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Challenges Faced by CIOs in cloud and IoT based organizations - A Study on IT and Business Leaders

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Abstract— The Internet of Things (IoT) is turning into the following Internet-related insurgency. It enables billions of gadgets to be associated and speak with one another to share data that enhances the nature of our day by day lives. Then again, Cloud Computing gives on-request, advantageous and adaptable system which makes it conceivable to share computing assets; surely, this empowers dynamic information integration from different information sources. There are numerous issues hindering the effective implementation of both Cloud and IoT affecting the role of a chief information officer (CIO).The integration of Cloud Computing with the IoT is the best path on which to conquer these issues. The immense number of assets accessible on the Cloud can be to a great degree advantageous for the IoT, while the Cloud can acquire exposure to enhance its confinements with true protests in a more powerful and conveyed way. This paper gives an outline of the integration of the Cloud into the IoT by featuring the integration advantages and implementation challenges. Cloud computing has developed enormously throughout the years. Since the term appeared in mid 90s it was produced and being worked upon to make it a conceivable answer for business information stockpiling and availability issues. Expansive undertakings are progressively discovering cloud an affable arrangement even inside their stringent hierarchical approaches.Cloud has been such advanced that there is a surge of executing virtualization among CIOs. This has prompt a larger number of complexities than arrangements. The issues with cloud implementation are for the most part because of the scurry without legitimate investigation of one's circumstances and necessities previously. Following is a concise dialog on the difficulties looked by organizations amid executing cloud computing.This study focuses on the challenges faced by CIOs in a cloud and IOT based organization. This study will analyze the major challenges in cloud and IOT environments like security, privacy, performance, compliance, governance, portability, interoperability, lack of resources, cost management etc. As part of this study a survey was conducted on 400 plus IT and business leaders from various organizations from almost 30 plus countries and their responses are recorded and analyzed as part of this study.

Keywords— Cloud, IoT, CIO, PaaS, SaaS, IaaS, IIoT, IoS

INTRODUCTION

The Internet of Things (IoT) has certainly turned out to be a standout amongst the most widely recognized and much-advertised ideas crosswise over business and innovation area. What's more, it is totally advocated and sponsored by the statistics. Gartner in a discharge expressed that, "It is required to see around 25 billion Internet-associated things by 2020, and near $2 trillion of monetary advantage comprehensively. A considerable measure of these applications are not broadly useful gadgets, for example, cell phones, and PCs, however, devoted articles, for example, candy machines, stream motors, associated cleanser distributors and a heap of different models."

As the necessity increments, there are sure difficulties that are looked by the individual CIOs in executing IoT arrangements in their particular associations. When they surmount the test the deployment will greatly affect the economy by changing numerous ventures into advanced organizations and encouraging new plans of action, enhancing effectiveness, and creating new types of income. Sri Karambati, CIO, SSS Springs says, "IoT isn't new. It has existed in some symbol called as SCADA frameworks. What is diverse currently is that the financial aspects and the biological system of equipment/software are greater. The test to IoT reception essentially remains the mentality. Either IoT isn't viewed as esteem accumulating or an excessive amount of is anticipated from it. What is basic is a legitimate and through comprehension of its capacity, particularly at the administration level of associations. IoT can get transformational benefits whenever drew nearer and embraced comprehensively." It is critical to investigate the regular highlights of the advances engaged in the field of computing. For sure, this is positively the situation with Cloud Computing and the Internet of Things (IoT) – two ideal models which share numerous normal highlights. The integration of these various ideas may encourage and enhance these advancements.

Cloud computing has changed the manner by which advances can be gotten to, oversaw and conveyed. It has generally concurred that Cloud computing can be utilized for utility administrations later on. Albeit many consider Cloud computing to be another innovation, it has, in undeniable reality, been associated with and included different advancements, for example, matrix, utility computing virtualization, systems administration and software administrations. Cloud computing gives administrations which make it conceivable to share computing assets over the Internet. Thusly, it isn't amazing that the inceptions of Cloud advances lie in the matrix, utility computing virtualization, systems administration and software administrations, and additionally circulated computing, and parallel computing. Cloud computing involves four sorts of sending models, three diverse administration models, and five fundamental attributes. Cloud computing sending models are most generally named having a place with the public Cloud, where assets are made accessible to purchasers over the Internet. Public Clouds are by and large claimed by a profitable association (e.g. Amazon EC2). Then again, the foundation of a private Cloud is normally given by a solitary association to fill the specific needs of its clients.

The private Cloud offers a safe domain and a more elevated amount of control (Microsoft Private Cloud). Hybrid Clouds are a blend of private and public Clouds. This decision is given to shoppers as it makes it conceivable to beat a portion of the constraints of each model. Interestingly, a network Cloud is a Cloud foundation which is conveyed to a gathering of clients by various associations which share a similar need. Keeping in mind the end goal to enable shoppers to pick the administration that suits them, benefits in Cloud computing are given at three unique levels, specifically: the Software as a Service (SaaS) show, where software is conveyed through the Internet to clients (e.g. GoogleApps); the Platform as a Service (PaaS) show, which offers a larger amount of coordinated condition that can manufacture, test, and convey particular software (e.g. Microsoft Azure); lastly, with the Infrastructure as a Service (IaaS) show, framework, for example, stockpiling, equipment and servers are conveyed as an administration (e.g. Amazon Web Services).

The idea of the IoT was first specified by Kevin Ashton in 1999, when he expressed that "The Internet of Things can possibly change the world, similarly as the Internet did. Possibly more so". Afterward, the IoT was formally introduced by the International Telecommunication Union (ITU) in 2005. A considerable number of meanings of the IoT have been advanced by various associations and scientists. As per the ITU (2012), the IoT is "a worldwide framework for the Information Society, empowering propelled benefits by interconnecting (physical and virtual) things dependent on, existing and developing, interoperable data and correspondence advances". The IoT presents an assortment of chances and applications.

The IoT and Cloud computing are both quickly creating administrations, and have their own novel qualities. From one viewpoint, the IoT approach depends on brilliant gadgets which intercommunicate in a worldwide system and dynamic foundation. It empowers pervasive computing situations. The IoT is ordinarily portrayed by broadly appropriated gadgets with restricted preparing capacities and capacity. These gadgets experience issues with respect to execution, unwavering quality, protection, and security. Then again, Cloud computing involves a gigantic system with boundless capacity abilities and calculation control. Besides, it gives an adaptable, vigorous condition which takes into consideration dynamic information integration from different information sources. Cloud computing has incompletely settled a large portion of the IoT issues.

BACKGROUND AND LITERATURE

The Cloud-IoT revolution is now re-characterizing how we make 'things' today. It sets out the ideas for how organizations can accomplish quicker development and increment efficiencies over the esteem chain. Yet, in the realm of therapeutic gadget manufacturing, or, in other words, administrative consistency is still generally reliant on paper-based procedures, how does Cloud-IoT have an effect? In what capacity will it enable producers to take care of the demand for progressively advanced, higher quality and thoroughly directed restorative gadgets, and past that exceedingly customized custom gadgets? New patterns in how medicinal gadgets are made and how they convey esteem are essentially changing, gadgets are moving increasingly into the universe of the Internet of Things, using exceedingly complex chipsets, preparing abilities, and sensors.

They are versatile and associated more than ever, conveying arrangements in inventive new territories, for example, persistent particular gadgets and 'Lab on a Chip' electronic demonstrative testing. What does the eventual fate of manufacturing medicinal gadgets, effectively and profitably, resemble? Or then again, would it be advisable for us to state manufacturing the 'Internet of Medical Things' (IoMT)?

The idea of cloud-IoT implementation and appropriation grasps various computerization, information trade and manufacturing advances that are changing the scene of how we make items and extending the limits of inventive, new manufacturing chances. It is modeled on a Value Chain Organization that unions genuine and virtual universes utilizing the Internet of Things (IoT) and the Internet of Services (IoS). It furnishes processing plants with constant insight enabling them to proficiently deliver results of higher quality that can be totally redone. The IoT unites physical items with inserted hardware, software, sensors and system availability that implies they can gather and trade information with one another. In the manufacturing condition, this turns into the Industrial Internet of Things (IIoT) with included machine learning, machine-to-machine correspondence, and integration of existing computerization advancements.

Shrewd machines can precisely catch continuous information and speak with one another and the items or materials they are preparing to settle on the best creation choices. This expands profitability as well as distinguishes any wastefulness, builds quality consistency, and diminishes squander both as far as better usage of machines and decreased scrap. Alongside making existing manufacturing forms more proficient, cloud-IoT offers new open doors as far as expanding aggressiveness; quickening development; putting up new items for sale to the public all the more rapidly; adding capacity to effortlessly alter singular requests, and empowering quicker reaction to client requests.

Restorative gadget makers are encountering expanding challenges as far as cost and edge weight, speed to showcase, expanded item (thus manufacturing) intricacy and more stringent administrative compliance. ressure on the expense of therapeutic gadgets come from extract charges and expanded expenses of meeting new administrative activities. Healing centers are likewise changing the manner by which they buy gear, attempting to upgrade their expenses in the 'Esteem Based Care' model. All of this is joined with expanded item multifaceted nature which can prompt more serious dangers to quality and require an interest in better innovation and more profound examination of creation information to enhance forms. A portion of the difficulties being presented by cloud computing-IoT implementation are broke down beneath;

a) Security and privacy: Cloud-based IoT makes it conceivable to transport information from this present reality to the Cloud. In fact, one especially imperative issues which has not yet been settled is the way to give proper authorization guidelines and approaches while guaranteeing that just approved clients approach the touchy information; this is essential with regards to safeguarding clients' privacy, and especially when information trustworthiness must be ensured. New difficulties likewise require particular consideration; for instance, the dispersed framework is presented to number of conceivable assaults, for example, SQL infusion, session riding, cross site scripting, and side-channel. Besides, imperative vulnerabilities, including session capturing and virtual machine escape are additionally hazardous. IoT has officially transformed into a genuine security worry that has drawn the consideration of noticeable tech firms and government organizations over the world.

