Business Stimulation Strategies of Cloud Computing

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Abstract

Cloud technology introduces immeasurable features with agility from green field to brown field offering a higher level of competition with innovative opportunities overcoming the barriers to success by rapidly adapting to the business demands. Business strategy should cover two important aspects; tomorrow and yesterday. Tomorrow, what I am going to do, should I go all public or hybrid first then public, should I go serverless or multi-cloud, whatever the choice is, customer should make sure won't find themselves falling behind their competitors. Yesterday, if I am not starting from scratch and I have legacy applications, legacy platform, what will I do with this environment if the goal is public cloud, could I convert it to hybrid, could the public provider help me with that, should I use for disaster recovery. At the end, it comes down to decisions to be made from the customer end and the cloud provider as well, putting into consideration the different and various levels of education of the executives who making those decision and the technical team of engineers and architects who actually implementing the projects that was budget for and approved migrations plans.

Keywords — *Cloud Computing, cGAP, Cloud provider revamp, Education cGAP.*

I. INTRODUCTION

Worldwide Hybrid Cloud Computing Market to grow at a CAGR of 34.3% during the period 2016–2022 to aggregate $241.13 billion by 2022. Internet data growing rate is driving all kind of changes to businesses by year 2025; the data rate is expected to grow to 160 zettabytes according to International Data Corporation, which is almost five times as of 2019. The urgent and almost need to accommodate with that growing rate become imminent and the public cloud with solution from storing the data, backup with geo-redundancy, different frequent access controlled by policies, with dynamic scaling up or down, supporting financial and public sector security regulations, to fully being in the public cloud is not avoidable anymore [1].

Businesses are adopting public cloud, moving workloads, reducing IT budget exponentially than was previously predicted. A study was done by The Vanson Bourne interviewing financial executives of around 500 organizations with respect to cloud computing resulted in 20.66% average improvement in time to market, 18.80% average increase in process efficiency, and 15.07% reduction in IT spending and totally 19.63% increase in company growth as shown in Fig 1 [2].

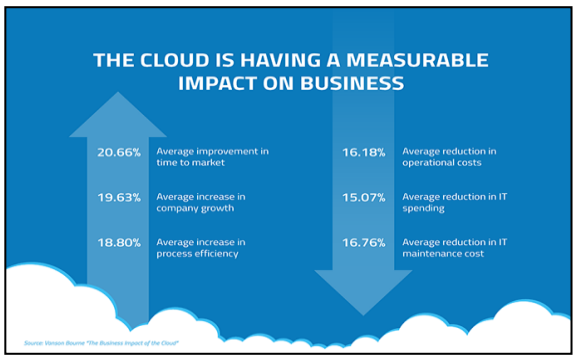

Fig 1: Vanson Bourne; Cloud Measurable Impact on business

2019 is a good year so far for cloud providers, some have grown more than the others for sure due to their pricing offers, their integration capabilities with the software that is utilized by the customers, and some because their new services that were in demands by users. We can say cloud capabilities on the rise but the adoption is slowing down a bit than was expected few years ago forming a gap, we will call it cloud gap or for short "cGAP" [3]. Fig 2 states the respondents to the Public Cloud Adoption.

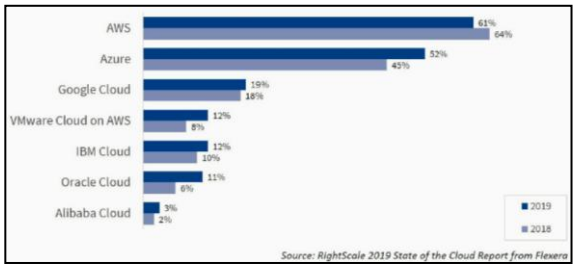

Fig 2: Public Cloud Adoption Respondents

Three major contributors to this cGAP; cloud provider, customer, and education system. The following section will address each one to cover the reasons and causes of the delay or slowness of public cloud adoption in addition the business model to close the gap and expedite the development

minimizing the CAPEX and OPEX for the customer and improving ROI for the cloud provider. In addition, how enhancing the education system will have a significant effect of the progress as well [4], [5].

