

***A study on the effect of Quality of Service (QoS) on  
enterprise cloud storage service adoption***

**Student: Awais Sikandar**

**University Number:**

**Supervisor: Dr. Rudolph Brown**

**Director of Studies: Dr. Elias Pimenidis**

**University: Cardiff Metropolitan University**

## **Abstract**

*Evaluating and understanding the factors affecting enterprise cloud computing services in terms of Quality of Service (QoS) was the main aim of this research. In the research, the cloud services, such as Google Drive, OneDrive and Dropbox, were given exclusive scrutiny. The conceptual framework depicted the QoS perception of users in enterprise cloud storage service influences customer satisfaction through the functional and non-functional parameter of personal cloud storage service. Secondary and primary data were included for meeting the research aim and objectives. Interview and survey were the used primary data collection strategies. Detailed and critical literature reviews on cloud computing, QoS in Cloud Computing and Service Quality and Cloud Service Quality have been elaborated. The purpose of this research is to contribute new knowledge of personal cloud computing. There is a need to incorporate QoS characteristics in the evaluation of cloud storage services for personal users. This study will be a contribution to that—the research aided to understand the current trends in cloud services. For example, the newest trend in the IT world is cloud computing. On-demand obtainability of computer systems resources regardless of locations, is the key feature of cloud computing. Microsoft's Windows Azure platform, Google Drive, Amazon's web services are part of this trend. Primary data or results also highlight this trend. The quality and reliability of services were regarded to be the most critical attributes of quality of service and those of privacy concerning the cloud services, that could be understood from literature and findings. Another aim of the study was evaluating cloud services (CS) based on critical attributes of QoS and user requirements such as privacy and security. QoS manages the data traffic for reducing the packet loss or jitter in the network and for accessing the security and privacy many attributes like privacy, data integrity and confidentiality are needed to be considered. An important recommendation provided at the end of the study was that service providers could extend measures by which the evolving needs of customers could be addressed such, as the need for an increased storage option.*

## Contents

Abstract	2
List of Tables and Figures	6
Chapter One: Introduction	7
1.1 Background	7
1.3 Research Aim, Questions and Objectives	11
1.4 Research Contribution	12
Chapter Two: Literature Review	144
2.1 Introduction	14
Section I: Cloud Computing	14
Section II: QoS in Cloud Computing	40
2.13 Service Quality and Cloud Service Quality	644
Chapter Three: Conceptual Framework	69
3.1 Introduction	69
3.2 Research Framework	69
Chapter Four: Research Methodology of the Study	76
4.1 Introduction	76
4.2 Ontological and epistemology consideration	78
4.3 Research Approach	83
4.4 Research design	855
4.5 Research strategy	889
4.6 Research Method	91
4.7 Data Collection	922
4.7.1 Primary Data Collection	933
4.7.2 Research Instruments	944
4.8 Sampling and Data Collection	955
4.9 Presentation and analysis of the research data	98

4.10 Ensuring reliability, replication, and validity of the findings	1000
4.11 Ethical and accessibility issues	1033
4.12 Research limitations	1044
4.13 Conclusion	1044
Chapter Five: Findings and Discussion – Expert Interviews	10706
5.1 Introduction	10707
5.2 Respondent Profile	107
5.3 Thematic analysis	1100
Chapter 6- Findings Part 2: Customer survey	1211
6.1 Introduction	1211
6.2 Construct Measurement Scale	1211
6.3 Study sample profile	1222
6.3.1 Qualitative code used	122
6.3.2 Company profile	1222
6.4 Descriptive statistics	12727
6.5 Cronbach’s Alpha test	1355
6.6 Normality Assessment	1355
6.7 Structural equation modelling	13737
6.7.1 Model fit	13838
6.8 Hypothesis testing	13939
6.9 Summary	1411
Chapter 7: Discussion and evaluation	Error! Bookmark not defined.3
7.1 Introduction	Error! Bookmark not defined.3
7.2 Discussion and evaluation	Error! Bookmark not defined.3
7.3 Conclusion for discussion and evaluation	Error! Bookmark not defined.4
Chapter 8- Conclusions and Recommendations	1455
8.1 Introduction	1455

8.2 Conclusions	1455
8.3 Recommendations	148
8.4 Future Scope	149
8.5 Limitation of the research	14950
References	1511
Appendices	1811
Appendix I: Survey	1811
Appendix II - Transcript	196

## **List of Tables and Figures**

<i>Figure 2.1: Technology acceptance model</i>	21
<i>Figure 2.2: Extended TDM model</i>	22
<i>Figure 2.3: Figure of cloud computing</i>	23
<i>Figure 2.4:SERVQUAL</i>	68
<i>Figure 2.5: GDT Theory</i>	71
<i>Figure 3.1.: Conceptual framework</i>	77
<i>Figure 4.1: Research Onion</i>	90
<i>Bar Chart 5.1: Years of existence</i>	127
<i>Bar Chart 5.2: Size of the company</i>	128
<i>Bar Chart 5.3: Number of employees in the company</i>	129
<i>Bar Chart 5.4: The main industry sector on business operates</i>	130
<i>Bar Chart 5.5: Use of cloud</i>	131

## **Chapter One: Introduction**

### **1.1 Background**

Researchers argue that there is an increase in the number of users and businesses who are migrating towards the use of cloud computing (Zheng et al., 2013). According to Armburst et al. (2010), over the years, there has been a significant scaling of cloud computing services with the adoption of cloud computing ranging from large MNCs to SME organizations and, finally, for consumer storage. The aim of cloud computing is to deliver a network of virtual services wherein users can access these services from multiple locations at competitive costs depending on the QoS service requirements (Sabi et al., 2016). Since cloud computing offers significant benefits to small businesses, communities and individuals, it results in a service setting where the consumer has access to a wide range of services. However, customers of the cloud require a wide range of steady and trustworthy services to ensure that the customers' expectations are met (Almorsi et al., 2016).

SMEs and MNCs have the opportunity to reduce the IT cost by incorporating cloud computing technology. As part of this, the managing and operation cost concerning IT services can be reduced. Likewise, collaboration can be improved in the workplace after integrating cloud computing technology. Employees can enjoy flexibility in the allotted tasks, and this is a notable advantage of cloud computing (Armburst et al., 2010). However, the cloud computing technology highly relies on network, and any network failure will affect the entire operation of the organizations. Likewise, technical failure can be projected at any time, and that will negatively influence the use of cloud computing in the business (Almorsi et al., 2016).

