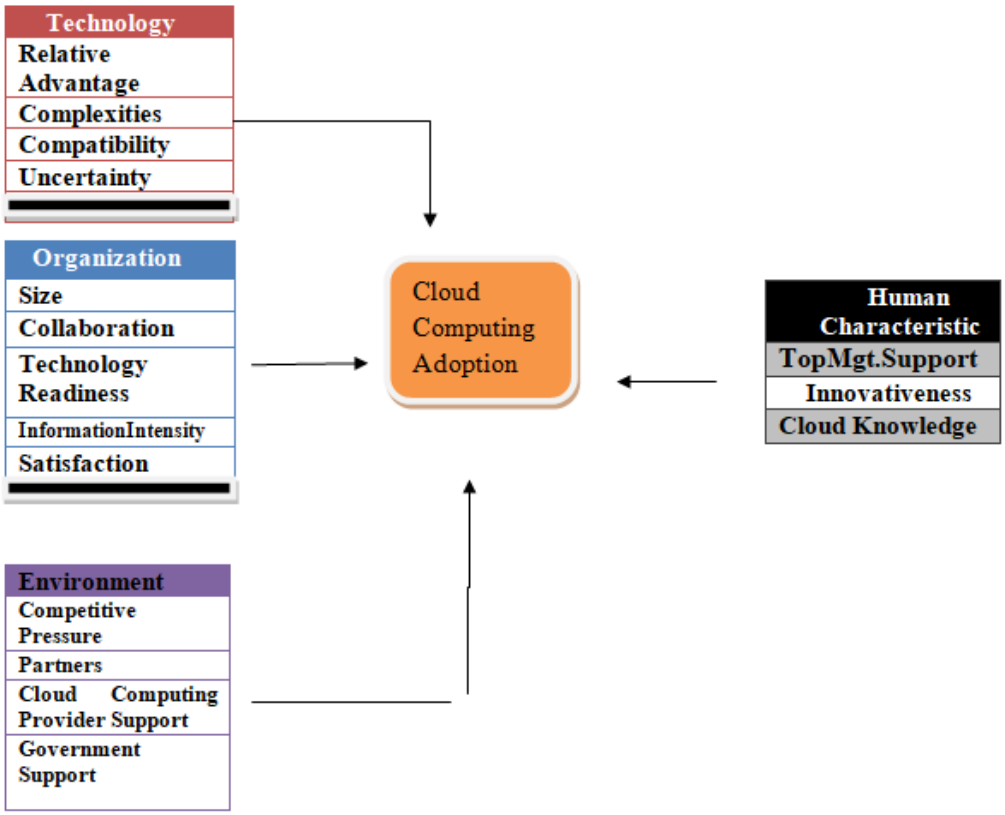

Fig 2: “Integrated Theoretical Framework for the adoption of Cloud Computing”.

2.4.2. Diffusion of Innovation (DOI)

“Diffusion of Innovation" (DOI) was propounded in 1962 by Everett Rogers. According to him, this theory gives a full description of how, why, and how quickly new concepts and innovations proliferate across cultural boundaries [24]. This theory is primarily predicated on the characteristics of the invention and how end users view it [25]. According to Rogers, DOI is the "process in which a new development is transferred over time through a particular channel”. This theory is instrumental to this study because the concept of cloud computing is not something that has been around for so long in the United States.

3. DATA AND METHODOLOGY

This study examined how cloud computing usage by SMEs has helped improve economic growth in the United States. As a corollary to the above, efforts will be made to compare how the economic growth rate of the United States has been prior to and after the advent of cloud technology. Meanwhile, the data characteristics and the complexity of gathering primary data led to utilizing secondary data for analyzing this study. The approach for this study is the deductive approach, and in order to examine the data that represents the variables of interest for this paper, both descriptive and inferential analyses were performed. The descriptive analysis utilizes the likes of line charts, tables, and donuts from Microsoft PowerBI in analyzing the data. The contingency Chi-square was inferentially used in testing for hypothesis 1.

3.1. Ethical Consideration

It is essential to consider the ethical implications of any research study because ethical standards must be taken into consideration at every stage of a research study so as to minimize any potential risk or prevent the divulging of sensitive information that belongs to the participants of this study or organizations whose data are used for this paper [26]. Therefore, consent, confidentiality, and protection of the participants' and organizations' data were highly upheld for this study.

