Innovatively Utilizing Cloud Computing To Minimize Challenges to Small and Medium Enterprises' (SMEs) Business Operations

Michael Kwabena Kwakye-Okyere

Abstract: ***Small and Medium Enterprises (SMEs) are very important business entities that contribute immensely to economies of the world, unfortunately SMEs have challenges in their business operations compared with the bigger firms and find it difficult to survive in a dynamic global economy. Survival, growth and success of SMEs are the priority of every nation especially in developing economies. The aim of this paper is to introduce Cloud Computing as an IT solution for SMEs by identifying the key features, benefits and how CC can be strategically employed. CC as an advanced Technology can enhance SME business operations and make them competitive in a dynamic global market by reducing cost through a more scalable IT infrastructure model, reengineer business processes through the application of PaaS, SaaS, IaaS, CaaS, NaaS and be innovative in order to keep up with current trends. Reviewing existing literature on CC in the form of books, journals and articles showed that SMEs in developed economies' reliance on cloud computing help improved their business operations significantly. The major outcome of using CC is that SMEs are able to reduce both capital and operational expenditures associated with IT Infrastructure, improve their business operations and be innovative.***

Keywords: Cloud Computing (CC), Innovation, IT Infrastructure, Reengineering, Small and Medium Enterprises (SMEs), SME Business Operations

I. INTRODUCTION

Small and Medium Sized Enterprises (SMEs) typically account for more than 95% of all firms outside the primary agriculture sector, constitute a major source of employment and generate significant domestic and export earnings in the OECD, transition and developing countries [1], [2], [3]. Recent empirical studies also show that SMEs contribute to over 55% of GDP and over 65% of total employment in high-income countries, account for over 60% of GDP and over 70% of total employment in low-income countries, while they contribute over 95% of total employment and about 70% of GDP in middle-income countries [4]; this means that improved SME competitiveness can positively contribute to economic and social development and poverty reduction in most especially developing economies and therefore their ability to achieve long term growth, survive and stay competitive should be every society's top most priority. Sadly, SMEs fail or collapse a few years after startup partly due to the unfavorable economic terrain in which they operate,

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Their lack of or inability to employ innovative IT Infrastructure and its applications, poor or inefficient business processes, their inability maintain and improve their business operations, Research innovation development challenges etc., have created a continuous cycle where SMEs start up and collapse then another group of SMEs start up again to replace them and the cycle continues. This paper tries to present a solution to this challenge by proposing the use of CC to SMEs. Literature on CC has been relatively general and not specific to SMEs in developing economies, i.e. how they can apply cloud computing to reduce operational challenges, this paper tries to identify specific areas where CC can be applied to improve the operations of such SMEs and help them to maintain their operations and be innovative enough to survive and grow.

A study of works from some authors on the subject of cloud computing and its benefits was done by analyzing journals, articles and books both in the library and online to emphasize how important CC is for businesses especially SMEs in developing economies. It was observed that CC was now the new terminology that is much talked about in terms of advanced technology.

Cloud Computing has been described in many different words and forms; but the basic principle behind this technology is the use of a network of remote servers hosted on the Internet to store, manage, and process data, rather than the use of a local server or a personal computer.

In a broader definition, Armbrust et al., define cloud as the "data center hardware and software that provide services" [5]. Accordingly, from Sotomayor's perspective, "cloud" is a term that mostly refers to the IT infrastructure that is deployed on an Infrastructure as a Service provider data center [6], Ambrust et al., therefore summarized the key characteristics of cloud computing as: "(1) the illusion of infinite computing resources available on-demand; (2) the elimination of an up-front commitment by cloud users whereby resource allocation can be adjusted; and (3) the ability to pay for the use of computing resources when needed". [7] Research into this relatively new technology also indicates that in 2013 cloud computing accounted for $16.7 billion making up 2.8% of the IT market and is expected to increase to $40 billion in 2020 accounting for about 15% of the IT market. This sector is also expected to grow to 36% annually and rake in $20 billion in revenue by the end of 2016, growth of cloud between 2012 and 2016 is as follows: 41% Platform (development tools like Heroku), 37% infrastructure (storage tools like Dropbox), 29% software (communication services such as Gmail). What this means for SMEs is reduced IT

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infrastructure cost, reduced production cost, enhanced goods and services, reduced redundancy and increased business productivity. SMEs in the developed economies have greatly benefited from the use of the cloud computing model.