The hacking of infant screens, savvy ice chests, indoor regulators, sedate mixture pumps, cameras and even the radio in your auto are implying a security bad dream being caused by the eventual fate of IoT. Such a significant number of new hubs being added to systems and the internet will furnish noxious performing artists with incalculable assault vectors and potential outcomes to complete their malevolent deeds, particularly since an impressive number of them experience the ill effects of security openings. The more essential move in security will originate from the way that IoT will turn out to be more instilled in our lives. Concerns will never again be restricted to the assurance of delicate data and resources. Our exceptional lives and wellbeing can turn into the objective of IoT hack assaults. The IoT makes special difficulties to privacy numerous that go past the information privacy issues that presently exist. Quite a bit of this stems from integrating gadgets into our environments without us deliberately utilizing them.

This is ending up more common in purchaser gadgets, for example, GPS beacons for telephones and autos and additionally brilliant TVs. As far as the last mentioned, voice acknowledgment or vision highlights are being coordinated that can consistently tune in to discussions or look for movement and specifically transmit that information to a cloud benefit for preparing, which some of the time incorporates an outsider. The gathering of this data uncovered legitimate and administrative difficulties confronting information insurance and privacy law.

What's more, numerous IoT situations include gadget organizations and information accumulation exercises with a multinational or worldwide extension that cross social and social limits. What will that mean for the improvement of a comprehensively relevant privacy insurance model for the IoT? So as to understand the chances of the IoT, methodologies should be created to regard singular privacy decisions over an expansive range of desires, while as yet cultivating development in new advancements and administrations.

b) Performance: Transferring the immense measure of information made from IoT gadgets to the Cloud requires high data transfer capacity. Subsequently, the key issue is getting sufficient system performance to exchange information to Cloud environments; without a doubt, this is on the grounds that broadband development isn't keeping pace with capacity and calculation advancement. In various situations, administrations and information arrangement ought to be accomplished with high reactivity. This is on account of opportuneness may be influenced by erratic issues and continuous applications are exceptionally delicate to performance proficiency.

c) Compliance: A standout amongst the most broadly perceived consistency issues going up against an association is information data. Utilization of an in-house computing center empowers an association to structure its computing condition and to know in detail where data is secured and what shields are used to anchor the data. Strikingly, a typical for some cloud computing administrations is that data is secured unnecessarily in different physical regions and separated information about the territory of an association's data is difficult to reach or not uncovered to the administration client. This situation makes it difficult to realize whether sufficient securities are set up and whether legitimate and regulatory consistency necessities are being met. For example, NARA controls fuse office essentials for the limit of government records and stipulate a base height above and separate a long way from a floodplain (Gartner, 2008). External audits and security assertions can help this issue somewhat, yet they are not a panacea.

Fitting IT administration should promise IT assets are realized and used by settled upon methodologies and procedures; ensure that these points of interest are honestly controlled and kept up; and ensure that these advantages are supporting your association's framework and business targets. In the present cloud-based world, IT doesn't, for the most part, have full authority over the provisioning, de-provisioning, and errands of an establishment. This has extended the inconvenience for IT to give the administration, consistency and risk administration required. To direct the diverse perils and vulnerabilities in changing to the cloud, IT must alter its standard IT administration and control methods to join the cloud (Gartner, 2008).

d) Governance-Cloud computing requires a legitimate IT administration/governance model to ensure an anchored computing condition and to consent to all huge various leveled information advancement approaches. In this way, associations require a course of action of capacities that are essential when suitably completing and directing cloud administrations, including demand administration, relationship administration, data security administration, application lifecycle administration, risk and consistency administration. A hazard lies with the impact of associations joining the improvement in cloud computing by getting the chance to be

providers. In any case, colossal quantities of the infrastructural and key worries with respect to the action of cloud computing associations are up 'til now dark. This immaturity may have suggestions for the business as a whole. Achieving and keeping up administration and consistency in cloud conditions conveys new challenges to various associations

The ability to lessen capital hypothesis for computing resources, and rather, satisfy computational needs through operational expenses is the great position of cloud computing. Cloud computing can cut down the fundamental cost of sending new administrations and curtail the time required to get a significant favorable position from the hypothesis (i.e., revive a chance to-regard), in this way better changing expense to honest to goodness use (Khan, 2014). Regardless, the customary techniques and approach an association uses to acquire computational resources as capital utilization may be adequately maintained a strategic distance from by a division or an individual, and the procuration obscured under regular assignments.

e) Portability and interoperability: To shield their ability to change dealers, later on, offices may try to avoid stages or progressions that "jolt" customers into a particular thing. For example, a Treasury official illuminated that it is attempting to separate from a dealer to some degree on account of a nonattendance of porousness into the shipper's system and data. Interoperability can be described as a proportion of what amount contrasting frameworks or fragments can coordinate adequately. Simply more formally, IEEE and ISO describe interoperability as the limit with respect to somewhere around two frameworks or applications to exchange information and generally use the information that has been exchanged.

Concerning cloud computing, interoperability should be viewed as the limit of open cloud administrations, private cloud administrations, and different frameworks inside the endeavor to see each other's application and administration interfaces, setup, kinds of approval and endorsement, data plans, et cetera remembering the true objective to work with one another. With respect to cloud computing, Portability is about the limit of a customer to move and sensibly modify their applications and data between their own specific frameworks and cloud administrations, and between cloud administrations of different cloud pro associations and perhaps exceptional cloud course of action models (Rochwerger, et al. 2009). The essential issue caused by the absence of portability is that it may require a noteworthy push to change the application or data from its casing on the source system to the shape required by the goal structure. Portability is isolated into two separate locales: cloud data conservativeness and cloud application transportability. Cloud data convenience is the ability to easily trade data beginning with one cloud advantage then onto the following cloud advantage or between a cloud advantage customer's structure and a cloud advantage, in a customarily used electronic course of action.

Cloud application conveyability is the ability to easily trade an application or application sections from one cloud administration to a proportionate cloud advantage or from a cloud advantage customer's structure to a cloud advantage. The best level of interoperability is most likely going to be found for IaaS cloud administrations, where helpfulness is often extensively equivalent and there are different standard interfaces - some formally regulated, for instance, CDMI, others being genuine measures in the business focus. PaaS cloud administrations have cut down levels of interoperability (Botta, et al. 2016). There are few interface checks for PaaS convenience, notwithstanding the way that there are some open source stages, for instance, Cloud Foundry, that are getting the opportunity to be common in the business focus and where unmistakable cloud pro associations use a comparable open source organize, their interfaces are either vague or immovably equivalent. It is SaaS applications which show the best interoperability challenge today.

f) Lack of Resources-For quite a while, security was the primary voiced cloud challenge. In 2016 regardless, a nonappearance of advantages/aptitude crept ahead. Associations are continuously putting more remaining tasks at hand in the cloud while cloud propels keep on quickly advance. Due to these segments, associations are encountering impressive challenges remaining mindful of the gadgets. In like manner, the necessity for capacity continues creating. These troubles can be restricted through additional getting ready of IT and headway staff. A strong CIO supporting cloud gathering moreover has any kind of effect. As Cloud Engineer Drew Firment puts it:

"The achievement of cloud gathering and migrations plunges to your people—and the theories you roll out powerlessness improvement program. Until the point that the moment that you revolve around the main bottleneck to the flood of cloud allotment, changes made wherever else are misleading." SME affiliations may find adding cloud specialists to their IT gatherings to be prohibitively excessive. Luckily, various typical errands performed by these aces can be automated. To this end organizations are swinging to DevOps gadgets, like Chef and Puppet, to perform errands like checking use models of advantages and modernized fortifications at predefined times. These gadgets moreover help overhaul the cloud for cost, organization, and security (Millard and Christopher, 2013).

g) Cost Management-For any endeavor that has affected the way to consolidate, they to understand that there is a grand desire to assimilate data in going from an on-acquaint server cultivate with a cloud advantage. The Next Web depicted them as "unfathomably phenomenal universes." The best qualification, or, in other words as one of the best troubles in the RightScale examine, is managing incurred significant injury (Netto, etal. 2018).

As shown by RightScale, 26 percent of respondents find cost organization as an essential test – a number that has reliably risen each year. In 2013, only 18 percent point by point issues with cost organization. As RightScale pointed out, cloud computing can offer finances openings, anyway couple of organizations know how to exploit them (Mell, 2011). For the most part cloud computing can save organizations money. In the cloud, an affiliation can without a doubt increment its dealing with limits without making tremendous interests in new gear. Organizations can rather get to extra getting ready through pay-as-you-go models from open cloud providers. Nevertheless, the on-ask for and versatile nature of cloud computing organizations make it difficult to describe and control adventure sums and costs. An abnormal augmentation in cloud utilize prompts cost attacks and Potential Loss of Revenue.

The survey was conducted using an online methods. The survey attempted to explore the major challenges faced by CIOs in cloud computing and IoT based organizations from various industries. This study was conducted on IT and business leaders/professionals from almost 30 plus countries across the globe. A sample size of 405 was used for this survey. Since the target population is unknown the baseline was of 385 has to be maintained. The sample size of 405 was used in order to have an effective result after excluding the errors. A website named e-mailmeform.com was used to create an online survey. It is a paid services based portal which provides survey setup services. This has security features like one response from one computer and one response from one IP address. These sort of security features would help to avoid duplicate submissions resulting in improved quality responses. A total of 40 questions were asked to the respondents and the results were captured and correlated using the IBM SPSS statistical tool.

SURVEY RESULTS & DISCUSSIONS

Altogether, about 346 male and 59 female respondents were surveyed to explore the major challenges faced by CIOs in cloud computing and IoT based organizations from various industries purely from the healthcare, manufacturing and service line. Thus the totality of the participants equals about 405 in number. The feminine gender has the less valid percent of participation as compared to the male counterparts.