4. RESULTS AND INTERPRETATION OF ANALYZED DATA

4.1.Descriptive Statistics of the Study

The descriptive statistics of the study asserted that GDP is a good parameter to measure economic growth [19], and hence it was used between two different time frames to measure the economic growth of the United States before the advent of cloud computing and after the concept has become a common phenomenon both in the IT and business worlds. The period prior to the popularization of cloud computing covers 1975–1990 (see Fig 3), while the post-cloud computing era covers a period from 2000–2010 (see Fig 4).

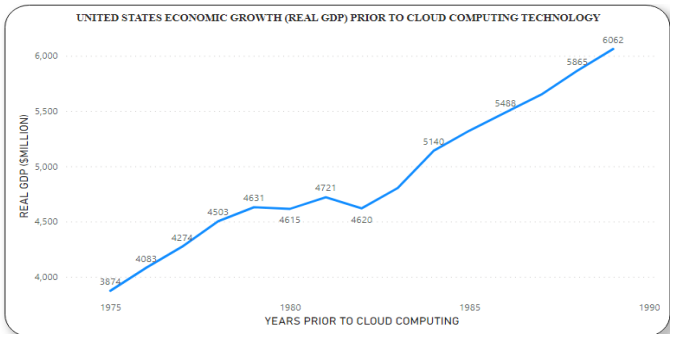

Fig 3: The United States Economic Growth prior to advent of cloud computing
Source: Excerpt from Economic Report of the President (1999)

Data from the tables shows a significant difference in the volume of GDP as it measures economic growth in the United States. This vast difference is obviously partly due to the introduction of innovation through cloud computing, which has encouraged firms, especially SMEs, which are major contributors to the American economy, to apply the cloud computing

innovation to the running of their businesses. Furthermore, the use of cloud computing services by SMEs is not the only way that it has significantly improved economic growth.

As revealed by Fig 4, the tremendous improvement in economic growth can also be attributed to the fact that most global cloud businesses are controlled by American companies. This is in support of Hooton & Kaing who found a very strong association between the productivity of firms in the US and the utilization of cloud technology [20]. The dominance of American technology giants on the list of cloud computing service providers is another major indicator of how the economic growth of the United States has improved tremendously in recent times.

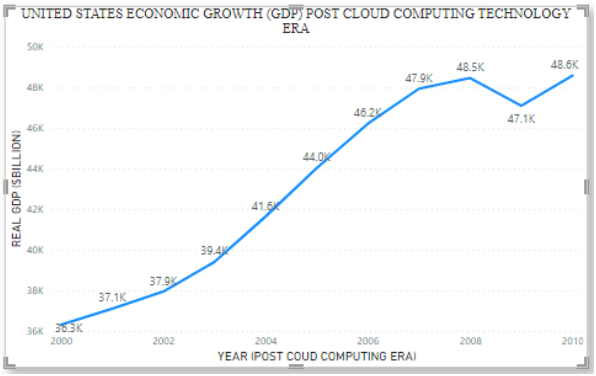

Fig 4: The United States Economic Growth after the advent of cloud computing
Source: (Imf.org; GDP per capita, current prices).

As displayed in Fig. 5, and as important as cloud computing is, there are some factors that prevent some SMEs from adopting cloud computing facilities in their businesses. Notable among them and the percentage of respondents to these factors as captured below include the fact that the technology is too expensive; about 6.98% of the secondary data gathered from the respondents supported this claim; about 1.08% of the secondary data revealed that respondents claimed that the cloud computing technology was not mature; and 6.57% of the respondents fall under the category of lack of access to required human capital and talent, concerned regarding safety and cyber security; and lack of access to both financial and physical capital in adopting the cloud computing facilities. About 30.65% of the respondents claimed that cloud computing does not apply to their business.

Interestingly enough and as important as cloud computing has been adopted by most SMEs in the United States, about 54.72% of the SMEs claimed that no factor is responsible for not adopting cloud computing facilities in their business. Simply put, in another language, that means that more than half of the SMEs in the US have adopted the utilization of cloud technology in their businesses.

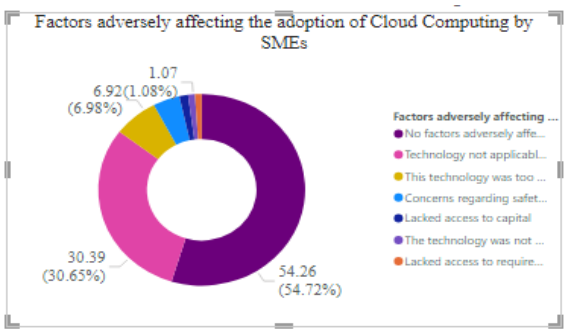

Fig5: Factors adversely affecting the embrace of cloud computingby some small businesses.
Source: NCSES & Census Bureau, 2019 Annual Business Survey.