II. CUSTOMER CGAP ANALYSIS

In this section, the cGAP is addressed from the customer and organization view, what they lacking and what are the reasons for being behind. Many reasons could be contributing to it. The following are common known factors [6]:

- With large amount of data being stored in the cloud and with significant nature such as medical, educational, or financial, this come with greater responsibility of compliance with industry regulations and laws for certain organizations such HIPPA (Health Insurance Portability and Accountability Act of 1996), FERPA (Family Educational Rights and Privacy Act), and PCI (Payment Card Industry). Make no mistake, compliance with those regulations is a MUST and for the good reason but also it complicates the design which in turn slows down the migration to public cloud.

- Some organization's reason to slow adoption of public cloud is the nature of the data they deal with and security requirements comes along with it. These organizations have worked for years utilizing their On-Premise resources that is not exposed to the outside world and it was enough and also to comply with government or federal demands, the data is encrypted at "Rest" which means stored encrypted. Thinking about moving to the cloud for them with no technical background how public cloud providers could help them, reduce their willingness to move workloads to public cloud.

- The vast majority of cloud providers if not all have encountered outages with respect to power, fiber optic cut, or network routing. These outages' news does not affect large scale enterprises to migrate workloads to public cloud because they themselves experience the same kind of outages, however for small to medium business, they are influenced with this news and makes hesitate in some cases which slows down the cloud adoption overall.

- A weak cloud adoption strategy developed by teams of architects belongs to different departments not correlating their goals, not being familiar with any discount or lower cost for certain packages or licenses form the cloud providers, and rushing to adopt public cloud with Ad hoc security measures have also contributed to delaying the public cloud growth.

- One of the most dominant obstacles enterprise encounter the minute the announcement comes out of thinking of public cloud is the immediate dispute and debate between the three major technical teams; Network, System, and Security. It seems a disconnect or not a team work environment but in fact it is totally natural because each team operated for years not only focusing on their job needs but also probably did not get exposed to the new world of virtualization or cloud [12].

- Hidden costs of migrating workforce to public cloud and automating resource allocations are considered number one rated of shaking the confidence of the enterprise executive leadership to continue the overall plan of migrating workloads or in some case stalling the migrations.

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- What sometimes organizations face as new adopters to public cloud is they do not know where to start, do not know what they have currently in their inventory that probably could be used as a start-up point, with minimal or no cost.

Fig 3 shows the respondents for the challenges of Cloud by the Company Size.

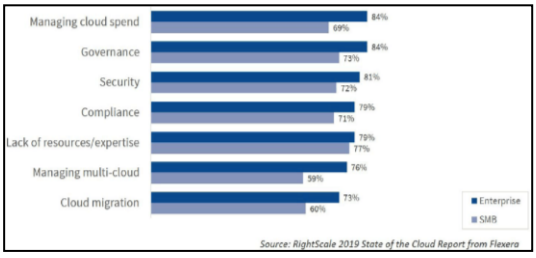


Fig 3: Cloud Challenges by Company Size Respondents

Organizations and enterprises planning to make the first move to public cloud should discussed important aspects that might affects the outcome technically and financially [3], [4]:

- Does the enterprise run the infrastructure management and the analytics On-Premise for

the different environments or on the cloud as SaaS (Software as a Service) which means web browser access anywhere and no installation or licenses complications, or no single point of failure in addition to simplifying the operations.

- What is the acceptable level of data protection and durability, five 9s, Seven 9s, or even eleven 9s.

- What is going to be the recovery mechanism from outages or failing over to the redundant site; application snapshot, local disaster recovery, or Cloud recovery.

- There are two interrupting activities to any applications and also to the network and system; Planned service interruption for patching or upgrading purposes, and Unplanned interruption due to wrong codes or human errors or else. Today's business requires the minimum interruption possible to guarantee the business continuity which can achieved through enabling high system availability to recover from any planned or unplanned interruption or failure event.