We can therefore infer that there is likelihood of more males functioning as IT business leaders than their female counterparts. This singular fact was considered in the distribution of the survey questionnaires. Out of the 405 respondents to the online questionnaire, only 55 people (both males and females) falls within the age range 21 to 25 years of age; eighty-six participants similarly fell within the age bracket of 26 to 30; whereas fifty-two respondents that participated in the online survey falls between age 31 to 35. The number of participants between the age ranges of 36 to 40 is forty-eight while the rest participant, about one-hundred and sixty-four, are all over 40 years of age.

TABLE I
GENDER

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	346	85.4	85.4	85.4
Female	59	14.6	14.6	100.0
Total	405	100.0	100.0	

In all, the majority of the respondents are well above forty years of age while the least frequency of the respondents falls between ages 36 and 40

TABLE III
AGE

	Frequency	Percent	Valid Percent	Cumulative Percent
21-25	55	13.6	13.6	13.6
26-30	86	21.2	21.2	34.8
31-35	52	12.8	12.8	47.7
36-40	48	11.9	11.9	59.5
>40	164	40.5	40.5	100.0
Total	405	100.0	100.0	

From the pool of respondents, it's a single participant that has his highest form of education as at then being PUC/XII, representing a minute 0.2% of the total respondents. The number of graduate-respondent elevated as high as 127 people in total representing 31.4% of the total respondents. A whooping 192 participants claimed to be holders of a post-graduate degree or qualification (47.4 % of the population) while, about thirty-five of them already has a PhD degree in relevant disciplines. Only forty-seven of the respondents studied a professional course accruing to about 11.6 percent of the total population. The remaining 0.7% of the total respondents, that is only three people, had a different educational background from the listed.

TABLE IIIII
EDUCATION

	Frequency	Percent	Valid Percent	Cumulative Percent
PUC/ XII	1	.2	.2	.2
Graduation	127	31.4	31.4	31.6
Post-Graduation	192	47.4	47.4	79.0
Doctorate	35	8.6	8.6	87.7
Professional course	47	11.6	11.6	99.3
other	3	.7	.7	100.0
Total	405	100.0	100.0	

According to the population studies, about forty-one team leaders responded to the online survey representing a significant percentage of 10.1 percent. Only eighteen of the participants that responded were junior managers in rank while thirty-one participants were senior officers or managers within their respective organizational domain. The number of respondents that were vice-presidents or general-managers amounted to thirty-five in all whereas a whooping one hundred and eighty-two of the participant were actually chief information officers, chief executive officers and/or chief functional officers- which accounts for almost half percent of the population. The remnant of the 405 respondents occupied other organizational positions not reflected in the listed designations.

TABLE IVV
DESIGNATION

	Frequency	Percent	Valid Percent	Cumulative Percent
Team leader	41	10.1	10.1	10.1
Jr. Manager	18	4.4	4.4	14.6
Sr. Manager	31	7.7	7.7	22.2
VP/GM	35	8.6	8.6	30.9
CIO/CEO/CFO	182	44.9	44.9	75.8
Other	98	24.2	24.2	100.0
Total	405	100.0	100.0	

With respect to their overall experience, most of the respondents had less than ten years of experience and exposure concerning the job description of a chief information officer; that is, about 169 respondents had lesser that ten years' experience of the subject matter accounting for 41.7 percent of the total population.

In the same vein, ninety-six of the participant had an overall experience and exposure of greater than or equal to ten years, but lesser than 20 years at the same time. Also, ninety-nine of the participants had already an overall experience worth more than twenty years but below thirty years of age. The remainder forty-one respondents already had experiences of the subject matter over accumulated years, typically above thirty years. Thus, the overall percent of respondents with the highest frequency suggests those of years below ten while those with years above thirty had the lowest overall percentage.

TABLE V
OVERALL EXPERIENCE

	Frequency	Percent	Valid Percent	Cumulative Percent
<10 years	169	41.7	41.7	41.7
10-20 years	96	23.7	23.7	65.4
20-30 years	99	24.4	24.4	89.9
>30 years	41	10.1	10.1	100.0
Total	405	100.0	100.0	

Most of the volunteers who responded, about a whooping population numbering about 197 people, only have had between one to five years of experience as a chief information officer (CIO) in their present position which may range from junior manager to senior managers, et cetera.

Only a handful of sixty-three persons who participated in the online survey have only had less than a year of experience as related to the job competencies of a chief information officer in any position they may be holding. Then it was calculated that about seventy-four of the total 405 respondents had only served between five to ten years in the capacity of a chief information officer in any capacity or position. The rest seventy-one respondents have had over ten years of experience in their present position with respect to the subject matter.

TABLE VI
EXPERIENCE IN PRESENT POSITION

	Frequency	Percent	Valid Percent	Cumulative Percent
<1 year	63	15.6	15.6	15.6
1-5 years	197	48.6	48.6	64.2
5-10 years	74	18.3	18.3	82.5
>10 years	71	17.5	17.5	100.0
Total	405	100.0	100.0	

The number of respondents within the telecommunication, service and information technology (IT) industries that participated in the online survey was 226 in number representing a whopping 55.8 percent of the total population.

About twenty five participants interviewed are currently working in certain manufacturing industries accounting for 25% of the totality of respondents. Forty-seven of the respondents are working in the healthcare sector of the economy whereas thirty-three of the respondents are domiciled in the finance, banking or the insurance companies, with the rest seventy-four of them practicing in other spheres of discipline accruing a whole 18.3 of the percentage of the whole population.

TABLE VII
EXPERIENCE IN PRESENT POSITION

	Frequency	Percent	Valid Percent	Cumulative Percent
IT/Telecommunication/Service	226	55.8	55.8	55.8
Manufacturing	25	6.2	6.2	62.0
Healthcare	47	11.6	11.6	73.6
Finance/Insurance	33	8.1	8.1	81.7
Other	74	18.3	18.3	100.0
Total	405	100.0	100.0	

According to sixty-nine of the respondents, most organizations within the sector-framework of discuss are prone to or experiences very high challenges during the implementation of IoT and Cloud computing based technologies in their respective organization. Only eleven of the respondents believed that organizations faces no challenge during the implementation of IoT and cloud computing based technologies; only 3 percent (about twelve persons) participant observed that such organizations and companies only faces slight challenges during cloud-IoT implementation.

A high challenge is believed to be faced by organizations. In short, cloud-Iot implementation challenges are seen to be a real thorn in the flesh of several organizations. On another scale, moderate challenges are also being faced by several organizations during the implementation of cloud computing and Iot technologies. Conclusively, cloud-IoT implementation based challenges poses a moderately-high risk and challenge to relating organizations globally.

TABLE VIII
WHAT LEVEL OF CHALLENGES DO ORGANIZATIONS FACE DURING THE IMPLEMENTATION OF IOT AND CLOUD COMPUTING BASED TECHNOLOGIES?

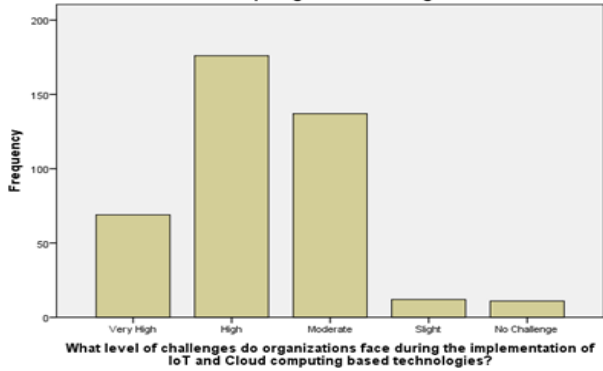|	Frequency	Percent	Valid Percent	Cumulative Percent
Very High	69	17.0	17.0	17.0
High	176	43.5	43.5	60.5
Moderate	137	33.8	33.8	94.3
Slight	12	3.0	3.0	97.3
No Challenge	11	2.7	2.7	100.0
Total	405	100.0	100.0	

In synergy to table 8, it is conclusively said that the challenges being faced by organizations during the integration and implementation of cloud computing and Internet of Things can be considered to be on a moderately high level as generated by our survey with respect to the concerned organizational sectors.

Fig 1. Level of Challenges

From all the prospective candidates that participated in the survey, more than half agreed to the fact that they are definitely in favor that cloud computing and IoT be integrated and implemented in the concerned organizations as it tends to possess more benefits than the proposed risks.

Less than 20 persons who participated in the survey disagreed with the implementation of cloud-IoT based technologies in organizations of nowadays accruing to only 4.7 of the percentage population that partook in the survey. Only 88 participants almost sat-on-the-fence when it comes to implementing cloud-IoT based technologies

TABLE IX
ARE YOU IN FAVOR OF IMPLEMENTING CLOUD AND IOT BASED TECHNOLOGIES IN OUR ORGANIZATION?

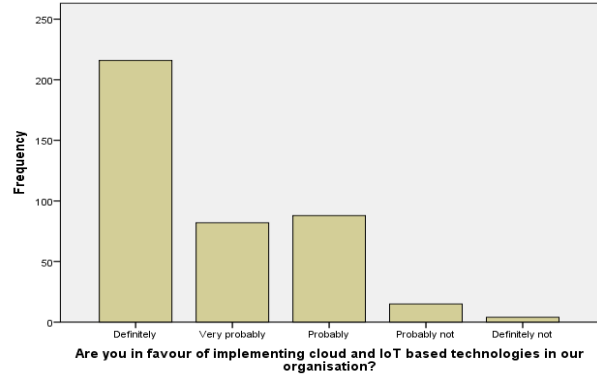|	Frequency	Percent	Valid Percent	Cumulative Percent
Definitely	216	53.3	53.3	53.3
Very probably	82	20.2	20.2	73.6
Probably	88	21.7	21.7	95.3
Probably not	15	3.7	3.7	99.0
Definitely not	4	1.0	1.0	100.0
Total	405	100.0	100.0	

Fig 2. Favour of implementing cloud and IoT

A. Resources and Costs

This graph simply typifies that most IT and business leader would actually love to enjoy the implementation of cloud-IoT based technologies in typical strata of the organizational framework.