The descriptive analysis in Table 1 revealed the combination of industries under which all SMEs that adopted cloud computing facilities fell. The top five (5) industries and their respective percentages of adoption include "information" (65.68%), "professional, scientific, and technical services" (60.79%), "educational services" (58.77%), "healthcare & social assistance" (52.77%), and "finance & insurance" (52.04%).

Table 1: Percentage of Businesses in the American Industry utilizing the cloud computing Innovation

AMERICAN INDUSTRY (BUSINESSES) UTILIZING THE CLOUD COMPUTING INNOVATION (%)	
Industry	Cloud computing
	Percent
Accommodation and food services	32.41
Administration and support and waste management and remediation services	46.16
Agriculture, forestry, fishing and hunting	30.26
Arts, entertainment, and recreation	48.9
Construction	39.73
Durable manufacturing	45.88
Educational services	58.77
Finance and insurance	52.04
Food and fiber manufacturing	47.32
Health care and social assistance	52.77
Information	65.68
Management of companies and enterprises	45.72
Mining	37.05
Nondurable manufacturing	48.74
Other services (except public administration)	33.42
Professional, scientific, and technical services	60.79
Real estate rental and leasing	49.21
Retail trade (Non Store)	43.43
Retail trade (Store)	34.55
Transportation and warehousing (Passengers & Cargoes)	36.82
Transportation and warehousing (Warehousing & Storage)	44.01
Utilities	43.76
Wholesale trade	48.53

Source: NCSES & Census Bureau, 2018 Annual Business Survey

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application of cloud computing in these critical areas of their business. To this end, large firms have the largest share of this application of cloud computing in these business areas, as those with 500–999 employees' strength had 27.75% of their cloud computing prowess devoted to product innovation, 13.97% devoted to new-to-market product innovation, 33.73% of their cloud computing strength devoted to business practice innovation, and 39.59% to marketing innovation. The large firms with staff strengths of 1000 and above adopted cloud computing, respectively, into these aforementioned functional areas: 34.31%, 19.28%, 39.9%, and 47.56%.

It is important to note that of all these functional areas, all firms, both SMEs and large firms, applied cloud computing technology mostly in the area of marketing innovation, while "new-to-market product innovation" received the least application of innovative cloud computing technology.

Table 2: Innovation through Cloud Computing as adopted by Firms (%)

Firm Size (No of Employees)	Category of Firm	Product Innovation (%)	New-to-market Product Innovation (%)	Business Practice Innovation (%)	Marketing Innovation (%)
1-4	SME	25.12	10.18	18.18	28.77
5-9	SME	26.44	11.98	23.72	33.90
10-19	SME	26.76	12.58	26.40	35.94
20-49	SME	26.09	12.60	28.30	36.79
50-99	SME	25.53	12.23	29.87	37.87
100-249	SME	26.96	13.71	33.05	38.11
250-499	SME	28.34	14.21	35.16	39.55
500-999	Large Firm	27.75	13.97	33.73	39.58
≥ 1000	Large Firm	34.31	19.28	39.90	47.56

Source: NCSES & Census Bureau, 2018 Annual Business Survey

4.2. Inferential Statistics of the Study

The contingent Chi-Square formula was utilized in determining if there is an existing significant difference in Innovation between SMEs and Large Firms in embracing cloud technology by these two categories of firms. Findings from the calculation revealed that there is no significant difference in innovation between SMEs and bigger enterprises in the adoption of cloud computing (P-value (0.98) > 0.05; see Fig. 6 below and Appendix for elaborate analysis using an Excel worksheet).

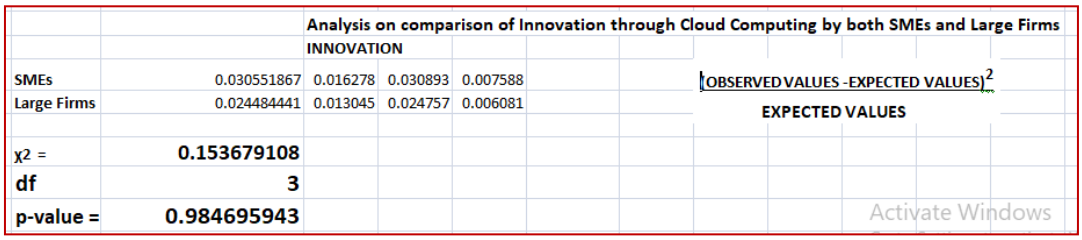

Fig 6: Analysis of comparison of innovation through cloud computing by both SMEs and Large Firms
Source: Data from *NCSES & Census Bureau, 2018 Annual Business Survey*analyzed throughMS-excel.