Drago et al. (2013) state that individuals tend to use personal cloud storage (PCS) spaces to share and store private information. The quality of service that is being provided by various PCS vendors has been the subject of scrutiny many times, including factors like the quantity of storage, ease of storing and retrieving information, privacy issues (Riva et al., 2011), and ease of sharing information (Srinivasan et al., 2011). Not a lot of studies have focused on the service quality or the knowledge of overall QoS, despite the adoption of PCS, due to the limited use of comparative features of these services (Gracia-Tinedo et al., 2013). According to

Zheng et al. (2013), QoS examination must involve an independent ranking of the services provided by PCS. Finally, it is also vital that the user experience is controlled along with their interaction with the network (Casas et al., 2013).

According to Drago et al. (2013), the advantages of PCS are in five areas, such as usability, cost-saving, bandwidth, disaster recovery and accessibility. However, the accessibility advantage is a most notable one. Concerning this, information can be accessed from anywhere without any location constraints. At the same time, it may not be possible for the people to access the data in the cloud if the internet connection is poor. As a result, the cloud services of enterprises may be adversely affected.

According to Hobfeld et al. (2012), QoS refers to those parameters which determine the quality of the network which is used to transfer the transmitted data. Rifai et al. (2011) argue that QoS, describes the performance of the system or the network based on the requirements of the customer. Therefore, quality of service can be considered as an umbrella which aims at presenting a comprehensive assessment of the network quality parameters and customer service acceptance parameters, and is currently a key factor guiding the management of quality in cloud computing.

This chapter is mainly provided with the background of the research, and as part of this, the key variables and its positive and negative sides are described. Moreover, the rationale of conducting the present research is discussed besides the aim, objectives and questions of the study. Finally, the contribution of the present study is provided in the final session of the chapter.

## **1.2 Research Rationale**

Cloud computing plays an essential role in small and medium enterprises in building proper and cost-effective benefits. AlBar and Hoque (2019) mentioned that this technology brings a great improvement in the availability of data, services etc. Moreover, it helps in scalability, efficiency, speed up decision making, expansion of markets and enhance communication with the customers. As a result, the proper development of the SME's will have a major role in the economic development of the country. Ali and Osmanaj (2020) specified that all the SME's need to adopt cloud computing technology as the need for ICT is essential for the survival and the



development of the company. As the use of cloud computing can reduce capital expenditures, this technology is considered as the most cost-saving procedure. Alismailli et al. (2020) revealed that the use of cloud computing in SME's improved the reviews on the internet, price considerations and maintain the use of services from certain cloud service providers.

Dincă et al. (2016) defined that there are many benefits for adopting cloud computing in SME's as it executed the cost-saving purpose using the rental services. AlBar and Hoque (2020) cited that the cost of capital expenditures was easily reduced with the help of cloud computing. This service is commonly known as an on-demand service as it executes the needs of the users. Moreover, it helps to run the company smoothly without investing huge funds. It ensures the shift tasks which the SME's want to be handled by the cloud computing providers. Another benefit of cloud computing is it minimize the purchase of new software licenses. Asadi et al. (2020) pinpointed that the license purchases for the new software can be reduced by the usage of cloud computing as the company users may not have their own infrastructures. As this SME's are hiring cloud computing in a most comfortable cost, they can use the software easily. Assante et al. (2016) referred that the facilities like integrated, dynamic and sophisticated computer systems are essential factors to be needed in the companies. By advantage of this, the applications, files and emails can be easily accessed using the internet connection and can avoid the software and hardware requirements. This SME's also benefit from the trial services of cloud computing as one of them is done with the help of the initial promotion. Domun and Bheemul (2018) defined that by using this facility, the SME's don't want to pay in advance to use this service. The main advantage of this service is the choice of test capabilities to the SME's as it allows using this service in the trial stage.

Alismailli et al. (2020) mentioned that the increase in the quality of the product could be ensured from the usage of this cloud computing service. As a result of this, the competitiveness of the company will also increase gradually. Sandu et al. (2017) claimed that the competitiveness of the company could be enhanced by improving the speed and cost-efficiency of the company. Ali and Osmanaj (2020) reported that the pressure to increase the competition provides a significant change in the growth, management and services to customers etc. Asadi et al. (2020) declared that cloud

service acts like a tool to improve the flexibility to the SME's as it provides the accessibility to anywhere. Khayer et al. (2019) found that SME owners can use corporate data from other devices, including personal devices. As an interesting fact about the cloud service is employee mobility. Karunagaran et al. (2019) mentioned that most of the companies use the hardware system, but the advent of cloud service avoided the role of the hardware system. In addition to that, the effective advantage of cloud computing is that it reduces the risk of data unavailability. Hassan (2017) revealed that an attractive advantage of cloud computing is it provides a number of services to SME's and ensures high-level security.

As per the view of Domun and Bheemul (2018) identified that there are some challenges of using this cloud computing by SME's. As per the rule of management that the cloud computing facility is under the control of management as this results in the lack of SME enterprise control over the server. Dincă et al. (2016) reported that due to the maintenance period, the companies want to face a lot of server service problems. If the server service is not working properly, it affects the working condition of the company. Assante et al. (2016) cited that for avoiding this problem, the companies want to use the multiple services for the whole day as it is very costly and difficult to use. Alismaili et al. (2020) pinpointed that the major issue in case of the SME's they mainly complain about is the lock-in system. The problems arise in the interoperability between different providers, and it isn't very easy to move from one provider to another provider. Askary and Kumar (2020) explained that the use of cloud service in most of the SME's is with the help of human resources who have excellent ICT knowledge. The use of the PaaS and IaaS is very difficult, and if any error occurs in the service, it will be a big potential loss to the company. Internet is an essential factor for every company as it was useful in the case of the cloud service, but it is still constraint in the case of the developing countries like Indonesia.