TABLE X
LACK OF SKILLED PERSONNEL IS THE BIGGEST HURDLE IN THE PROCESS OF IOT AND CLOUD IMPLEMENTATION

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	106	26.2	26.2	26.2
Agree	198	48.9	48.9	75.1
Neutral	68	16.8	16.8	91.9
Disagree	31	7.7	7.7	99.5
Strongly Disagree	2	.5	.5	100.0
Total	405	100.0	100.0	

In accordance with figures 12 and 13, majority of the population surveyed postulated that they concurred with the notion that the lack of skilled personnel is one of the biggest hurdles in the process of IoT and cloud implementation. As such, 26.2 percent of them strongly agreed with the idea of cloud-IoT implementation while almost 50 percent of them only agreed, but not with a strong conviction.

About sixty-eight of them seated-on-the-fence by being neutral about the whole idea of cloud, IoT, big data, etc.
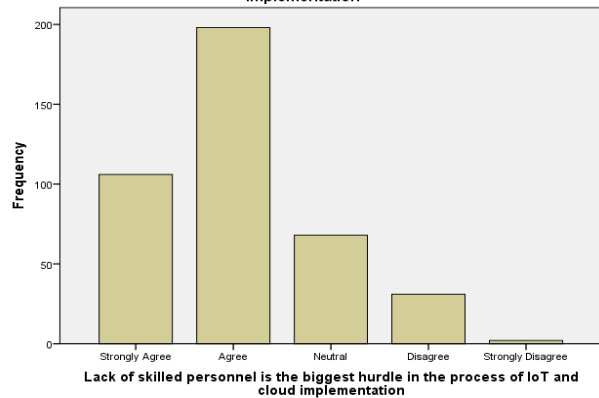

Fig 3. Lack of skilled personnel

Less than ten of the percentage total population studied are totally adherently against any objective aimed at implementing or integrating cloud-IoT based technologies into relevant organizational sectors of the economy.

TABLE XI
LIMITATION OF THE CURRENT INFRASTRUCTURE IS A HURDLE FOR SMOOTH DEPLOYMENT OF CLOUD AND IoT

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	77	19.0	19.0	19.0
Agree	186	45.9	45.9	64.9
Neutral	83	20.5	20.5	85.4
Disagree	56	13.8	13.8	99.3
Strongly Disagree	3	.7	.7	100.0
Total	405	100.0	100.0	

In tables11 and figures 4, a hundred and eighty-six of the total participants expressed their agreement with the fact that the limitation of the current infrastructure availability is a hurdle for a smooth deployment of cloud and Internet of Things. This huge frequency of personnel accounts for approximately forty-six percent of the overall 405 participants. Furthermore, only seventy-seven of the 405 respondents intensified their dissatisfaction by strongly believing that the problem of limitation as caused by current infrastructural availability in cloud-IoT organizations has been a thorn-in-the-flesh of respective organizations.
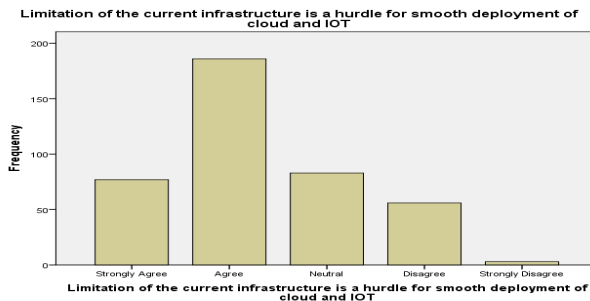
Fig 4. Limitation of current infrastructure

Only a few of the respondents (almost sixty in number) came against the basis of the idea that the current infrastructure available in the cloud computing-IoT based organizations is not in any way a limiting factor to these organizations.

TABLE XII
BUDGET CONSTRAINTS IS ANOTHER HURDLE FOR IoT AND CLOUD IMPLEMENTATION IN MY ORGANIZATIONS

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	77	19.0	19.0	19.0
Agree	184	45.4	45.4	64.4
Neutral	90	22.2	22.2	86.7
Disagree	48	11.9	11.9	98.5
Strongly Disagree	6	1.5	1.5	100.0
Total	405	100.0	100.0	

In accordance with the statistical data results, most of the respondents agreed varying degrees to the fact that budget constraint is another hurdle for IoT and cloud implementation in several organizations. Exactly 45.4 percent of the population target had a strong belief that a major determinant limiting the ability of cloud-IoT based technologies to become fully operational. Whereas, a few of the respondents never agreed that budget constraint is actually a major threat to implementing cloud-IoT technologies in organizational framework.
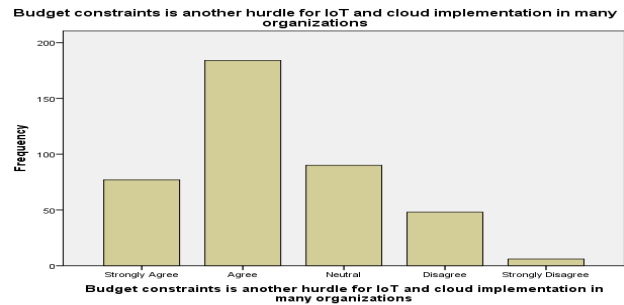

Fig 5. Budget Constraints

TABLE XIII
IoT/CLOUD BASED ORGANIZATIONS SPEND A LOT OF FUNDS ON INNOVATION RESEARCH AND DEVELOPMENT

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	89	22.0	22.0	22.0
Agree	168	41.5	41.5	63.5
Neutral	105	25.9	25.9	89.4
Disagree	37	9.1	9.1	98.5
Strongly Disagree	6	1.5	1.5	100.0
Total	405	100.0	100.0	

In unison to the data collated in table18 and fig. 6 total sum of 257 respondents agreed to the notion that IoT/Cloud based organization spend a lot of funds on innovation research and development. Out of whi Following the result computed in Fig. 24 and 25, most of the respondents agreed to the idea that A Cloud/ IoT based platform should be able to attend to the maximum workload with the available infrastructure. The result shows exactly 135 strongly agreed and 198 respondents casually agreed. Considering the population of the people that responded, very few (as low as 3.2 percent) disagreed with the idea.ch an exact 22.0 percent of them strongly agreed. Meanwhile, a few respondents that makes up 10.6 percent of the total respondents which are 450 in number, disagreed that IoT/Cloud based organization spend a lot of funds on innovation research and development.

Fig 6. IoT/Cloud based organisations

TABLE XIV
THE MAJOR CHALLENGES OF IOT AND CLOUD IMPLEMENTATIONS IS
ACQUIRING THE BEST TECHNOLOGY AT REASONABLE COSTS

The major challenge of IoT and cloud implementation is acquiring the best technology at reasonable costs

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	107	26.4	26.4	26.4
Agree	200	49.4	49.4	75.8
Neutral	65	16.0	16.0	91.9
Disagree	31	7.7	7.7	99.5
Strongly Disagree	2	.5	.5	100.0
Total	405	100.0	100.0	

In phase with the statistical data recorded in Table 14 and Fig 7, a total number of 405 populations responded to the notion which states: The major challenge of IoT/Cloud implementation is acquiring the best technology at reasonable costs. A number of 307 respondents agreed with this notion, and 107 out of these respondents had a strong belief. Meanwhile few of these respondents whose percentage covered 8.2 percent of the total respondents, disagreed.

Fig 7.The major challenge og IoT and Cloud Implementation

B. Performance and Security

In congruence to the data collated in Table 15 and Fig 8, a number of 371 out of 405 respondents agreed with idea that Cloud or IoT platform should be responsive to the user's needs and should give reliable results. Very few respondents, not more than 5 in number disagreed, while a few number of respondents are neutral about it.

TABLE XV
A CLOUD/IOT BASED PLATFORM SHOULD BE RESPONSIVE TO THE USER'S
NEEDS AND SHOULD GIVE RELIABLE RESULTS

A cloud/ IoT based platform should be responsive to the users' needs and should give reliable results

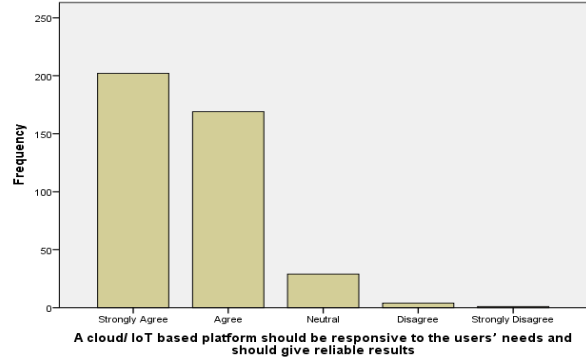|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	202	49.9	49.9	49.9
Agree	169	41.7	41.7	91.6
Neutral	29	7.2	7.2	98.8
Disagree	4	1.0	1.0	99.8
Strongly Disagree	1	.2	.2	100.0
Total	405	100.0	100.0	

Fig 8. A Cloud/IoT based platform

Following the result computed in Table 16 and Fig 9, most of the respondents agreed to the idea that A Cloud/ IoT based platform should be able to attend to the maximum workload with the available infrastructure. The result shows exactly 135 strongly agreed and 198 respondents casually agreed. Considering the population of the people that responded, very few (as low as 3.2 percent) disagreed with the idea.