5. CONCLUSION

This paper was borne out of curiosity to determine to what extent cloud computing has been adopted by SMEs and the extent to which this has contributed to the economic growth of the United States. Relevant literature was reviewed to gain previous researchers' assertions and findings on the concepts of "cloud computing," "SMEs," and economic growth.

To start with, this paper utilized secondary data in its analysis due to the herculean task involved in generating primary data. The paper asserted in its findings that cloud computing in the US became popularized around the 1990s and has since been adopted by some SMEs and even larger firms. Our findings also revealed that the economic growth of the United States, measured using GDP metrics, has improved during the era of the advent of cloud computing compared to prior to that period. This improvement in the United States' economic growth is not limited to the productivity and business innovation enjoyed by these SMEs in the adoption of cloud computing technology but also as a result of the fact that the major share of cloud computing services is dominated by American tech giants.

The findings from this paper also revealed that, as essential as cloud computing is to most SMEs in the United States, it has not been fully adopted, as some SMEs believe that its adoption is too expensive, some claim that the technology has not matured, and some lack access to financial, physical, and human capital that will be used to facilitate the utilization of this innovation. Other reasons why some SMEs have not resorted to adopting this innovation, as revealed by this study, are that some businesses have serious concerns for safety and cyber security, and some claim that it is not applicable to their business.

The paper also revealed in its findings the top five industries that adopt cloud computing innovation in their businesses, and these include "information," "professional, scientific, and technical services," "educational services," "healthcare and social assistance," and "finance and insurance," respectively. This paper also revealed various functional innovative areas of SMEs to which cloud computing has been applied, and references were made to "product innovation," "new-to-market product innovation," "business practice innovation," and "marketing innovation." Lastly, the findings from this paper that were captured in one of our hypotheses through the inferential statistics revealed that there is no significant difference in innovation between SMEs and bigger enterprises in the adoption of cloud computing in the United States.

5.1. Recommendations

From our findings, the following have been recommended to all stakeholders in the cloud computing world:

- A more robust paper can be written where primary data will be gathered and comparisons made with its findings, as well as what the findings of this paper have revealed.
- Since the cloud computing innovation has improved the American economy tremendously in no small measure, as it reflects in its economic growth, the American government should create an enabling atmosphere where these SMEs can effectively operate through the adoption of cloud computing technology in their businesses.
- As a corollary to the above, there should be full sensitization on the use and importance of cloud computing for those SMEs whose management has not believed in its innovation. In addition, systems should be put in place where they become affordable for all SMEs to adopt.

Lastly, due to the fact that some SMEs have not adopted it, considering that there are no adequate personnel within the reach of this category of SMEs, there should be a convincing plan put in place to support the training of more people in this field of innovative technology.

REFERENCES

[1] Wyld, D.C (2009). *Moving to the Cloud: An Introduction to Cloud Computing in Government.* Washington DC: IBM Center for the Business of Government.

[2] Mell, P., & Grance, T., (2011). *The NIST definition of Cloud Computing.* NIST Special Publication 800-145.

[3] Downing, D. & Gracia, F. (2021). "Demographic Makeup of SMEs in the United States and United Kingdom "*United States International Trade Commission Executive Briefings on Trade.* Retrieved from https://www.usitc.gov/publications/332/executive_briefings/ebot_demographic_makeup_of_smes_in_the_united_states_and_united_kingdom.pdf.

[4] Haucap, J., Fritz, D., Thorwarth, S. (2019). *The Economic Impact of Cloud Computing in Europe.* Dice Consult. https://www.imf.org/external/datamapper/PPPPC@WEO/USA?zoom=USA&highlight=USA

[5] Etro, F. (2009). "The economic impact of cloud computing on business creation, employment and output in Europe."*Review of Business and Economics.* Vol.5 No 2, pp179-208.

[6] Filiopoulou, E., Mitropoulou, P., &Michalakelis, C. (2014). *SMEs in the cloud: The impact of cloud adoption on economic growth and development.* In Proceedings of the ICEIRD 2014 (Nicosia, Cyprus, 5-6 June, 2014).

[7] Centre for economics and business research ltd (CEBR). (2011*). "The economic benefits of cloud computing to business and the wider EMEA economy: Comparative analysis of the impact on aggregated industry sectors"*. Retrieved from https://www.dataprix.com/files/cloud-dividend-report-2010.pdf.