Askary and Kumar (2020) mentioned that the implementation of the wrong server might result in the security problem from that the company can affect the cyber-attacks. Due to this cyber-attack, the cloud also produces a hazard to the consumers or corporate web users. Ali and Osmanaj (2020) declared that the usage of the internet is not secure as it makes troubles with fingerprints and loud security attacks, transactions and file transfers. Asadi et al. (2020) cited that the government is also

expected to provide services which support the internet connections as the government want to allow the private sector to connect the SME's with the cloud computing technology. The issue of the difference in working from the user of prior technology to services is the major challenge of the migration issue. Askary and Kumar (2020) revealed the labour issue raised from the operational automation is also a major problem as it is very important from the technical point of view. AlBar and Hoque (2019) mentioned that the major challenge is to move data in very large as most of the company's fear that this may affect the company's operations.

The above paragraphs discussed the views of using cloud computing technologies in several small and medium enterprises. In addition to that, it mainly discussed the benefits and challenges of cloud computing in the SME's.

QoS is an important parameter in determining the adoption of cloud storage services by enterprises (Connor et al., 2011). The initial research into the drivers motivating enterprise cloud storage adoption identified cost-reduction as the most important factor affecting cloud storage adoption among enterprises (Gupta et al., 2013). On the other hand, recent study by Hsu and Lin (2016) revealed that privacy and security factors along with convenience and ease of use influenced enterprise cloud storage adoption. However, there is a research gap in this area as existing studies on cloud storage adoption by enterprises did not adopt a QoS perspective in reviewing cloud storage services. In this context, the current research intends to address the above research gap by arriving at a common framework to identify the determinants of QoS in enterprise cloud storage adoption by examining the experience of enterprise users of Google Drive, OneDrive and Dropbox.

### 1.3 Research Aim, Questions and Objectives

#### 1.3.1 Research Aim

The aim of this research is to evaluate and understand the factors affecting enterprise cloud computing services in terms of Quality of Service (QoS), with reference to the most popular cloud services Google Drive, OneDrive and Dropbox.

#### 1.3.2 Research Question

1. What are the determinants, which impact the consumer use for enterprise cloud computing services?
2. What are the different attributes related to the QoS that effect privacy of enterprise cloud services (PCS)?
3. What are the popular cloud services and the related privacy attributes?

### 1.3.3 Research Objectives

To accumulate basic details related to the determinants that influence the use of enterprise cloud computing services

To conduct a systematic literature review to propose and validate a framework that addresses the challenges that enterprise cloud services face in terms of QoS

To use the literature outcome to develop a framework allowing for the evaluation of enterprise cloud services (PCS) based on the key attributes of QoS and user requirements.

To identify and detail the proper research methods for evaluating the research questions and state the relevant justifications

To discuss and analyze the findings of the expert interview to comprehend the major parameters that assure the loyal bond between the service provider and the client

To survey users of the most popular cloud services (Dropbox, OneDrive and Google Drive) to verify the QoS and Privacy attributes identified from the literature.

To reflect a fuller discussion and evaluation of the findings of the study to draw the main conclusions of the study

### 1.4 Research Contribution

The current research acknowledges that there is a significant increase in available frameworks on privacy and QoS for cloud computing services. However, the purpose of this research is to contribute new knowledge of the personal cloud computing service use by consumers by understanding the changing landscape of market demand. As noted by Singh and Chana (2016), cloud computing has become one of the most beneficiary approaches for the use, management and upgradation.

With an internet connection, an extensive volume of applications is available and this accumulation depends on Service Level Agreements (SLAs). SLAs specify the service requirements and this is regarded under Quality of Service (QoS). Furthermore, SLA's take service pricing, obligations and penalties into consideration (Almorsi et al., 2016).

As contended by Stergiou and Psannis (2017), one of the key challenges associated with the cloud computing services is the management of QoS. This is more challenging due to the market-oriented nature of the cloud structure, where regulation of space would be dependent on supply and demand.

Given such a possibility, from the cited research above and other information emerging at present it's clear that there is a need to incorporate QoS characteristics in the evaluation of cloud storage services for personal users. The proposed research aims at addressing this knowledge gap by proposing a new framework for assessing cloud storage services. This would incorporate key QoS determinants, as perceived by users of some of the major service providers, into existing frameworks. The current research will act as a reference to understand the individual consumer preference for cloud computing and the importance they ascribe to QoS and privacy.

### 1.5 Key actors involved in the research

According to Bell et al. (2019), key actors in a research or study are the people who directly involved in the major activities performed as part of the research. The study on the impact of Quality of Service (QoS) on enterprise cloud storage service adoption is closely related to the human viewpoints, and hence, amassing clear and updated data from human participants along with secondary can augment the reliability and rationality of the study (Žukauskas et al., 2018). Hence, the research employs both qualitative (interview) and quantitative (survey) approaches to amass the information. The representatives of cloud service providers, i.e. Google, Dropbox and One Drive, are contacted for an interview, while the general public utilizing cloud services, who are the customers of various cloud service providers in the UK, are contacted for a survey. The pilot testing of the interview questionnaire would be performed with the support of peers. Moreover, friends and colleagues provided support and essential resources to undertake the study efficiently.

## **Chapter Two: Literature Review**

### **2.1 Introduction**

The aim of this chapter is to present the review of background literature on the research. This chapter is presented in two sections.

*Section 1* presents the basics of cloud computing, models and dimensions as well as the current research status on personal cloud storage.

*Section 2* identifies the importance of QoS in cloud computing, the key metrics of QoS and the role of security.

### **Section I: Cloud Computing**

#### **2.1.1 Definition and Characteristics**

Extant literature has presented multiple definitions of cloud computing (Table 1). Hashem et al. (2015) contend that over the years, significant efforts have been undertaken to standardize the definition and components of the cloud. Wang et al. (2010) indicate that the standard definition provided by NIST (National Institute of Standards and Technology) is accepted as the most effective one as it addresses the components, models and the requirements from cloud computing. According to Mell and Grance (2011), cloud computing is defined as a model which helps in providing ubiquitous and convenient access to a shared pool of computing resources including networks, servers and storage spaces which can be provided immediately by the management. Such models of cloud services have five primary characteristics, three models of service and four models of deployment. According to Sabi et al. (2016), the cloud is a platform or an infrastructure whose purpose is to promote the execution of service applications in a reliable manner, meeting pre-existing quality parameters while ensuring that there is elasticity in meeting the needs of the user. Elasticity implicitly identifies the upward and downward scalability of resources and data by balancing the user requirements in a clear manner.