TABLE XVI
A CLOUD/IOT BASED PLATFORM SHOULD BE ABLE TO ATTEND TO THE
MAXIMUM WORKLOAD WITH THE AVAILABLE INFRASTRUCTURE

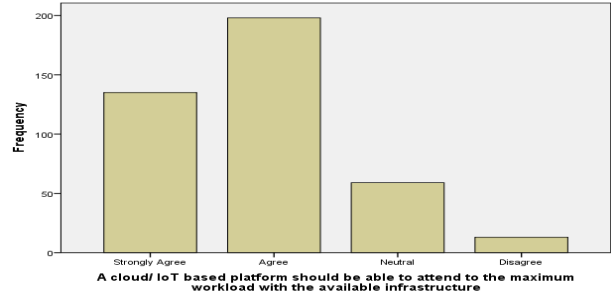|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	135	33.3	33.3	33.3
Agree	198	48.9	48.9	82.2
Neutral	59	14.6	14.6	96.8
Disagree	13	3.2	3.2	100.0
Total	405	100.0	100.0	

Fig 9. Cloud/IoT based platform

TABLE XVII
AN IDEAL CLOUD/IOT PLATFORM SHOULD PERFORM TASKS WITHIN THE
STIPULATED TIME

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	147	36.3	36.3	36.3
Agree	194	47.9	47.9	84.2
Neutral	58	14.3	14.3	98.5
Disagree	5	1.2	1.2	99.8
Strongly Disagree	1	.2	.2	100.0
Total	405	100.0	100.0	

26

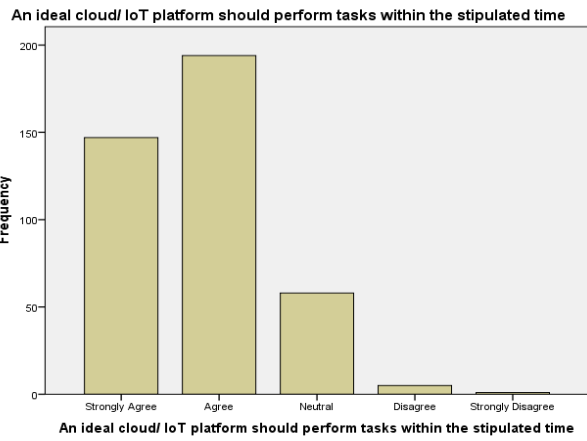An ideal cloud/ IoT platform should perform tasks within the stipulated time

Fig 10. An Ideal Cloud/IoT platform

In accordance to data recorded in Table 17 and Fig 10, very high number of respondents, covering about 81 percent of total respondents agreed to the notion that an ideal cloud/IoT platform should perform tasks within the stipulated time. Meanwhile a negligible number of respondents disagreed.

TABLE XVIII
NETWORK SECURITY IS THE MOST IMPORTANT CHALLENGE FOR IOT AND CLOUD WHICH NEEDS CONSTANT ATTENTION

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	185	45.7	45.7	45.7
Agree	169	41.7	41.7	87.4
Neutral	34	8.4	8.4	95.8
Disagree	17	4.2	4.2	100.0
Total	405	100.0	100.0	

Network security is the most important challenge for IoT and cloud which needs constant attention
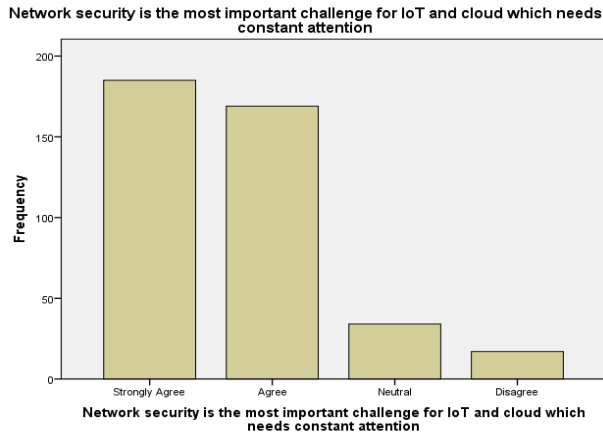
Fig 11. Network Security

Regarding the data recorded in Table 18 and Fig 11, most of the respondents numbering up to 354 agreed that network security is the most important challenge for IoT and cloud which needs constant attention. And about 185 of these 354 respondents did agree strongly, meanwhile few respondents at exactly 17 in number disagreed while a few respondents covering 8.4 percent of the total respondents are neutral towards it.

TABLE XIX
MORE INTERCONNECTED DEVICES MEANS MORE THREATS TO SECURITY

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	148	36.5	36.5	36.5
Agree	158	39.0	39.0	75.6
Neutral	71	17.5	17.5	93.1
Disagree	24	5.9	5.9	99.0
Strongly Disagree	4	1.0	1.0	100.0
Total	405	100.0	100.0	

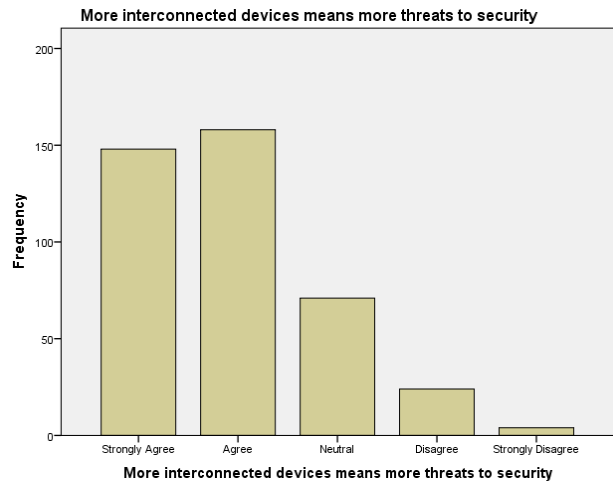More interconnected devices means more threats to security

Fig 12.More Interconnected devices

In conformance to the data computed in Fig. 12, total number of 405 people made known their opinions on the notion: More interconnected devices means more threats to security. Out of these respondents, 148 of them strongly agreed with the notion, 158 did agreed casually while as few as 28 respondents disagreed. Meanwhile, there are still few respondents occupying 17.5 percent of the total respondents who are neutral towards this notion.

TABLE XIX
THE SECURITY THREATS ARE CONSTANTLY EVOLVING WITH TECHNOLOGICAL PROGRESS

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	186	45.9	45.9	45.9
Agree	176	43.5	43.5	89.4
Neutral	33	8.1	8.1	97.5
Disagree	8	2.0	2.0	99.5
Strongly Disagree	2	.5	.5	100.0
Total	405	100.0	100.0	

As regards the data result computed in Fig. 31 and 32, most of the respondents agreed with the fact that the security threats are constantly evolving with technological progress. Among this set of respondents who agreed, 186 out of them strongly did. However, a negligible number relative to the total number of respondents disagreed with this fact.
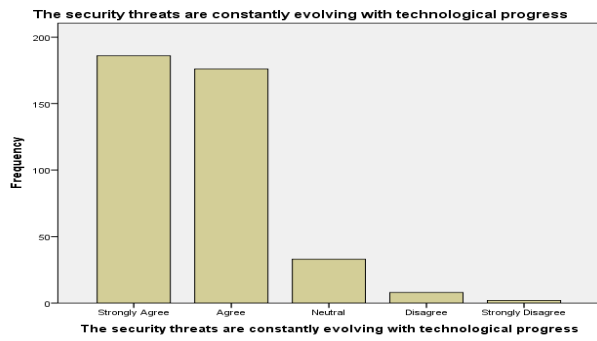
Fig 13. The Security Threats

TABLE XX
IoT AND CLOUD BASED ORGANIZATIONS NEED TO REGULARLY UPDATE AND
IMPROVE THEIR NETWORK SECURITY MECHANISMS

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	213	52.6	52.6	52.6
Agree	157	38.8	38.8	91.4
Neutral	25	6.2	6.2	97.5
Disagree	8	2.0	2.0	99.5
Strongly Disagree	2	.5	.5	100.0
Total	405	100.0	100.0	

Following the result computed in Table 20 and Fig 14, high number of respondents expressed their agreement with idea that IoT/Cloud based organization need to regularly update and improve their network security mechanisms. In a more precise report, 213 respondents strongly agreed while 157 respondents agreed casually. However a very few respondents did disagree that the security of IoT/Cloud based organization constantly need to be updated and improved.
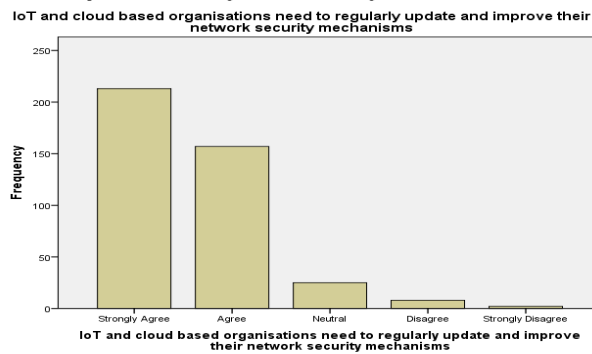
Fig 14. IoT and Cloud based organisations need

C. **Compliance** and **Governance**

TABLE XXI
IoT AND CLOUD BASED ORGANIZATIONS ARE BURDENED WITH EXHAUSTIVE
AND RIGID COMPLIANCE GUIDELINES

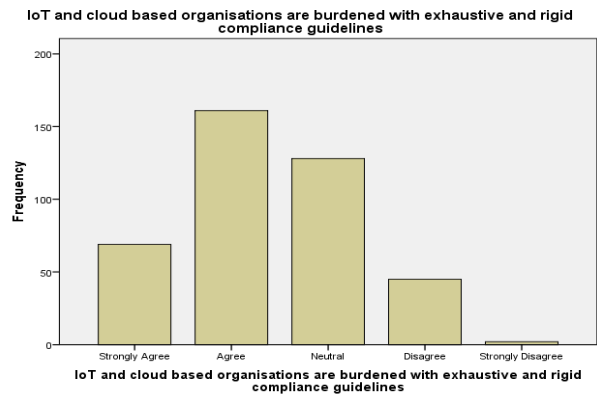|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	69	17.0	17.0	17.0
Agree	161	39.8	39.8	56.8
Neutral	128	31.6	31.6	88.4
Disagree	45	11.1	11.1	99.5
Strongly Disagree	2	.5	.5	100.0
Total	405	100.0	100.0	

Fig 15. IoT and Cloud based organisations

In phase with the data computed in Table 21 and Fig 15, most of the respondents affirmed that IoT and cloud based organization are burdened with exhaustive and rigid compliance guidelines. Among these respondents, about 17 percent of the total respondents strongly agreed. Meanwhile few respondents, summing up to 24 in number still showed their dissensions.