[8] Hammer, Alexander; Jabara Cathy; Cardenas, E; Wise, Jeremy; Grossman, Nicholas; Peterson, Joann &Gosney; Allison. (2010) Small and Medium-Sized Enterprises: Overview of Participation in U.S Exports. *United States International Trade Commission. Investigation* No. 332-508, USITC Publication 4125.

[9] Li, Zhenlong, Yang, Chaowei, Huang, Qunying., Liu, Kai, Hu, Fei, (2017). Big data and cloud computing: Innovation opportunities and challenges. *International Journal of Digital Earth*, vol. 10, Issue 1.

[10] Goscinski, A., & Brock, M. (2010). "Toward dynamic and attribute based publication, discovery and selection for cloud computing". *Future Generation Computer Systems.* Vol. 26, No. 7, pp 947-970.

[11] Wu, W.W. (2011). "Mining significant factors affecting the adoption of SaaS using the rough set approach". *Journal of Systems and Software* vol. 84, No.3, pp435-441.

[12] Foote, K. (2021).*"Brief History of Cloud Computing".* Retrieved from https://www.dataversity.net/brief-history-cloud-computing/

[13] Srikumar, U.J. (2013). "Cloud computing & SMEs in India-opportunities and Challenges".

[14] *International Journal of Current Research.* Vol.5, No.8, pp2379-2383.

[15] Chuma-Mkandawire, S. (2004, October 25-27). *National Economic Consultative Forum:* Report on the Policy Implementation Workshop For SMEs.

[16] Office of Advocacy (2023). *U.S Small Business Administration.* Retrieved from https://advocacy.sba.gov/2023/03/07/frequentlt-asked-questions-about-small-business-2023/#:~:text=There%20are%2033%2C185%2C550%20small%20businesses,net%20jobs%20created%20since%201995.

[17] Mack, C. (1999). "Economic Growth and the Future Prospects of the U.S. Economy". *Growth and Prosperity Series (1).*

[18] Jones, Charles (2002). "Sources of U.S. Economic Growth in a World of Ideas", The American Economic Review, Vol. 92, No. 1.

[19] Valliere, D. & Peterson, R. (2009). Entrepreneurship and economic growth: Evidence from emerging and developed countries. *Entrepreneurship & Regional Development*. Vol. 21, No.5-6, pp459-480.

[20] Henderson, J.V., Storeygard, A. & Weil, D.N. (2012). Measuring Economic Growth from Outer Space. *Author Manuscripts Econ. Review.* Vol.102, No.2, pp994-1028.
[21] Hooton, C.A & Kaing, D. (2018). "Exploring machine learning's contributions to economic productivity and innovation". *The International Journal of Technology, Knowledge and Society.* vol. 14, No.3, pp1-25.
[22] Tornatzky, L.G. & Fleischer, M. (1990). *"The Processes of Technological Innovation".* Lexington, MA: Lexington Books.
[23] Depietro, R., Wiarda, E., & Fleischer, M.,(1990). "*The context for change: Organization, technology, and environment*. In L. G. Tornatzky, & M. Fleischer (Eds.)", Processes of technological innovation. Lexington, MA: Lexington Books.
[24] Melville, N., & Ramirez, R.,(2008). "Information technology innovation diffusion: An information requirements paradigm". *Information Systems Journal.* Vol.18, No. 3, pp247-273.
[25] Rogers, E. M. (1962). *"Diffusion of innovations"*. New York, NY: Free Press.
[26] Oliveira, T., Thomas, M., &Espadanal, M. (2014). "Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors". *Journal of Information & Management*. Vol.51, pp497–510.
[27] Maxwell, J.A. (2005). Qualitative research design: An interactive approach. Thousand Oaks,CA: Sage Publications.

APPENDIX

	INNOVATION				Grand Total
SMEs	26.46	12.5	27.81	35.85	102.62
Large Firms	31.03	16.63	36.82	43.57	128.05
Grand Total	57.49	29.13	64.63	79.42	230.67

OBSERVED VALUES

	INNOVATION			
SMEs	25.57603416	12.9593	28.75246	35.33221
Large Firms	31.91396584	16.1707	35.87754	44.08779

EXPECTED VALUES

	INNOVATION			
SMEs	0.030551867	0.016278	0.030893	0.007588
Large Firms	0.024484441	0.013045	0.024757	0.006081

$$\frac{(\text{OBSERVED VALUES} - \text{EXPECTED VALUES})^2}{\text{EXPECTED VALUES}}$$

χ^2 =	0.153679108
df	3
p-value =	0.984695943