Mell and Grance (2011) identify that there are five primary characteristics of cloud computing services which indicates unique prospects. The characteristic includes:

- a. On-demand services: On-demand services present an assistive platform for the users in requesting one or more services based on the user requirement and further to pay for the same by adopting a 'pay as you go' approach (Sen, 2015). Armburst et al. (2010) contend that the provision of computing resources to an individual or an organization based on demand and thereby eliminating the need of cloud computing users to plan ahead for provision is a key success characteristic which has increased the use of cloud computing facilities.
- b. Broad Network Access: According to Hamdaga and Tahvidari (2012) and Yakimenko et al. (2009) the availability of resources and services located in different vendor areas of the cloud which can be made available from a wide range of locations is a key characteristic enhancing adoption of cloud computing. Julia et al. (2014) further argue that such a provision is made possible through standard mechanisms which have global reach capability.
- c. Pooling of Resources: According to Yang et al. (2017) cloud computing provides a collection of resources which aim at simulating and providing the behaviour a single blended resource. As Armburst et al. (2010) contend, in cloud computing, the user does not require the knowledge and location of provided services. This helps vendors provide multiple real and virtual resources on the cloud.
- d. Elasticity: According to Julia et al. (2014), the elasticity of cloud computing presents the ability to the user to scale up or scale down resources and services based on requirements.
- e. Measurement of Services: Multiple aspects of the cloud are continuously monitored and optimized at different levels to ensure that the required quality of service is made available to the consumers while the resources are used in a manner that provides good storage space for the vendor (Shaikh and Sasikumar, 2015).

Apart from these five characteristics, some other major characteristics are highlighted in literature and these are presented in the following table.

Characteristic	Conceptualisation	Evidence
<b>Higher fault tolerance</b>	One of the main characteristics of cloud computing is that the dependence between different transactions is kept very minimal. This means that the failure of one transaction does not lead to a chain reaction of errors. Usually, faults occur in four areas and these include provider-user, provider-inner, provider-across and user-across and these faults could be managed. There are fault management systems at software, operating and hardware levels and at the zenith, regulations exist. This implies that the fault tolerance of cloud computing is relatively higher.	Moghaddam et al. (2015); Ren et al. (2017).
<b>Business model</b>	The economic characteristic of cloud computing is that it could be regarded as a pay per use business model pre-dominantly. To an extent, considering the free available services, it could also be regarded as a utility service.	Zhang et al. (2010); Armbrust et al. (2010); Ren et al. (2017).
<b>Multi Tenacity</b>	This feature implies that different consumer constituencies should be addressed by the execution of isolation, segmentation,	Awadallah (2016); Rittinghouse and Ransome (2016).



	chargeback/billing models and service levels and governance.	
<b>Loose coupling</b>	Cloud computing relies on a client-server model and the platform serves as an abstract layer which helps in isolating different applications. This loose coupling is one of the fundamental characteristics of the cloud computing.	Mell and Grance (2011); Armburst et al. (2010); Ren et al. (2017).
<b>Ease of Use</b>	Offers internet-based interfaces. The other facets that emphasize this characteristic of cloud computing is the credibility, desirability, accessibility and usability.	Hashem et al. (2015); Chaisiri et al. (2012)
<b>Service SLA</b>	The presence of a service level agreement in cloud computing provides the expectation of the consumer from the provider.	Sabi et al. (2016); Yan et al. (2016).

*Table 1: Characteristics of Cloud Computing*

### **2.1.2 Service and Deployment Models**

According to Mell and Grance (2011) the service models included in the cloud computing are distinctively three categories.

Ellinger and Shin (2013) argue that cloud computing is the mechanism that provides multiple functionalists to the user within provider defines restrictions through an interface. The SaaS (Software as a service) system develops an effective platform

for the customers in developing the vendor's infrastructure as a service through an active interface developed through computer programming.

Ren et al. (2017) posit that a platform service is one where the computer has hardware equipment, operating systems and application development tools which can be used to deploy and execute commands based on the needs of the user. Platform as a service (PaaS) is a service model where the vendor provides access to platform elements, thereby enabling the consumer to develop applications or use the software for their specific needs.

Infrastructure, on the other hand, identifies the physical components required by a system to promote specific functionalities (Jula et al., 2014) and can contain processors, network equipment and storage needs. Infrastructure as a service (IaaS) is a service model where the consumer has the applications and software and requires the infrastructure to operate the same. The IaaS platform provides the infrastructure that the customer needs.

- a. Public Clouds: According to Jula et al. (2014), public clouds are the primary model of cloud computing, where the cloud owner presents services on a public platform based on policies, pricing models and pre-defined rules.
- b. Private Clouds: Private clouds are established to provide virtual services to a specific organization or an institute. Such services are targeted at setting up a system where there is a need to have clear corporate firewalls to reduce concerns about security (Mell and Grance, 2011).
- c. Community Cloud: Organizations form communities to share cloud computing services to be used by community members' consumers. The service is provided by members of the community or by a third-party service provider. The primary advantage of such a cloud is the reduction in cost by division of expenses and the improvement in security services (Dillon et al., 2010).
- d. Hybrid Clouds: Hybrid clouds are those where there is combining of two or more public, private or community clouds and where there is creation of different models of cloud service. Hybrid clouds serve specific functions where standardization and functionality determination are required to enhance communication (Schumbert et al., 2010).

## **2.2 Personal Cloud Storage Platforms**

As per Drago et al. (2012), the complexities in storage issues related to computing are the major reason for developing an alternative research for information storage that eventually led to the discovery of cloud computing. Along with the storage space issues, the development of cloud computing as further contributed in providing users a less economic alternative for data storage. Furthermore, Srinivasan et al. (2011) argue that the personal cloud model identifies a ubiquitous storage platform which enables the unification of access to information by individuals from any device and application without the inherent drawbacks of location. As Drago et al. (2013) argue, this increase in cloud computing services resulted in a significant increase in the launch of personal cloud storage capabilities by players including Microsoft, Google and Amazon in 2012 to existing services like Dropbox and SugarSync. Dropbox was the first personal cloud space introduced in 2007 and has over 50 million users who upload more than 500 million files on a daily basis. However, most research on the growth of personal cloud and its impact on cloud computing has been carried out in the market. For instance, Pyramid (2014) reports that personal cloud business is growing, with the global number of personal storage accounts reaching 1.25 billion by 2013 and with an annual growth of 60% since 2011. The report also identifies the need to examine the consumer expectations and service provision currently available through personal cloud storage platforms. Gartner (2012a) further contends that the personal cloud should be considered as a transformational force which is aimed at reflecting the user expectations in terms of content, application and services made accessible across multiple devices. Forrester's (2011) report forecasts that in the US alone, the market for personal cloud storage is expected to increase to \$12 billion from paid subscriptions.