TABLE XXII
SECURITY COMPLIANCE IS NECESSARY TO ENSURE A FOOLPROOF IoT AND
CLOUD COMPUTING PLATFORM

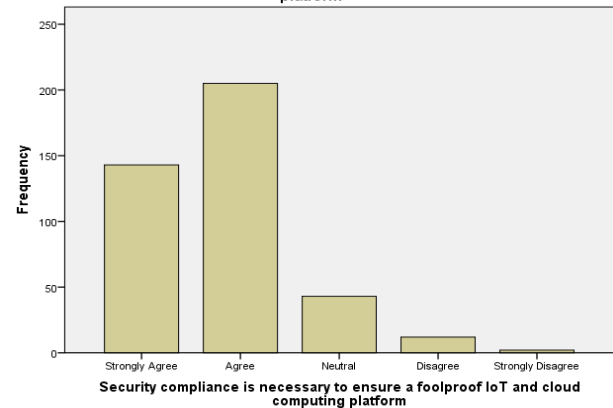|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	143	35.3	35.3	35.3
Agree	205	50.6	50.6	85.9
Neutral	43	10.6	10.6	96.5
Disagree	12	3.0	3.0	99.5
Strongly Disagree	2	.5	.5	100.0
Total	405	100.0	100.0	

Fig 16. Security Compliance

According to the data recorded in Table. 22 and Fig 16, a total number of 405 respondents expressed their opinion on if security compliance is necessary to ensure a foolproof IoT and cloud computing platform. A high number of respondents nodded in affirmation to the notion. In a more precise report, exactly 143 respondents strongly agreed and exactly 205 respondents agreed as a matter of fact. However the data

showed few respondents who are not more than 14 in number disagreed to this, capitalizing security compliance is not necessary to ensure a foolproof IoT and cloud computing platform

TABLE XXIII
COMPLIANCE REQUIREMENTS HAVE INCREASED WITH AN INCREASE IN THE NUMBER OF USERS AND INTERCONNECTED DEVICES

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	122	30.1	30.1	30.1
Agree	195	48.1	48.1	78.3
Neutral	65	16.0	16.0	94.3
Disagree	21	5.2	5.2	99.5
Strongly Disagree	2	.5	.5	100.0
Total	405	100.0	100.0	

In congruence to the data computed in Table 23 and Fig 17, most of those people who had their say in the notion stating that compliance requirement have increased with an increase in the number of users and interconnected, agreed with it. From the result in the figures, exactly 122 respondents strongly agreed to the notion while 195 respondents did agreed as a matter of fact. However a few number of respondents occupying 5.7 percent of total respondents, disagreed.
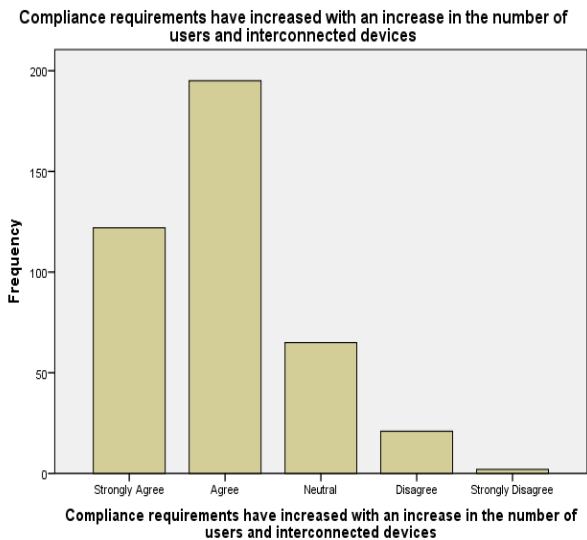
Fig 17. Compliance Requirements

TABLE XXIV
COMPLYING WITH ALL THE SERVICE LEVEL AGREEMENTS (SLA) IS ONE OF THE MAJOR CHALLENGES FOR CLOUD AND IOT BASED ORGANIZATIONS

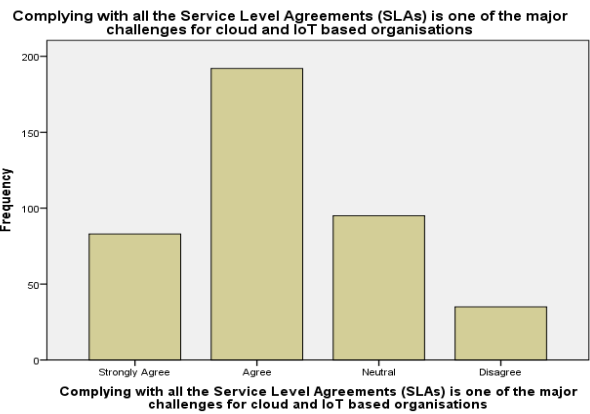|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	83	20.5	20.5	20.5
Agree	192	47.4	47.4	67.9
Neutral	95	23.5	23.5	91.4
Disagree	35	8.6	8.6	100.0
Total	405	100.0	100.0	

Fig 18. Complying

From the result computed in Table. 24 exactly 275 out of 405 respondents concurred that complying with all the Service and Level Agreements (SLAs) is one of the major challenges for cloud and IoT based organizations. And about 20.5 percent of the total respondents did agree strongly to this notion. However 36 respondents making up 8.6 percent of the total respondents disagreed to this fact.

TABLE XXV
IT IS NOT EASY TO ALIGN THE IOT AND CLOUD COMPUTING OBJECTIVE WITH THE OVERALL BUSINESS STRATEGY OF THE COMPANY

It is not easy to align the IoT and cloud computing objectives with the overall business strategy of the company

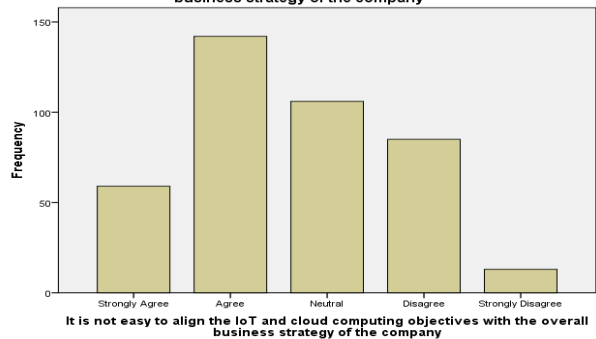|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	59	14.6	14.6	14.6
Agree	142	35.1	35.1	49.6
Neutral	106	26.2	26.2	75.8
Disagree	85	21.0	21.0	96.8
Strongly Disagree	13	3.2	3.2	100.0
Total	405	100.0	100.0	

Fig 19. IoT and Cloud Computing Objectives

In phase with statistical data computed in Table. 42 and Fig 19, a reasonable number of respondents agreed to the fact that; it is not easy to align the IoT and cloud computing objectives with the overall business strategy of the company. Precisely 201 respondents agreed, in which a number of 92 respondents strongly agreed. Meanwhile some respondents showed their dissensions towards the notion.

According to the data recorded in the Table 44 and 45, exactly 270 respondents agreed with the thesis: Cloud and Iot based organization are under pressure to implement innovative data and governance policies. Out of these respondents who agreed an exact number of 78 of them did agree strongly. However total number of 28 respondents disagreed with this thesis among which 2 disagreed strongly. Meanwhile some respondents neither disagreed nor agreed, their population summing up to an exact number of 107.

TABLE XXVI
CLOUD AND IOT BASED ORGANIZATIONS ARE UNDER PRESSURE TO IMPLEMENT INNOVATIVE DATA AND GOVERNANCE POLICIES

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	78	19.3	19.3	19.3
Agree	192	47.4	47.4	66.7
Neutral	107	26.4	26.4	93.1
Disagree	26	6.4	6.4	99.5
Strongly Disagree	2	.5	.5	100.0
Total	405	100.0	100.0	

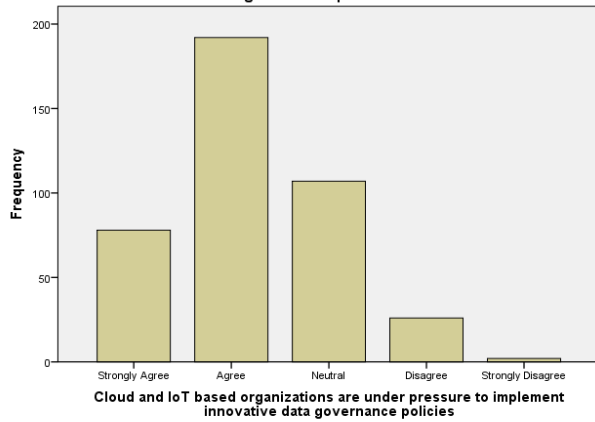Fig 20.Cloud and IoT based Organizations

TABLE XXVII
COMPLYING WITH THE IT GOVERNANCE GUIDELINES IS A MAJOR CHALLENGE FOR AN IOT AND CLOUD BASED ORGANIZATION

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	91	22.5	22.5	22.5
Agree	182	44.9	44.9	67.4
Neutral	96	23.7	23.7	91.1
Disagree	34	8.4	8.4	99.5
Strongly Disagree	2	.5	.5	100.0
Total	405	100.0	100.0	

In conformance with data recorded in Table 27 and Fig 21, a total number of 273 respondents agreed that complying with the IT governance guidelines is a major challenge for an IoT and cloud based organization. Exactly 91 of these respondents strongly agreed to this fact. Meanwhile few respondents of about 32 in number disagreed to the IT governance guidelines is a major challenge for an IoT and cloud based organization
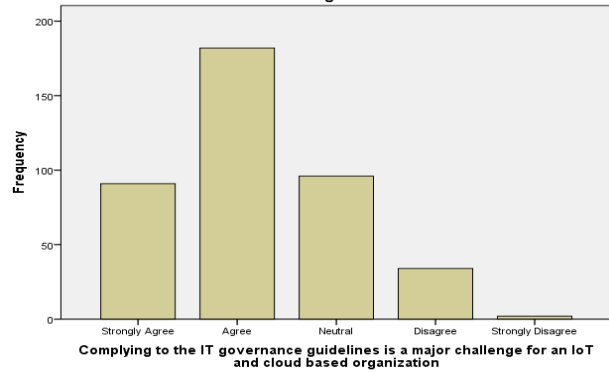