According to an analyst firm IDC, the cloud infrastructure market segment registered the second highest growth and as a logical consequence, the technologies that are the basis for the cloud, such as servers, storage systems and Ethernet switches, accounted for 30% of expenditure in 2015, against 26.4% in 2014, HP maintained its position as No. 1 in the world with a 15.7 % market share, followed by Dell (11.9%), Cisco (9.3%), EMC (7.2%) NetApp (4.4%) and Lenovo (3.6%) etc. [8].

Investments are growing in both public cloud and private cloud. But it is the public cloud that carves the lion's share with two-thirds of the cloud infrastructure expenditures dedicated to them. While sales of private cloud rose 24.4% to $4.2 billion, those of public cloud have evolved similarly, a 25.5% increase to $3.9 billion [9]. This literature on CC shows how much it is growing in demand and popularity which means it's an IT solution for the future.

This paper has been organized as follows: Section Two discusses the need to embrace cloud computing and what it means for SMEs, Section Three brings out the barriers/challenges to SMEs' Business operations and how to strategically employ the use of cloud computing to overcome such challenges; Section Four then concludes the paper.

II. CLOUD COMPUTING AND WHAT IT MEANS FOR SMEs

SMEs in developing economies have tried over the years to build their own IT Infrastructure and software apps in the hope of improving their operations without success as big companies have done, such ventures were expensive, time consuming, resource demanding in the form of employing IT experts which can take a chunk of SMEs profits, very difficult to run and maintain etc., but in the end was not sustainable needs to be addressed. These efforts that SMEs made in the past to improve and maintain their operations meant that they understood the need and importance IT could play in the survival, whiles giving them the ability to take advantage of business innovation opportunities. Unfortunately, SMEs in developing economies have grappled with this challenge over decades without having a permanent solution. However, studies on SMEs in developed economies showed that their reliance on cloud computing helped them to improve their business operations by way of acquiring IT infrastructure and Software apps, reengineering of their business operations, reduced cost on their IT needs in terms of equipment, Human resource (IT staff) etc., thereby giving them stability, growth and some form of competitive advantage. This means that Cloud Computing can provide an extensive market environment that offers enough leverage for SMEs in developing economies to compete with the giants in the industry by having access to IT infrastructure that is the most cost-effective and yet very efficient.

A thorough analysis of journals, articles and books from the library and online gave a detailed account into what cloud computing is, how it works, its features and how it benefits users, writers of these materials had different ways of presenting their thoughts and the research done on cloud computing but over all they all arrived on basically the same conclusions that Cloud computing comes in models such as Infrastructure as a Service (IaaS), Platform as a Service (PasS), Software as a Service (SaaS), Communication as a Service (CaaS) and Network as a Service (NaaS) all of which can be deployed as Private cloud, Public cloud, and or Hybrid cloud.

For the purpose of this work details regarding cloud computing and how its adoption and use can improve business processes or operations was specifically narrowed down to SMEs and what cloud computing can do for them especially for those in developing economies.

A. Features and Benefits of Cloud Computing To SMEs

i. On-demand self-service whereby SMEs can unilaterally have access to computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider;

ii. Broad network access capabilities that are available to SMEs over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations),

iii. Resource pooling gives abilities that gives SMEs access to computed resources that serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand;

iv. Rapid elasticity meaning that cloud capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with SMEs demand.

v. A measured service which allows the cloud systems to automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth, and active user accounts); Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and SMEs of the utilized service giving them value for money.

The industry in which SMEs operate will inform their choice of service and its deployment model to give them different levels of control, flexibility, and management.

Infrastructure as a Service (IaaS) can be useful to SMEs in the area of accessing, monitoring, and managing remote datacenter infrastructures, such as compute (virtualized or bare metal), storage, networking, and networking services (e.g. firewalls) and pay as they consume rather than having to purchase hardware outright. Some examples of IaaS are Amazon Web Services (AWS), Cisco Metapod, Microsoft Azure, Google Compute Engine (GCE), Joyent etc.

SMEs can also rely on Platform as a Service (PasS) by way of applications and the development of other applications, while providing cloud components to software. SMEs can gain with a framework they can build upon to develop or customize applications

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using PaaS. PaaS makes the development, testing, and deployment of applications quick, simple, and cost-effective. With this technology, enterprise operations, or a third-party provider, can manage Operating System Environments (OSEs), virtualization, servers, storage, networking, and the PaaS software itself. Enterprise SMEs can use PaaS as a self-service portal for managing computing infrastructure from centralized IT operations and the platforms that are installed on top of the hardware. PaaS platforms for software development and management include Apprenda suitable for NET and JAVA, Appear IQ, Mendix, Amazon Web Services (AWS) Elastic Beanstalk, Google App Engine and Heroku.