According to Gracia-Tinedo et al. (2013), the popularity of personal cloud storage services is linked to the ease of use of the SaaS mode of services as well as the ubiquitous IaaS cloud storage resources. However, as Ion et al. (2011) and Drago et al. (2012) posit, such an introduction of cloud based services has resulted in a significant focus on different parameters of the personal cloud, including system architecture and design and a focus on security and privacy issues. Drago et al. (2012) further argue that currently the knowledge of personal cloud storage is

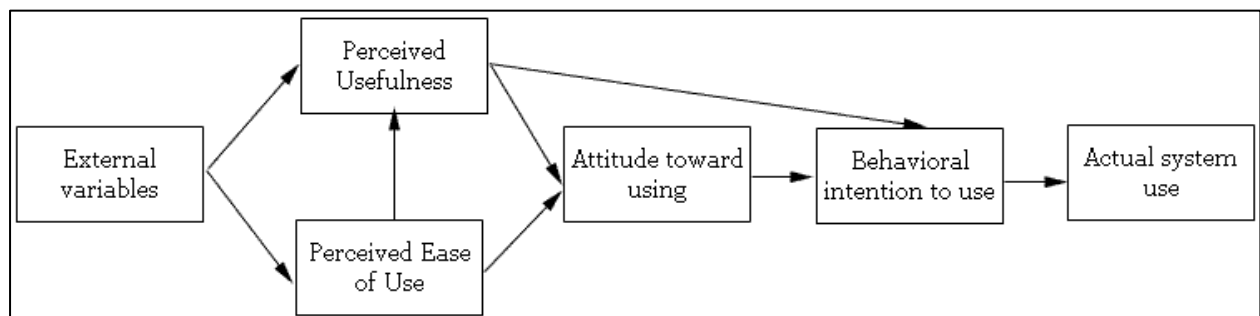
limited, as most of the services offered are through commercial services which are unwilling to share information due to the proprietary nature of solutions. Drago et al. (2012), in their examination of the design and architectural choice of personal cloud space Dropbox, identify that these parameters are found to have great impact on service performance and network usage. However, the authors use passive measurements and do not provide clear information about the implementation of services and designs of other providers. Hu et al. (2010) compare the performance of Dropbox, Mozy, CrashPlan and Carbonite; however, they do not use the example of a comprehensive list of performance measures. Li et al. (2013), on the other hand, compare the cloud provider performance to benchmark the same, but only focus on server infrastructure.

Drago et al. (2013) benchmark the personal cloud performance of Dropbox, Microsoft OneDrive, Google Drive, LaCieWuala and Amazon Cloud Drive. The results of the study indicate that there is no clear winner, with all services suffering from some limitations. The results indicate that Dropbox had a sophisticated boost performance and had clear capabilities check. On the other extreme, Cloud Drive showed bandwidth wastage and had some lack in client capabilities. OneDrive had performance limitations and Wuala had client side encryption impacting synchronization of performance. From the above assessment, it is evident that the focus of personal cloud storage computing has been on examining benchmarks of performance and the impact of the shift in resource provision. However, as Buyya et al. (2010) contend, the management of quality of service (QoS) at the consumer storage level is vital, as it not only depends on performance benchmarking and management, but also on meeting the needs of the consumers and the consumer behaviour and perception. The following section will therefore examine the principles of QoS.

### **2.3 TAM Model and cloud storage adoption**

As per the view of Yaokumah and Amponsah (2019) revealed that the technology acceptance model (TAM) is a theory which describes how the users accept and use technology. In the current situation, it is effective to use the technology for several purposes. Abdullah and Ward (2016) specified that the behavioural intention is the major factor which influences people to use the technology. Wu and Chen (2019)

identified that there are a number of factors which influence the decision of users about the usage of the technology they have perceived usefulness (PU) and the perceived ease-of-use (PEOU). It was noted by Alassafi (2019) that in the case of the perceived usefulness, the users mainly believe that the use of a particular system would improve their job performance. On the other hand, in the case of perceived ease-of-use, the users mainly thought that the usage of the particular system would reduce their effort. The following figure demonstrates the TAM model:

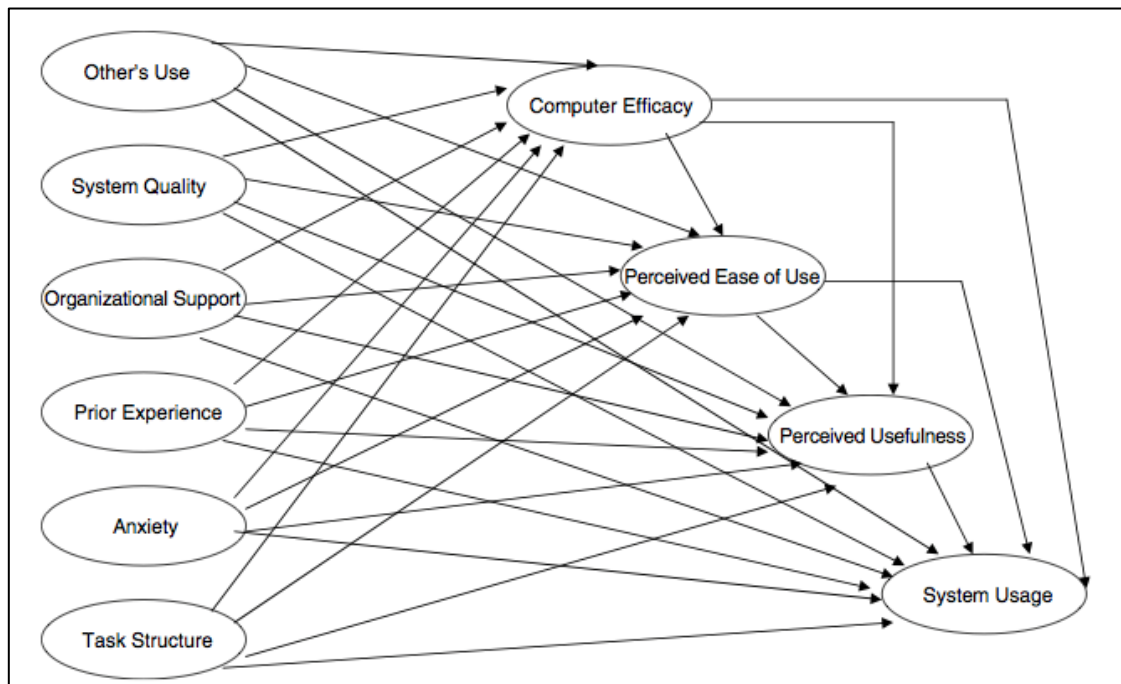


*Figure 2.1: Technology Acceptance Model*

*Source: Ooi et al. (2016)*

Wu and Chen (2019) defined that the use of information system by a user could be determined by the behavioral intention as this can be identified by the person's behavior towards the use of the system. It was noted by Ooi et al. (2016) that the behavior is not only the factor for the behavioral intention, but it also depends on the impact of the performance of the users. Al-Emran (2018) described that the technology acceptance model has a direct link between the perceived usefulness and the perceived ease-of-use. Tarhini et al. (2017) found that the usage of both systems is the same one will find more useful, and the other will be easier to use as described in the above paragraph. Abdullah and Ward (2016) cited that in the case of the perceived ease-of-use, which measures the attitude of an individual on the basis of two factors, they are self-efficacy and instrumentality. Self-efficacy is a concept that describes the user's sense of efficacy. Almarazroi et al. (2019) mentioned that this self-efficacy is an effective tool which is easy to use and will make the user feel that he has control over what he is doing. Chen et al. (2017) declared that the efficacy could be considered as the main factors of intrinsic motivation as it has the direct bond between the perceived ease-f-use and the

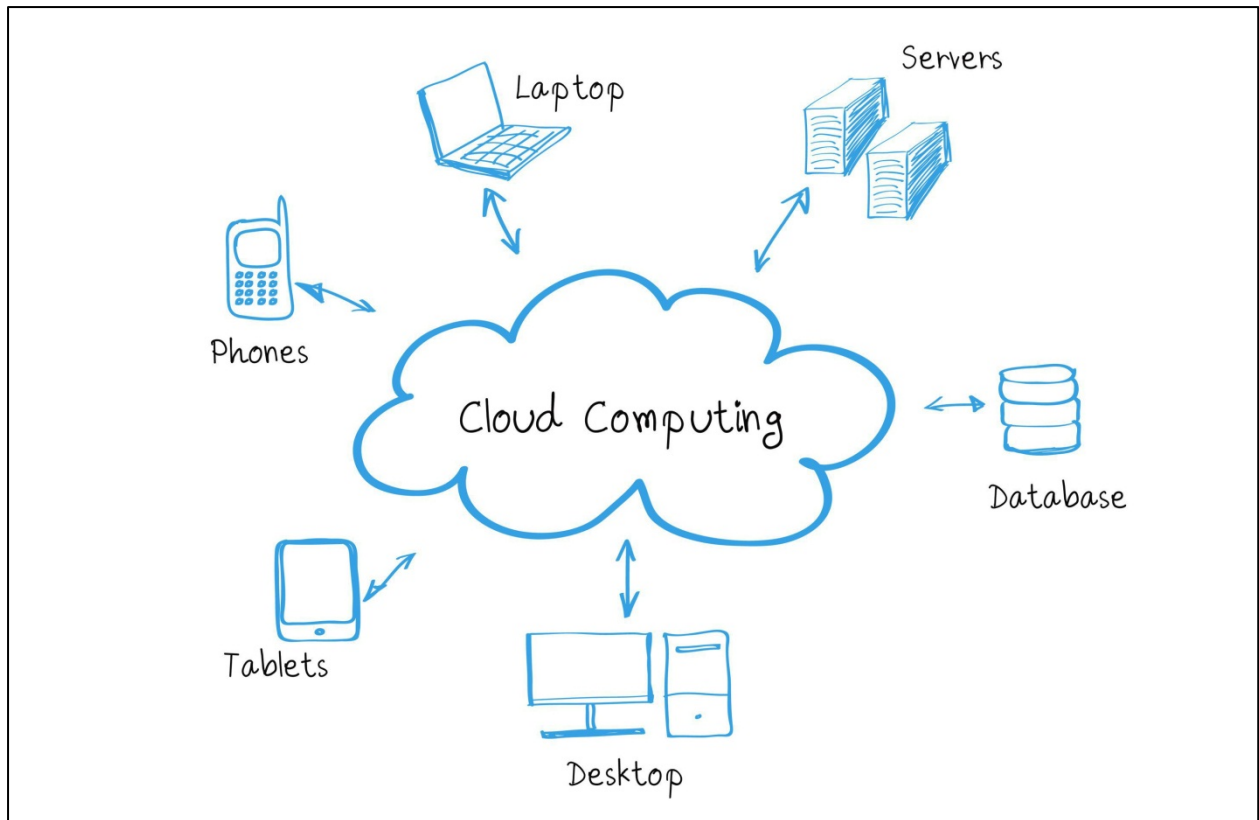
attitude. As this would help the users with fewer efforts as a tool and thus they can do the other tasks.



*Figure 2.2: Extended TAM (Technology Acceptance model)*

*Source: Tarhini et al. (2017)*

In the case of the above figure, it mainly describes six contextual variables such as the prior experience, other's use, computer anxiety, system quality, task structure and organizational support. Abdullah and Ward (2016) pinpointed that this model also explains the relations between the external variables and system usage. From the view of Al-Emran (2018) mentioned that the system usage is directly affected by task structure, prior experience, other's use, organizational support, anxiety and system quality. Thus, the initial TAM model and its extension did not completely reveal the observed variance in system usage. Alassafi (2019) claimed that the two models agree that computer efficacy affects perceived ease-of-use, and thus it will be related to the perceived usefulness.