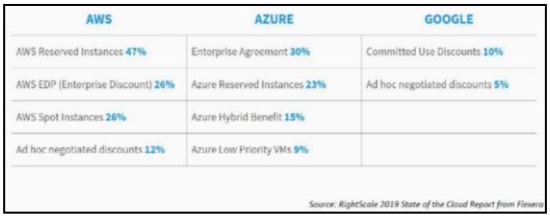
IV. CUSTOMER ACCELERATING CLOUD ADOPTION MODEL

In previous section, the customer cGAP has addressed the reasons that might be contributing to the delay of movement toward the cloud. This section introduces a customer business model that could accelerate the process toward the public cloud adoption [7]:

- Despite the challenges come with the migration strategy to the public cloud such as complexity, connection to On-Premise data center, and troubleshooting, are not enough to discourage customer to adopt public cloud for their applications. Customers should always focus on the bright side of the story and the benefit of the end goal. Choosing the right business intelligence along with the proper strategic approach will overrule any of the challenges.

- Educate businesses about cloud computing helps companies reducing their on-premise data center numbers or the size taking the advantage of the geographical coverage of the public cloud providers nationally and internationally, that is extremely pricy for any organization to even think of replicating it. Additionally, worth to mention, it is environment friendly, it reduces the global carbon foot print.
- Public cloud providers and managed service providers proactively engage with the customer utilizing their high-tech skills engineers and long years of experience architects to develop an efficient strategy to begin moving a portion of their data center resources to the public cloud and maintain them in addition to continuous technical support if needed.

- In some cases, the customer is using software to build upon the applications that consume a great deal of the budget just for the licenses associated with it such as Microsoft SQL database. Cloud providers such as Microsoft Azure could offer a discount or long-term low-cost contract since it is a native application to the cloud provider as shown in Fig 4. Others such as AWS could offer alternative model such as My SQL that does not have any associated licenses, provide the customer with the dev environment and even help the customer integrate the application which achieves tangible advantage to the OPEX.



AWS	AZURE	GOOGLE
AWS Reserved Instances 47%	Enterprise Agreement 30%	Committed Use Discounts 10%
AWS EDP (Enterprise Discount) 26%	Azure Reserved Instances 23%	Ad hoc negotiated discounts 5%
AWS Spot Instances 26%	Azure Hybrid Benefit 15%	
Ad hoc negotiated discounts 12%	Azure Low Priority VMs 9%	

Source: RightScale 2019 State of the Cloud Report from Flexera

Fig 4: Discount Types used by Cloud Provider

- Running applications as service in the cloud (SaaS) expediates the developing, testing newer versions and releases and making it available to the customer when it ready without interrupting the financial cycle for the current business, in addition to expediting the learning curve for different UIs (User Interface) if the product gets upgraded. This of course comes with flexibility, options and with "Pay as you go" model reduces the CAPEX dramatically and intern also the OPEX.

- The cloud management and analytics become very important to a point that the customers need to predict every move of the operations and even suggest solutions before an event or issues happen. VMware has begun January 2019 offering their analytics' tool vROps as a SaaS and in July 2019 will include also their cloud management software vRA 8.0 to manage the cloud resources also as SaaS.

- Vast majority of public cloud providers if not all of them provide a proactive analytics and migration simulation service free of charge to customers. Those services help customers to do the math for the necessary requirements for the migration to the public cloud or integrating with it such as the infrastructure, storage, network and bandwidth, security to assure compliance and successful operation.

- Cloud providers often utilize specific tools to be able to repackage the customer's physical or virtual workloads and rehost automatically it in the public cloud environment with the least amount of human intervention. An example of this service is AWS Migration Acceleration Program (MAP) and AWS Cloud Adoption Framework (CAF) that enable AWS to work with the customer on an efficient plan based on best practices and be with the customer till the migrations is completed successfully.

- With public cloud's resources almost unlimited scalability and agility, availability 99.99%, and durability 99.999999999% accelerate migrating the business workloads and increase application's sustainability.

- One of the main goals should be to automate as many processes as possible. Manual process leads to mistakes, automation reduce those flaws and expediate the scalability of the framework when it completed.