Fig 21. Complying to the IT Governance

TABLE XXVIII
A STRONG GOVERNANCE AND COMPLIANCE FRAMEWORK IS IMPORTANT FOR SUCCESSFUL IMPLEMENTATION OF IOT AND CLOUD

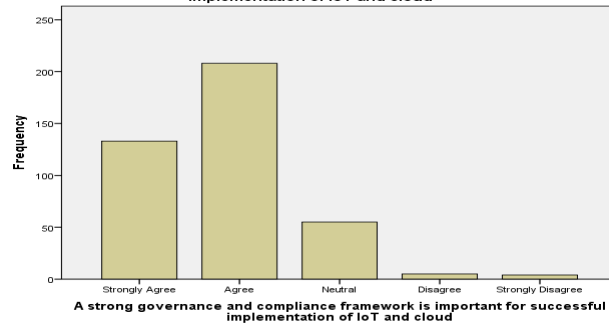|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	133	32.8	32.8	32.8
Agree	208	51.4	51.4	84.2
Neutral	55	13.6	13.6	97.8
Disagree	5	1.2	1.2	99.0
Strongly Disagree	4	1.0	1.0	100.0
Total	405	100.0	100.0	

Fig 22. A Strong Governance and compliance framework

In congruence to the data result computed in Table. 28 and Fig 22, most of the respondents, exactly 341 in number agreed that a strong governance and compliance framework is important for successful implementation of IoT and cloud. Whereas very few of the respondents disagreed to this fact.

TABLE XXIX
IT GOVERNANCE PLAYS A MAJOR ROLE IN PROMOTING DATA SECURITY AND DEVELOPING CONFIDENCE IN IOT AND CLOUD BASED USERS

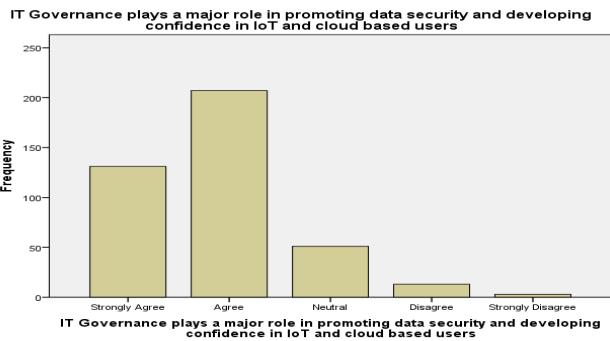|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	131	32.3	32.3	32.3
Agree	207	51.1	51.1	83.5
Neutral	51	12.6	12.6	96.0
Disagree	13	3.2	3.2	99.3
Strongly Disagree	3	.7	.7	100.0
Total	405	100.0	100.0	

Fig 23. IT Governance plays

In accordance to the data computed in Table.29 and Fig 23, a total number of 338 out of 405 respondents agreed with the notion: IT governance plays a major role in promoting data security and developing confidence in IoT and cloud based users. Among thedse respondents who agreed with this notion, a number of 133 of them strongly did. Meanwhile a negligible number relative to the total respondents disagreed with this notion. And about 12.6 percent of the total respondents are neutral toward the notion.

D. **Portability and Interoperability**

From the data recorded in Table 52 and Fig 24, exactly 274 out of 405 respondents agreed that considerable amount of cost and time is required for the transfer of components or resources from one cloud environment to another without losing data. And 88 respondents among these respondents strongly agreed, giving the percentage of 67.6 percent of those who agreed and 21.7 of those who agreed strongly. However a total number of 46 respondents did not agree and a negligible number of 2 relative to the total number of respondents, strongly disagreed.

TABLE XXX
CONSIDERABLE AMOUNT OF COST AND TIME IS REQUIRED FOR THE TRANSFER OF COMPONENTS OR RESOURCES FROM ONE CLOUD ENVIRONMENT TO ANOTHER WITHOUT LOSING DATA

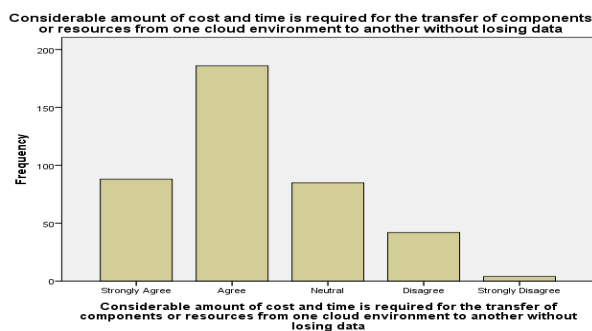|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	88	21.7	21.7	21.7
Agree	186	45.9	45.9	67.7
Neutral	85	21.0	21.0	88.6
Disagree	42	10.4	10.4	99.0
Strongly Disagree	4	1.0	1.0	100.0
Total	405	100.0	100.0	

Fig 24. Considerable amount of cost and time

TABLE XXXI
SHIFTING TO A NEW CLOUD ENVIRONMENT TAKES A LOT OF PLANNING, TIME AND RESOURCES

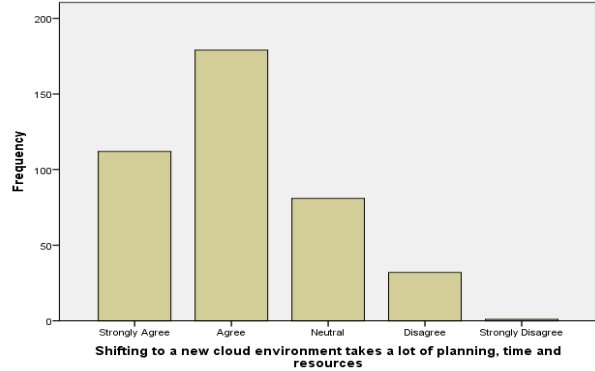|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	112	27.7	27.7	27.7
Agree	179	44.2	44.2	71.9
Neutral	81	20.0	20.0	91.9
Disagree	32	7.9	7.9	99.8
Strongly Disagree	1	.2	.2	100.0
Total	405	100.0	100.0	

Fig 25. Shifting to anew cloud environment

Following the data computed in Table 31 and Fig 25, exactly 291 respondents agreed that shifting to a new cloud environment takes a lot of planning, time and resources. 122 respondents strongly agreed to this supposition. However about 33 respondents disagreed which 1 out of them strongly did. The remaining respondents are neutral towards it.

TABLE XXXII
CLOUD PORTABILITY IS NECESSARY TO ENSURE CONSISTENT ACCESS TO VALUABLE DATA

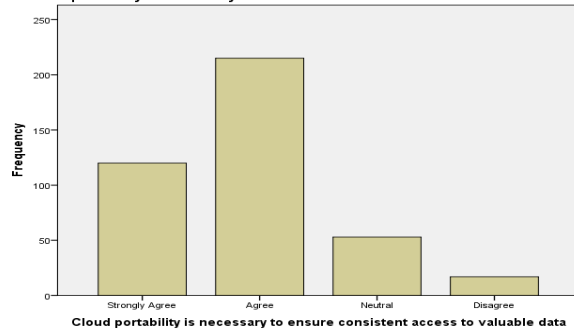|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	120	29.6	29.6	29.6
Agree	215	53.1	53.1	82.7
Neutral	53	13.1	13.1	95.8
Disagree	17	4.2	4.2	100.0
Total	405	100.0	100.0	

Fig 26. Cloud Portability

In conformance to the data computed in Table 32 and Fig 26, a large number of respondents, about 335 in number agreed with fact that cloud portability is necessary to ensure consistent access to valuable data. And exactly 120 respondents strongly showed their agreement. However, few respondents, about 17 of them expressed their dissensions.

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	58	14.3	14.3	14.3
Agree	136	33.6	33.6	47.9
Neutral	124	30.6	30.6	78.5
Disagree	72	17.8	17.8	96.3
Strongly Disagree	15	3.7	3.7	100.0
Total	405	100.0	100.0	

In congruence to data result in Table 33 and Fig 27, total number of 194 respondents agreed with the notion stating, it is difficult to retain same cloud/IoT functionality after shifting to a new cloud environment. 56 of these respondents strongly agreed. However a few number of respondents covering exactly 21.5 percent of the total respondents still disagreed with this notion.
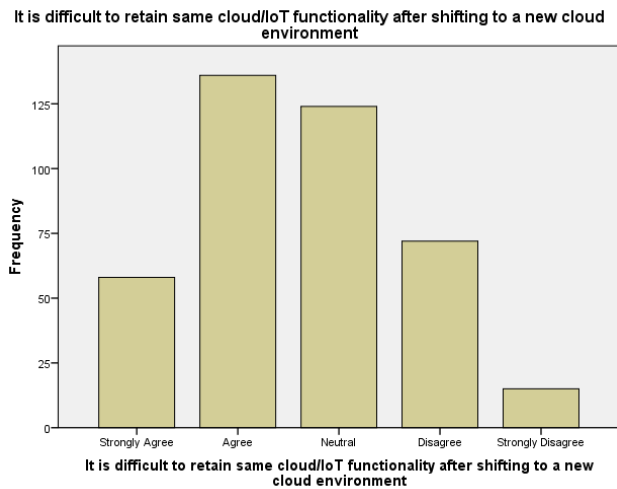

Fig 27. Retain same Cloud/IoT functionallity

TABLE XXXVI
INTEROPERABILITY MAKES IT DIFFICULT TO MONITOR AND CONTROL ALL THE SYSTEMS COLLABORATING INSIDE AND OUTSIDE CLOUD