Software as a Service (SaaS) provides SMEs with the ability to use the web to deliver applications that are managed by a third-party vendor and whose interface is accessed on the clients' side such as email and collaboration, customer relationship management. Most SaaS applications can be run directly from a web browser without any downloads or installations required, although some require plugins. Since SaaS is a web delivery model, it eliminates the need to install and run applications on individual computers reducing cost of SMEs maintenance and need for support. Google Apps, Salesforce, Workday, Concur, Citrix GoToMeeting, Cisco WebEx are typical examples of SaaS.

There are other cloud computing services like Communication as a Service (CaaS) which is an outsourced enterprise communications solution that can be leased from a single vendor which includes voice over IP (VoIP or Internet telephony), instant messaging (IM), collaboration and videoconference applications using fixed and mobile devices and Network as a Service (NaaS) which is a virtual networking business model that integrate current cloud computing offerings with a cloud networking framework, it give flexible and extended VPN (Virtual Private Network), security firewall, WAN (Wide Area Network) , bandwidth, custom routing, content monitoring and filtering, multicast protocols, intrusion detection and prevention and antivirus.

SMEs can choose or adopt any of the above cloud computing services depending on their area of business so that they can enjoy expandability that small as they are might not otherwise be able to afford, allowing for the addition of devices, modes or coverage on demand. The network capacity and feature set can be changed from day to day if necessary so that functionality keeps pace with demand and resources are not wasted. There is no risk of the system becoming obsolete and requiring periodic major upgrades or replacement. However, these Cloud Services are charged for on a per-use basis, some Service Providers charge a flat monthly fee to access the cloud services and the apps hosted within it. It is important to for SMEs to discuss pricing, service uptime and support with the cloud service provider before engaging their services.

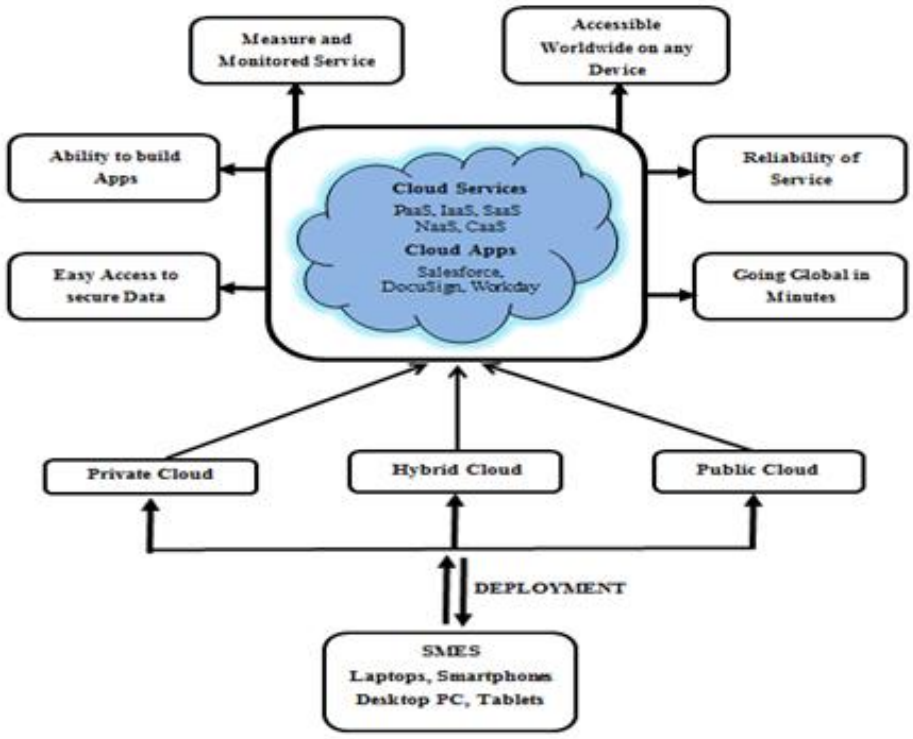

Figure 1: Cloud Computing Makes it Easy for SMEs to be Innovative in their Business Operations and Give Them Enough Leverage to Compete with the Bigger Companies.