*Figure 2.3: Figure of cloud computing*

*Source: Scherer et al. (2019)*

From the observation of Almarazroi et al. (2019) mentioned that the cloud computing is the collection of the computer system resources mainly the data storage and the computing power without the direct connection with the user. Butt et al. (2019) pinpointed that from a central server, the functions may be distributed over multiple locations. Chen et al. (2017) revealed that there are two types of cloud computing they are enterprise cloud and the public cloud. In the case of enterprise cloud, the cloud may be limited to a single organization, and on the other hand, in case of a public cloud, this may be available to many organizations. Alassafi (2019) explained that the combination of public and hybrid clouds provides companies to minimize the cost of IT infrastructure. Ooi et al. (2017) claimed that this cloud computing helps the enterprises to get their application up and to run smoothly.

Al-Emran (2018) mentioned that there is much importance of TAM in adopting the cloud computing model in advanced technology. Abdullah and Ward (2016) found a definition for the bond between the TAM and the adoption of it. Almarazroi et al.

(2019) mention that in the case of the TAM model, the perceived usefulness and the perceived ease-of-use are the most critical factors in the adoption process and the system use. Moreover, it can be referred to as the particular case of TRA as it describes the beliefs and evaluation, which may lead to the attitude, intention of use and at last the real behaviour. Chen et al. (2017) noted that the TAM model could be considered as the widely accepted model for enhancing ICT adoption and the usage processes and most organizations are adopting the technology. Butt et al. (2019) asserted that there are many factors which influence the IT professionals are the image, job relevance and the perceived usefulness. Alassafi (2019) reported that the ease of use, convenience is the biggest favourable factor in case of security and privacy. Al-Emran (2018) asserted that in the case of the public sector, organization adoption is conducting by collecting data through interviews. Moreover, the availability, reliability, security and access affect the perception of usefulness while the availability and access affect the perception of ease of use.

Butt et al. (2019) found that some measures such as the subjective norms, voluntariness, job relevance, output quality, result demonstrability in perceived usefulness and the cognitive influence processes in perceived ease of case. Almarazroi et al. (2019) mentioned that the different systems such as two voluntaries, pre-implementation, one- month post-implementation and three-month post-implementation are used for the collection of the self-reported knowledge and the user perceptions of knowledge workers. Abdullah and Ward (2016) found that there are two main groups in case of perceived ease of use they are anchors and adjustments. As in the case of the anchors include computer self-efficacy, perception of external control, computer anxiety and computer playfulness while in case of adjustments includes perceived enjoyment and objective usability. Ooi et al. (2016) declared that anchors are related to the general beliefs of the system and the system usage while on the other hand, the adjustments are the beliefs which come from the direct experience with the system. Alassafi (2019) noted that this proposal could be tested in three different organizations, as three measurements were taken over the three-month period. Chen et al. (2017) explained that the usage of structural equation modelling technique could be used to analyze the data. In all models, it satisfied the concept of reliability and discriminant validity.



However, it was finalized from the further findings that the TAM model is very useful for the users, and the establishment of the modified TAM is essential. The importance of TAM in the adoption of cloud computing invented many factors is very useful for the entire users in our world.

According to Holden and Karsh (2010), the technology acceptance model deals with the prediction of how a particular technology can be accepted in an organization. Technology acceptance model is also defined as the acceptance of a tool to make necessary changes to the existing system in an organization which is made acceptable to the users. The model is based on the view that the acceptability of a technology depends on two factors which are perceived usefulness and perceived ease of use. The current section provides information about how TAM can be effectively used for the adoption of cloud computing services within the organization. In the opinion of Marangunić and Granić (2015), TAM helps to predict the acceptance of cloud services in the organization. The acceptance of cloud services in organizations is discussed in terms of two factors which are the following.

According to Turner et al. (2010), perceived usefulness is defined as the extent to which a person believes that the use of a particular system will improve his or her performance. The perspective of a person about technology is different from the other. It is necessary to understand whether cloud computing enables to complete the tasks quickly in an organization. TAM also helps to understand if the employee performance can be enhanced through cloud services in organizations. Cloud services can be adopted the cloud computing serves the purpose of increasing productivity. Thus the usefulness of cloud computing services is measured through the use of technology acceptance model. As per the model, the perspective of the stakeholders of an organization is understood regarding the acceptance and use of cloud computing (Erasmus et al., 2015).

According to Abbasi et al. (2015), perceived ease of use refers to the degree to which a person thinks that using a particular technology will help to reduce the effort. The easiness of using new technology is measured in this stage. An employee evaluates the use of a new system in terms of its use in the organization. In the usage of cloud services in an organization, the employees determine whether cloud services make their job easier and convenient. Therefore, the technology acceptance model has

great significance in assessing the usage of perceived ease of use. When implementing the cloud services in an organization, it is necessary to evaluate how the service help in reducing the workload and improve the performance (Alharbi, 2012). The users of cloud services provide information about the easiness of the technology. Cloud computing can be implemented in an organization only if it is found useful for the users. Thus the application of technology acceptance model is significant in the use of cloud computing in organizations.

As per the observation of Pinheiro et al. (2014), external factors such as social influence also affect the adoption of cloud services. The social influence indicates that it creates positive among the people to accept cloud services in organizations. Therefore, the technology acceptance model plays a key role in the adoption of cloud services in the organization. The technology acceptance model helps to understand how the cloud services make the company operations easier, and they can be used efficiently for enhancing the performance better.

#### **2.4 Effect of utility factors on cloud storage adoption**

The business of all size and geography are using cloud storage nowadays. Cloud storage has aided the companies with the potential technological advantage to stay competitive in this ever-evolving world. From the observation of Yang et al. (2017), along with the technological edge, cloud storage gives to all type of company; cloud storage also gives significant utility advantage as well. Most of the business will have data, and most of them will be stored in local storage devices or hard disks. Business data is considered as one of the crucial factors which help a business grow substantially. Moreover, more the data the company has about the business, more will be its competitive advantage it has on its competitors. Therefore, business management continuously tries to collect more data from different sources through different methods. According to Ab Rahman et al. (2017), business management collects this data and uses these data to analyze various business processes such as market analysis, customer behaviour and such core functional areas. Until the advent of cloud storage, these crucial pieces of information were stored in secondary storage devices. As the company grew over time, the data needed also increased; this, in turn, increased number of storage device required for store all these data. More amount of space, money, cost of handling and risk were the additional

drawback the secondary storage device bought along. Using the cloud storage device will remove the secondary storage devices and their problems. The convenience of using cloud storage has given the cloud storage the most considerable advantage over the secondary storage devices comments Xiao et al., (2017).