- Virtualization of customer applications was step one, moving to the cloud was step two, the time has come for step three, which is utilizing every drop of the resources the customer paid for. Containers such as Docker used to package the customer application, associated databases, libraries, etc, makes them work cohesively better than as individual VMs. Associated orchestration tool such Kubernetes improve the overall performance by automating complicated tasks and achieves faster growth.

- One technology is gaining popularity that integrates with containerization platform, and orchestration tools is "Ansible". Ansible improves the scalability, consistency, and reliability of the customer's applications environment from provisioning to deployment and management.

- Should the customer decide to invest in hybrid cloud, one of the powerful platforms in 2019 and just getting better by the day and expanding features and functionality is VMC (VMware Cloud) that runs On-Premise and a number of public cloud providers, AWS is considered the pioneer that enable the architects and engineering to use seamlessly same UI and interconnecting the two environments as one platform, moreover connecting and utilizing the AWS native resources simultaneously which improve productivity and drive down the cost dramatically as shown in Fig 5 [3], [4].

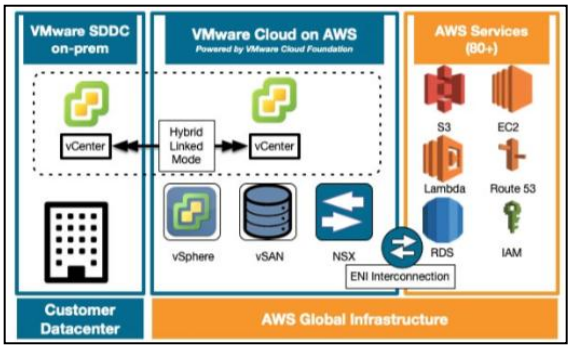


Fig 5: VMware Cloud on AWS

- Public cloud environment and in particular Serverless Computing or Function-as-a-Service (FaaS) has formed a new business era when no time to build a data center, manage or scale resources or whenever there is an opportunity for organization want to start new line of business they can afford but what they can't afford is the time to wait to build the infrastructure to host it. New generations of businesses called "Coreless", they have no data center to host their applications. All they need is agile dynamic virtualized environment to execute a script or perform a function when they are triggered by the customer application. In other cases, they are triggered to access non-public database to do a certain job, such as "Federated Wireless" to control LTE small cells operate on certain frequencies for government regulation or access public database such as Google search engine to perform specific tasks such as "Alexa or Google Assistant". The great benefit in this case is reducing time to establish the business and significantly lowering the cost, the business only pays for the trivial time the function is triggered and executed.

- VMware vSphere continues to lead as a private cloud option (both in adoption and number of VMs) followed by OpenStack and VMware vCloud Director, and Cloud foundation. Two private cloud technologies from public cloud providers, Azure Stack and AWS Outpost, are growing more strongly and generate the strongest interest level for future use. The significance of the cloud is increasing exponentially as shown in Fig 6. Gartner forecasts that the cloud services market will grow 17.3% in 2019 ($206.2 billion) and by 2022, 90% of organizations will be using cloud services.

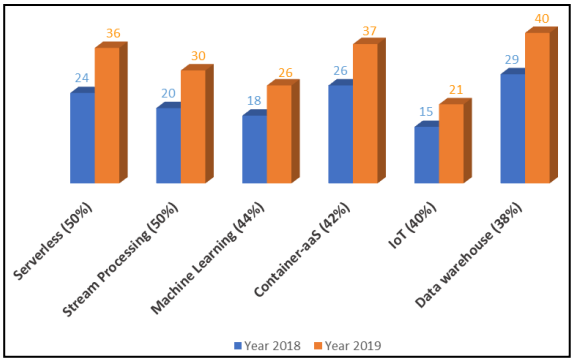


Fig 6: Advanced Cloud Service Growth

V. CLOUD PROVIDER CGAP ANALYSIS

This section tackles the cGAP as well but this time form the cloud provider end. As mentioned in the previous section the customer is lacking knowledge about certain aspects of the cloud cause the delay of early adoption of public cloud architecture. It is unfair to put it all on the customer, the cloud provider is to be blamed as well and is responsible as well for the delay [6]:

- Cloud providers lack of understanding the customers detail projects, not aware about the accumulated licenses' cost and utilizing the cloud service to estimate the Inbound/Outbound utilized bandwidth could extensively lead to a customer dissatisfaction and demotivation to move on with their migration goals.