III. USING CLOUD COMPUTING SERVICES STRATEGICALLY TO MINIMIZE SMEs OPERATIONAL CHALLENGES

The bottom line of most business decisions lies in the availability of resources; SMEs usually lack the necessary resources to push their business decisions and plans to a successful end making them unable to grow their business and succeed. A study of SMEs in developing economies revealed that they have challenges relating to IT Infrastructure, poor business processes or operations, lack of innovation development and financial challenges to mention a few. It has been observed that the adoption and use of cloud computing can reduce the impact of these challenges on SMEs and give them enough room to operate and grow. SMEs in America,

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Europe and some parts of Asia have employed cloud computing in their operations and have been successful with it in the areas mentioned above. In the Study of cloud computing and how it benefit SMEs, three very important areas were identified in this paper where if SMEs focused on will give them the opportunity to overcome the many operational challenges they face.

A. IT Infrastructure and Cloud Computing Services - Related Business

In the traditional system organizations built their own on premise IT infrastructure and IT departments were tasked to buy, provide and maintain servers to run applications within the confines of the business, in most cases this redundancy even happened in the same company where departments were partitioned by physical buildings, organizational divisions, or by global geography. This "rack and stack" approach was expensive and time consuming, with the same tasks being repeated in every department of the business and in its branches across the world.

This put pressure on SMEs resources because they are small and privately held and did not have adequate financial resources operate and expand, raising enough money to procure the business premises, machinery and equipment for production of goods and services, IT infrastructure and its related accessories, payment of bills, payment of remunerations meant that maintaining such in-built IT infrastructure was virtually impossible

Cloud Technology is a way for these SMEs to own IT infrastructure much cheaper than it was in the traditional system. And they do this by simply outsourcing their IT needs from a cloud computing service provider by using IT services, software and applications from a service provider over the internet on a pay-as-you go basis instead of buying them totally or setting up their own IT infrastructure which is capital intensive and time consuming and paying for the service consumed over a period of time. This means that both capital and operational expenditure in relation to IT resources and Infrastructure setup, power and energy, purchase of and upgrading of physical hardware, management and maintenance of IT infrastructure/systems (technical staff and software updates) are eliminated since the service provider bears them.

This is a more flexible and cost effective way of attending to their huge IT needs which is vital to their survival and long term growth whilst reducing both short and long term IT cost and making savings that could be channeled to improve other sectors of their business i.e. R & D, increase production, quality of goods and services and aftersales services etc. this innovative way of acquiring their IT needs relieve them of that huge burden they had in the past.

B. Reengineering Business Processes and Cloud Computing Services - Related Business

SMEs find it difficult to access advance technology that will drive their operations to reflect the current trends in the market, over the last decade; technology has become the differentiator and enable of businesses. Market participators and trends have shifted in the way business is conducted by employing technology which allows to venture into new markets of opportunity worldwide. In order to catch up SMEs are expected to employ the use of innovative technologies that will help them to manage their enormous business process as well as provide data storage facilities that will support the huge data they will gather in the process of doing business. Advancing and transforming SMEs business processes therefore becomes imperative to SMEs success; Cloud computing makes the way SMEs do their business very innovative through enhanced and efficient business processes making the SMEs reliable, attractive and competitive. Reengineering business processes means SMEs can have the following:

Increased Data Storage Capabilities: SMEs whose business operations involve huge data storage can rely/subscribe to Dropbox/Box, Box.net, GoogleDocs, Evernote and SugarSync; these are cloud storage, file sharing/synchronizing and collaboration apps. By relying on open cloud environment SMEs don't have to seek the services of highly trained IT staff to take care of their Business operations because the cloud system does not need day to day servicing and monitoring as well as specialized skills to run them, probably with a little bit of training staff of SMEs can operate the cloud system without the need for special skills. Cloud computing enables innovation within SMEs because the cloud technology can speed up innovation by taking services and data and link them together to create new and innovative applications or business processes.