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	58	14.3	14.3	14.3
Agree	158	39.0	39.0	53.3
Neutral	121	29.9	29.9	83.2
Disagree	61	15.1	15.1	98.3
Strongly Disagree	7	1.7	1.7	100.0
Total	405	100.0	100.0	

In accordance to the data result in Fig 60 and 61, total number of 216 respondents agreed with the supposition that Interoperability makes it difficult to monitor and control all the systems collaborating inside and outside cloud. About 58 of these respondents strongly agreed with this fact. However, some respondents up to 68 in number did not agree and about 7 of the respondents strongly expressed their dissensions toward this supposition.
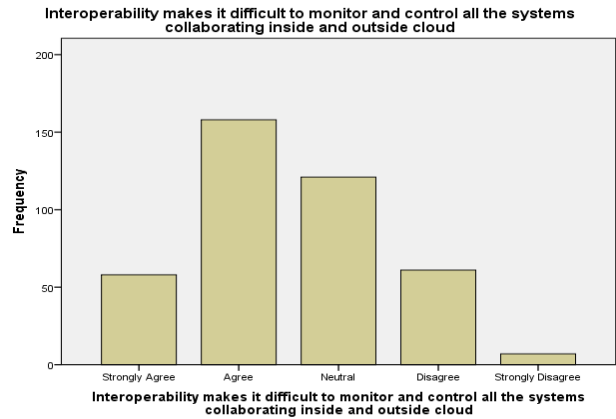

Fig 28. Interoperabillty

TABLE XXXVII
CLOUD/IoT INTEROPERABILITY EXPOSES THE NETWORK TO SECURITY AND PRIVACY THREATS

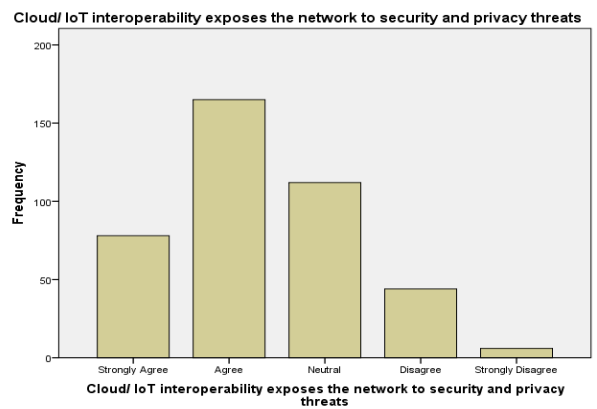|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	78	19.3	19.3	19.3
Agree	165	40.7	40.7	60.0
Neutral	112	27.7	27.7	87.7
Disagree	44	10.9	10.9	98.5
Strongly Disagree	6	1.5	1.5	100.0
Total	405	100.0	100.0	

Fig 29. Cloud/IoT Interoperability

According to the result showed in Table 37 and Fig 29, total number of 243 respondents concurred that Cloud/IoT interoperability exposes the network to security and privacy threats. And a number 78 of these respondents did agree strongly with this. However few respondents, summing 50 in number disagreed with this thesis and 6 out of these respondents strongly expressed their dissensions

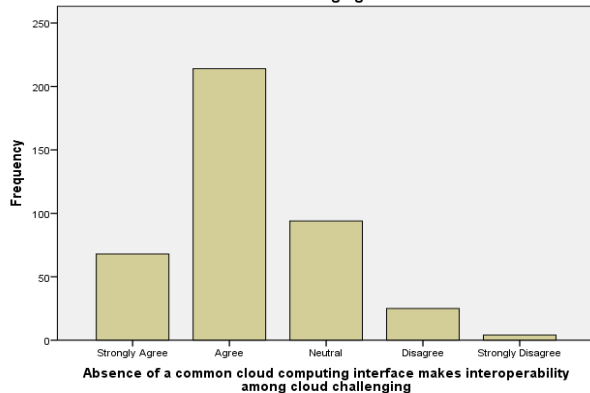|	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Agree	68	16.8	16.8	16.8
Agree	214	52.8	52.8	69.6
Neutral	94	23.2	23.2	92.8
Disagree	25	6.2	6.2	99.0
Strongly Disagree	4	1.0	1.0	100.0
Total	405	100.0	100.0	

Fig 30.Absence of a common

According to the data recorded in Table 38 and Fig 30, most of the respondents agreed with the fact that absence of a common cloud computing interface makes interoperability among cloud challenging. 16.8 percent of the total respondents strongly agreed with this. Meanwhile few respondents covering 6.2 percent of the total respondents expressed their disagreement towards this fact.

CONCLUSION AND RECOMMENDATIONS

In particular, CIO as a senior level overseer requires key, business and authoritative abilities. A CIO should have extraordinary capabilities as a rule cognizance of IT, however the key is the ability to lead and supervise IT authorities' purposely right route for the organization. Those abilities change from the capacities required for IT authorities, in this way making such job way extremely troublesome. This investigation has judicious congruity for enrollment and progression of CIOs. This investigation also analysed the various challenges faced by CIOs in cloud and IoT based orgaizations.Business understanding and essential organization aptitudes should be joined into headway programs for potential CIO's. This investigation was done by analyzing slants of experts who are or were working in IT and business areas in cloud and IoT based organizations.

The study states that the CIOs face high challenges during the implementation of cloud and IoT. The responses states that most of the IT& business leaders are in favor of implementing cloud and IoT in their organizations. This proves that there is huge scope of business for cloud and IoT service providers too. The analysis of challenges based in resources and cost factors states that lack of skilled professionals is this area is a major challenged faced by many organizations. This also states that most of the companies has not given enough amount of training to their employees on the emerging technologies. This gives us a confirmation that cloud and IoT training providers has huge sales opportunities in various industries. As per the responses the limitation of the existing infrastructure is a major challenge for many organizations to move smoothly into cloud and IoT. They are hesitant to migrate based on their fear of the business impact which even has a positive relationship on their lack of knowledge.

The survey results also states that companies has budget constraints affecting them from moving to cloud and IoT based technologies. The study also states that many companies are spending good amount of money for innovation and research. This can even affect the role of a CIO to a chief technology research officer or to chief innovation officer. The study also states that organizations are facing a great challenge in implementing the best technology at reasonable costs. This has great relationship with CIOs budget planning and the cost optimization solution provided by cloud service providers. A zero error rate budget and cost solution from the cloud service providers can greatly overcome the fear of cost faced by organizations and it can lead to implementation of cloud and IoT services. A wise investment strategy or proper strategic methodologies would help these organizations to come out of their various fear factors like skill set, infrastructure limitations, training, budget issues etc.

The performance and security analysis of this study shows that the most of the It business & leaders that the cloud and IoT platform should be responsive to the business needs and should be able to give reliable results. The study also states that the expectation of the cloud and IoT platform is that they handle maximum workload with the available infrastructure so there is huge business demand for scalability in cloud and IoT platforms. The cloud service providers should come up with innovative solutions to extend the scalability based on the business demands. The expectation of an ideal cloud/IoT platform is that they perform the tasks within the stipulated period of time so this proves that efficiency and performance has great demand in the business. Most of the IT and business leaders consider network security as a major challenge for cloud and IoT platforms. The study also states that the number of devices on the infrastructure increases there is a likelihood of more security issues. The study also states that security threats and constantly evolving with technological progress and the cloud based organizations needs to regularly update and improve their security mechanisms. These results proves that the cloud service providers should come up with innovative solutions to reduce security issues and also prove that minimal security violations are occurring on their infrastructure.

The Analysis of compliance and governance and challenges states that Cloud/IoT organizations are burdened with exhaustive rigid compliance guidelines. This could be a reason why some of the BFSI sectors are still in a dilemma whether to adopt cloud and IoT technologies. Majority of the respondents states that security compliance has high importance to ensure a foolproof IoT and cloud platform.The demand for compliance requirement has increased with an increase in the number of users and interconnected devices.

This again points back to the analysis made earlier about the relationship of security with the device count. The adherence to SLA is considered to be a major challenges by majority of cloud and IoT organizations.A proper service planning portfolio from the cloud service providers can eliminate these sort of challenges faced by the organizations adopting the cloud. There is also challenges in aligning cloud and IoT objectives with the overall business strategy of the company. This is a factor where deep research is required as almost 50% is in an agreement for this where as 50% do not agree to this. The cloud and IoT based organizations are under pressure to implement data governance policies and complying with IT governance guidelines has become a difficult factor for many cloud and IoT organizations. A strong governance and compliance framework is considered as an important factor for successful adoption of IoT and cloud. Governance has a great role in promoting data security and developing confidence in cloud and IoT services.

The study on portability and interoperability as a challenge states that the difficulty to transfer components from one cloud environment to another without losing data is a major challenge and a fear factor for many organizations. The IT and business leaders believe that shifting to a new environment takes lot of planning, time and resources. This can indeed affect the business to an extent. The cloud portability is necessary to ensure consistent access to valuable data. This becomes a concerning factor when moving from one cloud provider to another cloud provider. The study also states that there is a challenge of retaining same functionality when changing the cloud environments. The interoperability issues becomes a pain point to monitor and control all the systems collaborating inside and outside the cloud. The cloud/ IoT interoperability exposes the network to security and privacy threats and the absence of a common cloud computing interface makes interoperability a challenging factor. Adopting a globally accepted migration standard and implementation of a standard interface by all the cloud providers would help in fixing this most of these challenges related with portability and interoperability.

The evidences in the outcomes section shows that the global CIO role has moved a long way from the standard development organization part and moved towards a more key role. To be productive, the CIO needs a fair cognizance of the business as a key pioneer, and needs outstanding skills at all levels in the organization and be competent to manage all the challenging factors while adopting cloud or IoT or post after the implementation of cloud and IoT. The CIO needs to have the ability to cooperate with others and handle these challenging factors to the betterment of the organization

Splendid CIOs and senior IT authorities have begun to get a handle these challenges to ensure key course of action for their IT and business goals. Through a blend of planning, continuing with preparing, instructing programs and simply inserting themselves into more business trades among their non-specialized official allies, the CIOs has to venture forward.

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