- Cloud providers tend sometimes to rush and push for everything to move to the pubic cloud. It is important to remember that not all applications are suitable for the public cloud; applications such as content storage, Virtual Desktop Infrastructure (VDI) and mobility management are best candidate for hybrid cloud. Fig 7 shows the Software challenges in the Cloud.

- If cloud adoption's cost is the first thing executives always concern about, security is by far is the concern for the technical leadership. The fact is that public cloud security is based on shared model, which means the customer is responsible for securing the network as the cloud provider responsible for other aspects. Instead of educating the customers about security and work with their technical team, it become too late after the customer already surrendered to the myths and rumors of cloud security breaches when in fact likely due to inside job for unethical purposes.

Fig 7: Top Challenges in Software in the Cloud

VI. CLOUD PROVIDER REVAMP BUSINESS MODEL

The business model of adopting the public cloud should begin with addressing certain key elements that assist the customer being on the successful path [3]:

- Complete understanding of all aspects of the customer's business and clear view of the needs, features, and future goals to run the organization. Will the budget align with the cloud adoption demands, and is the time to achieve the goals in the customer side despite the significant competition.

- Will the customer depend on his own resources and architects with regard to technical aspects such as security, cloud model; hybrid or Multi-Cloud, or might consult with the cloud provider in addition taking advantage of the geographic diversity of the cloud provider that support the enterprise with multiple locations nationally or internationally. Very important to remember during the designing phase of leveraging the public cloud is that in some cases not all advanced services such as Containers and Kubernetes offered by the cloud provider are available at all the cloud provider geo-locations, it is recommended to do the homework before taking actual deployment steps.

- With regard to data durability, the expectation should be at least nine to eleven 9s which is provided by the major public providers, AWS, Azure, and GCP, which means the possibility of a loss of one object of few million stored in thousands of years.

- When it comes to storage, worth to remember there is not one solution for everyone. In case of green field environment, the legacy infrastructure evaluation should be the first to think of before considering the public cloud to extend the storage or backup for On-premise due to the cost could come with this decision. In case of brown field environment, using the

public cloud for storage might be the best pending calculation of data rate out the cloud that come with extra cost. Hybrid storage seems to be the preferred solution these days with many techniques to connect. Some of the On-Premise storage providers such as NetApp or Rubric and many others partner with the public cloud provider by adding a "Built in Cloud Connector" to the On-Premise storage to enable the connection natively the public cloud storage environment. AWS has provided a solution called "Storage Gateway" in some cases when the storage providers did not partner with the cloud provider.

Unlike humans, all cloud providers are not created equally, some are better with regard to integrating with popular software such as Microsoft Office with Azure with incomparable cost for Enterprise IT, some are fast developing offering the customer what they need today before tomorrow such as AWS, and some with futuristic needs such as machine learning financially affordable by technological organization for development purposes such as GCP and their advanced service AI (Artificial Intelligence) [9].

Cloud providers should put the other providers under microscope for their competing features and should not just think to rush and try to offer the same features because they might be going against the odds, what they should do is taking the lead for certain aspects of the customer demands or better offer a way to integrate with the other cloud provider to make sure to stay in the game of the business, which makes them wiser and smarter. As such, the market is observing Azure is growing rapidly in 2019 catching up with AWS and closing the gap.

A common mistake among people to think that word "Virtualization" and "Cloud" can be used in any context synonymously; they are related but could not be the same. Despite the main goal of public cloud providers is to get the customers to move their workforce and application to their environment, it is preferred to take a gradual approach through converting the customer On-Premise from just virtualized environment to a private cloud first then followed by introducing the concept of hybrid cloud that will lead at the end to at least 80% of the workload to be in the public cloud serving the main goal of the providers. It might seem to be a slow approaching model but it has a positive convincing faster behavior and makes the customer confident and not to be frightened of a new environment with less knowledge about it.