Improved Products and Services: SMEs can save time, reduce inefficiencies, reduce waste, eliminate staff redundancy etc., through the integration of apps such as Microsoft Office 365, Workday, NetSuite, DocuSign, Yammer, Zendesk, Atlassian Jira, Adobe Creative, ADP Portal and many others mentioned in the table above to manage their day to day managerial and human resource, production, sales and marketing, and financial and auditing operations of the business. These apps allow users to easily access, manage, edit and share their content from anywhere with any browser thereby improving workflow processes which in the past were labour intensive to build and maintain. SMEs are also able to Innovate New Products and Services through Cloud services such as Platform-as-a-Service (PaaS) which has the ability to offer SMEs the opportunity to create new products and services within their operational portfolio with a solid cloud business platform, SMEs are better positioned to innovate and offer new products and services that will generate additional sources of revenue. SMEs can also accelerate their experimentation and testing cycles because they don't have to divert time and budget to building dedicated technology to make innovation happen.

Mobility of SMEs and Access to New Markets: Going Regional and Global/Venturing into New Markets is no longer an option but a must and as mobility has become very important and the networks of SMEs are scattered around the world, being able to access SME business applications and data from any part of the globe is crucial. SMEs can use Cloud computing as an innovative tool to go global in minutes at the click of a button giving them access to new customer base in new geographic locations. SMEs can save tremendous amounts of time, money and manpower by avoiding lengthy negotiation with technology vendors in foreign countries, minimizing

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unnecessary risks while accelerating time to market. The ability to move fast is often one of the critical success factors in global competitiveness for any SME. Cloud computing can therefore be an enabler here as well, as one of the Cloud characteristics is service delivery over the Internet, adopting and using cloud affords SMEs with remote access and business expansion abilities because their information can be accessed and used by employees from any part of the world 24/7 rather than limiting them to one physical location .i.e. the office; the cloud service can be accessed at home, in hotels, on buses, on trains, on ships, at recreational parks on their PC, Laptop, Tablets, Mobile Phones etc., so long as there is availability of internet connection.

SMEs whose operations rely on remote or mobile workers and contract staff (sales and marketing staff) benefit the most since they are highly constrained by their inability to expand and venture into new markets through the setting up of branches both local and international; SMEs can innovatively apply the use of cloud computing to eliminate this challenge easily by adding new users and staff onto the cloud computing platform from any location without spending so much on big office premises, IT infrastructure (staff, hardware and software updates) and maintenance, other auxiliary staff etc. again cost of power usage and cooling to run internally housed hardware (servers) are reduced, all this reduce the time and cost of expansion. Despite its remote access feature, the SMEs data and applications are secure, easily accessible and always available without the risk of loss of data.

Innovative Tools: SMEs usually lack the tools and methods that speed up their innovation process to ensure growth, better tools and methods results in increased production of goods and services whilst guaranteeing quality. SMEs lack of knowledge on this subject means they are unable to invest in the necessary tools and methods; therefore they are unable to fully exploit the processes, strategies, technologies and organizational structures that promote innovation efforts and provide the necessary conditions for innovation to thrive.

With cloud SMEs can simply subscribe to the available apps on the market as well as build their own apps which is an innovative way to improve their business and stay competitive using cloud services such as salesforce one platform, Amazon Web Services (these suites and sites allows businesses to build their own apps), they can be used as tools by sales and marketing people to track their customers, leads and contracts (a product category known as customer relationship management or CRM) and to create marketing campaigns and support customers. With this, customers/buyers can build their own customized products or services even before they visit the shops and showrooms etc., Toyota and Dell Computers usually use this strategy to engage their customers. This innovative strategy can transform the way SMEs connect with their customers and eliminates the frustrations SMEs go through as they engage IT Technicians to build such apps which is tedious, time consuming and very expensive. SMEs are also able to Innovate New Products and Services through Cloud services such as Platform-as-a-Service (PaaS) which has the ability to offer SMEs the opportunity to create new products and services within their operational portfolio with a solid cloud business platform, SMEs are better positioned to innovate and offer new products and services that will generate additional sources of revenue. SMEs can also accelerate their experimentation and testing cycles because they don't have to divert time and budget to building dedicated technology to make innovation happen.

C. Research Innovation Development Challenges and Cloud Computing Services - Related Business

It is a lot easier for the bigger firms to allocate big budgets that engage the services of consultants, economists and professional advisors and to hire staff to support their R & D operations. They are able to allocate the people, time and the capital to effectively and efficiently explore and create innovatively as compared to the smaller firms like SMEs.