Cloud providers should never start conversation with the customers by offering to move all workloads to public cloud despite they are technically and financially 100% correct but the human and education factor could be more powerful than the technical and financial aspects, they should put into their consideration to take the migration journey as steps accepting in some cases they there are some services for certain businesses better to stay On-Premise such as LDAP, DNS, DHCP and others.

A competitor to cloud providers' initiative is "Do it you self" led by "OpenStack" to enable building your On-Premise and have full control over the environment and no licenses associated which saves OPEX and CAPEX spending. It seems indeed a good approach and usually has outstanding results however it is heavily depending on high-tech engineers but also has significant flaws that now the business in the hand of few engineers might form a security threat in addition the product itself is open source. Some providers such as Redhat offer their technical support but come with licenses and contract which means back to spending mode. Cloud providers such as VMware has decided to work around this business threat through integrating OpenStack with their services and offered VIO (VMware Integrated OpenStack) [8].

VMware Integrated OpenStack is ideal for many different use cases, including building a IaaS platform, providing standard, OpenStack API access to developers, leveraging edge computing and deploying NFV services on OpenStack. VMware Integrated OpenStack greatly simplifies deploying an OpenStack cloud infrastructure by streamlining the integration process. VMware Integrated OpenStack delivers out-of-the-box OpenStack functionality and an easy configuration workflow through a deployment manager vApp that runs directly in vCenter Server®. Fig 8 shows the top Cloud Initiatives for the year 2019.

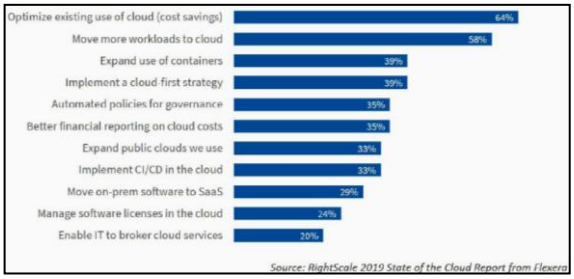


Fig 8: Top Cloud Initiatives in 2019

Future seems optimistic with more Containerizations and Orchestration and so, cloud providers should invest more of integrating with their services in addition to monitoring and analytics tools that helps the customer to be proactive regarding the operation. Numbers might be more persuading in this case, Overall Docker adoption increased to 57 percent from 49 percent last year. Kubernetes, a container orchestration tool that leverages Docker, saw faster growth, growing from 27 percent to 48 percent adoption. The AWS container service (ECS/EKS) had 44 percent adoption in 2019 (flat from 2018). Azure Container

Service adoption reached 28 percent (up from 20 percent in 2018), and Google Container Engine grew slightly to reach adoption of 15 percent. Fig 9 shows the respondents for the Container Tools used by Cloud.

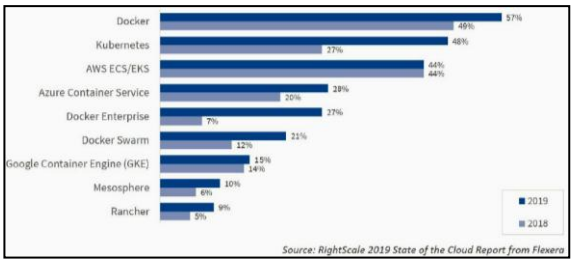


Fig 9: Cloud Container Tools

There might be reasons such as cost and backward compatibility to legacy infrastructure that concerns the business executives before migrating or integrating with public cloud. One intermediate solution is almost offered by all public cloud providers; prototyping as free service which is highly desirable that enables the customer to test the architecture, infrastructure, or the applications before the migration and in case if satisfying results, the cloud provider go hand to hand with the customer to assure a successful operations workflow.