Research Innovation Development is an essential part of most advanced businesses, but for SMEs time and resources is a challenge in the sense that they do not possess them to undertake every role that larger organizations might have especially in the areas of R & D departments, marketing, finance and IT to take care of operational challenges and opportunities and therefore

Low Research Innovation Development is a major challenge for SMEs. The development of innovative new products or services needs to be quickly experimented and failure of these innovations and inventions often demoralize SMEs. If the experiment with a particular cloud-based product or service does not work it can be halted during the experimentation process and investment on them discontinued. This eliminates the barriers to innovation, creates a culture that motivates people to try out new ideas, fail fast and fail forward at a low cost so that businesses can accelerate development and time-to-market.

Enhanced Research Innovation Development is key to the success of SMEs', and one of the crucial elements is being able to quickly and inexpensively test out new ideas. Cloud computing is an innovative platform for SMEs - be it developers, engineers, researchers, product development team, marketing professionals, advertising companies, health care delivery or pharmaceutical companies etc., - to test out ideas or new campaigns at a nominal cost. In order to avoid the collateral damage of a failed experiment SMEs can rely on cloud computing by accessing within minutes the most up-to-date and highly secure technology resources to experiment; through this, the time lapse between waiting for weeks and months in the traditional procurement process is avoided.

Cloud computing removes the fear and perception of failure, changes the game in how fast people and companies can innovate, and fosters a more entrepreneurial mind-set. SMEs can also use cloud to eliminate guessing the capacity of their infrastructure needs because they don't have to decide prior to deploying an application, if they do this they either end up sitting on expensive idle resources or dealing with limited capacity. With Cloud Computing, these problems go away. You can access as much or as little as you need, and scale up and down as required with only a few minutes' notice.

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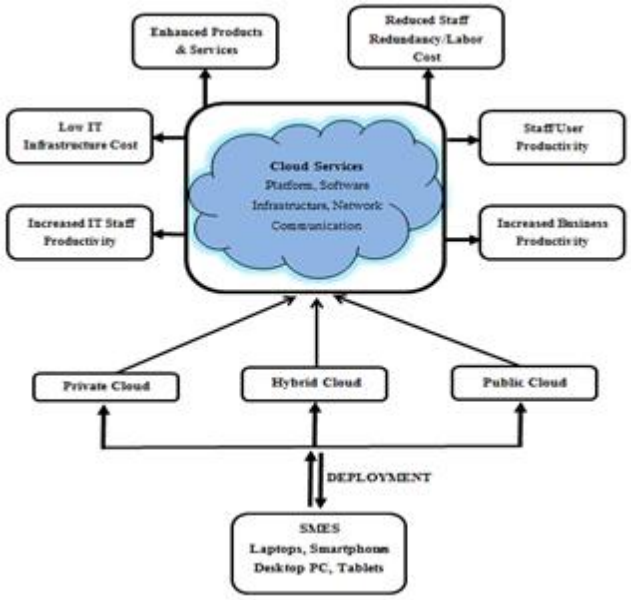

Figure 2: SMEs Can Creatively and Innovatively Reengineer their Business Processes using Cloud Computing

IV. CONCLUSION

In the not too distant future, businesses especially SMEs will no longer own IT assets or infrastructure, this is because the benefits related to IT technologies like cloud computing will propel a rush towards decreased IT infrastructure. The reliance on cloud enabled services means that employees will only have to work with personal computer systems - desktops, laptops, notebooks etc., and mobile devices like tablets, phones etc.

SMEs need for computing hardware and software either on the employees desktop, the company server and the data centers provided by the cloud computing service provider will always be there but the big advantage is that the ownership, maintenance, management, upgrading etc. will be shifted to a third party which is the service provider. SMEs budget for IT infrastructure will reduce thereby making funds available to be directed to more –strategic projects, the need for IT staff will also reduce and those employed already could be reskilled to meet new job requirements. Employees in the sales and marketing department, audit and finance, production and manufacturing departments will also reduce because of the use of cloud computing services. This will reduce the cost of recruitment, staff training, staff remuneration including bonuses, allowances, health care and insurance cost, retirement benefits etc., thereby making funds available to SMEs to redirect to other sectors of its business operations.

SMEs can also enjoy reliable and continued operations without interruptions because the cloud services offered by the service providers are backed by service level agreements (SLA) this is a contract between a service provider (either internal or external) and the end user that defines the level of service expected from the service provider. SLAs are output-based in that their purpose is specifically to define what the customer will receive. This means that SMEs can comfortably use cloud with some peace of mind to concentrate their efforts on their core business whiles continually innovating. Finally, Further research should be done to investigate the impact of cloud usage on SMEs in the developing economies and the appropriate recommendations made thereof.

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