Cloud providers should not push and rush the customers but start with educating them, understand their business technology, any technical or executives needs to accommodate with it and offering appropriate solution. One of the subjects the cloud provider needs to stress on educating the customer about it is security which in some cases frightens the customer. Public cloud is a rich environment of secure algorithms, it has the option of encrypting the data at "Rest" according to industry standards but also giving the customers the opportunity to bring their own encryption algorithm, in addition encrypting the data in "Transit" which means moving the data form point A to point B encrypted to offer same level of security the customer already had On-Premise [10].

VI. EDUCATION CGAP ANALYSIS

In many cases, we find management leadership holding higher positions on the organization board of directors, CTOs, or even CEOs. Educational wise, they might hold higher degrees such Master degree or even Ph.D. however they are missing one thing only exist today, the heartbeat of our life; Cloud technology knowledge. Not knowing much and in some case how it works likely influence the executives' decisions regarding the budget and futuristic plans where the enterprise should be in few years to accommodate with economy demands.

Most of technical businesses' organizations have their incentive educational programs to leverage and improve their employee's technical education level and in turn help the company at the end. Despite virtualization is around for years and cloud engineering become popular, but still those organizational education programs are not fully integrated and, in most cases, a small number of engineers and architects are self-sufficient but the majority are not and those are the ones they might be pushing back the new changes.

Cloud engineering education comprised of two directions; vendor certifications and college degree. Unfortunately, the engineers and architects are literally torn between those directions. Vendor certifications are very powerful and usually are the reasons to improve the engineer's performance at work or even allocate more opportunities, practices, and experience with the caveat of no degree which could reduce the chances for getting higher positions in the future. If the engineer proceeds with the college degree, the curriculum does not align with the technology and usually not strong as certification which reduce the opportunities and does not really leverage the technical levels of the engineers.

VII. EDUCATION ENHANCEMENT MODEL

As mentioned previously regarding executives in charge of making decisions about cloud next move not being educated enough or perhaps other political goals, at the end not helping and delaying the cloud migration process, the best advice is for the cloud management leadership must have the capability to convince the executives and procurement with the plan, which means ability to tell and sell a story, get all the fund they need, assisted with all the resources and expertise such as networking, systems, databases, and security.

Cloud providers should begin offering free of charge courses and classes to at least large-medium scale to education business about how they can help the business with next move, in addition to another set of classes dedicated for educating executives and management leadership members not to overwhelm them with all technical details but to help them with their technical budgetary concerns.

Universities need to change a way they are been operating for years. They should look for opportunities to integrate the vendor certification courses into the technical syllabus programs achieving the best of both worlds; current technology and experience, and the scientific foundation [11].

VIII. CONCLUSION

Confidently, we can say cloud technology from private cloud to public or hybrid, whether heterogenous or homogenous is already a present we live and the future generations to come. 2018 we were talking about cloud technology flavors while 2019 we are talking serverless, machine learning, container-as-a-service, IoT, data mining, and artificial Intelligence which could not grow rapidly

without the cloud environment exist. Taking advantages of different superior features, discounts, georedundancy of public cloud providers become the norm, from the customer point of view it is one virtual cloud to invest in. Cloud providers are getting involved more with the customer business, understanding their work flow, technology, able to offer testing environment for DevOps to qualify the service before it touches the ground for the user [3]. This approach has affected positively on cloud adoption rate which helps business worldwide. The need for other set technical expertise becomes a MUST to accommodate with fast growing economy in addition to the business skills to influence the designs regarding cost optimization and avoiding hidden charges. No doubt there is still a waste, inefficiency, wrong decision, and higher bills due to inexperience yet but the good news is this is slowly disappearing. Public cloud can scale up and scale down anytime and anywhere, no purchase upfront necessary, reliability is currently up to the roof with up to five to eleven 9s durability and with up to 75% of the organization energy saving. Lastly, for the purpose of accomplishing the move to the public cloud is a significant goal that requires the cloud provider investing in and understanding different kinds of businesses, it needs a customer taking a chance to bring this technology aboard, it demands from the engineers and architects working day in and day out to be familiar with the technology. Together let's Cloud it the right way [7].

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