Ease of using the data is another advantage of using cloud storage services. Unlike the traditional secondary device or the servers, using cloud anyone with an internet connection and accessibility permission can access data from any part of the world. Li et al. (2019) mentioned that companies which have more than one branches would have severe issues with data accessibility. At times, data were moved from one place to another using a secondary storage device. Accessing data from servers also had certain drawbacks such as network crash, poor data quality and failed storage. While cloud storage has very minimized drawbacks when compared to other means of storage services.

Technology is evolving every day, more amount of technologies which ease out business process are introduced to the world frequently. From the findings of Kumar et al. (2012), upgrades are one of the ways software companies provide the most advanced technologies and services to their clients. Moreover, staying up to date with the software, storage and technology is very beneficial for the growth of the company. Using secondary storage devices or local servers will not give the privilege of obtaining these updates from software providers. Cloud storage has the solution for all these problems, utilizing the capacity of cloud storage, a business or an individual can download the latest update when it is available comments Lan et al. (2017). Moreover, the management can also increase its storage capacity online. There are no additional procedures for expanding storage.

Another significant advantage of using cloud storage is the processing speed and the to and fro data communication. Business websites are becoming one of the critical parts of a business. Most business websites are nowadays dynamic in nature; this dynamic property of the website will attract customers and improve customer interaction. Using a regular server or a local server will not give the complete effectiveness of the dynamic property of the websites. However, cloud storage has immense storage capacity and does not have problems with so many clients running

on a single server says Zhang et al., (2018). Every client will feel like they are using a single dedicated route directly from the server, where in fact, there are multiple dedicated routes in a single sever. Cloud storage has fast data processing and transmission speed and all the right qualities to handle modern websites and data storage.

Cost of assets and resources are the primary area was a business lose money. As modern technologies are evolving along with market competition, companies are forced to upgrade their technologies to stay competitive in the market. The advent of cloud computing and storage services were a blessing for all companies who were struggling with cost problems, and struggles of traditional storage and server facilities were removed. According to Liu et al., (2017), using the cloud storage, the cost for purchasing storage disks and servers are instantly reduced, and the need to install and upgrade over-priced software are removed as well.

## **2.5 Security and privacy concerns underpinning enterprise cloud storage adoption**

Cloud storage and cloud computing are the most modern technological trends which reduced business costs and improved business process. According to Zhe et al. (2017), even the small-scale business using the advantage of cloud computing has emerged as prominent players in a saturated market environment where multi-national companies compete. The potential and usefulness of cloud storage in the business environment are very vast. It has helped companies to reduce IT investments and other technological costs. As even small business started using the cloud services, cloud service providing business all started sprouting up in the market rapidly.

With everything good comes something bad, so was the case with the cloud storage and the bad thing that came along with the cloud services was severe. Dorri et al. (2017) illustrated that data are very precious assets for a company of modern times. A company uses its data for enhancing its growth and acquire essential competitive advantage in the market. Individual companies not only store their own data but also stores information about ordinary people, which they collect according to the guidelines specified by the government. These data are later used by the company

to understand market and customer behaviour. Therefore, a company needs to protect its and the customer's data. As the companies moved towards using cloud storage, they entrust other cloud handling business to handle their data, and the company may sometimes lose their control over sensitive data. This can cause a severe problem for the business of companies, comments Mollah et al., (2017). However, to tackle this problem. Cloud computing companies developed security frameworks and techniques to ensure the protection of data from unauthorized accesses. As the data storage and the need to protect data in many different levels lead to the development of different methods to ensure data security and privacy. including the following properties in the cloud storage will help in increasing the data security and privacy.

Data integrity means protection of data from unauthorized modification, deletion and fabrication. DBMS and ACID were two tools that are used to ensure data integrity. ACID is a method which is used to enable safe transaction of data. Wang et al. (2017), mentioned that technologies such as RAID and digital signature could be used to ensure authorized access to data and thereby increasing data integrity. There are also techniques to identify whether the data are replicated and to prohibit such actions.

Data confidentiality ensures that data is kept confidential, and no third-party can access important data. There are different methods used to ensure data confidentiality and some of them are: homomorphic encryption, encrypted search and database, distributive storage, hybrid technique and data concealment says Subramanian and Jeyaraj, (2018).

Data availability is another valuable property that should be included to ensure data protection. It is the property by which the data stored in the cloud can be recovered and restored after incidents that may cause damage to data. Including techniques to ensure data availability will increase the credibility of the cloud storage service.

Cloud computing and storage services have great potential for growth and ability to improve business processes of a company. Artificial intelligence and internet-of-things are some of the modern technologies that use the benefits of cloud storage and related services. According to Gou et al. (2017), the application of cloud storage

is numerous, and the way it changed the business process and people's life is phenomenal. Data protection and privacy is the only significant barrier faced by cloud storage and computing. Hopefully, things are getting clear in this area too. Many techniques and methods are implemented by top cloud services providing companies such as Google, Amazon and Microsoft to ensure high-end data protection and privacy. However, people's concern about using cloud service is not gone completely. There is still work that needs to be done to gain customer loyalty. With these levels of improvements in technology and business management, cloud computing and storage can easily tackle this challenge in the near future, perhaps most of such data security issues are solved comments Lim et al., (2017). Cloud computing and storage are just the beginning of ultra-modern technological evolution and is not completely evolved.

From the invention of Nakayama et al. (2017), Cloud storage can be defined as the model of cloud computing where the data is stored on the remote servers accessed from the internet. Nakayama and Taylor (2016) mentioned that the cloud storage service provider manages this cloud storage on storage servers. Moreover, cloud storage is commonly known as utility storage as it enhances the actual implementation and service delivery. As per the view of Naous and Legner (2019), the working of the cloud storage is through data centre virtualization as in this end, users and applications with a virtual storage architecture are provided. Mainly its operation is done through the web-based API as its implementation is based on the interaction with the client application.

Liao et al. (2019) cited that most of the organizations have a lot of benefits from the adoption of cloud storage as it increases the business productivity, enhances the back-up and recovery of files, wireless network management, increase the automation etc. Barhamgi et al. (2016) revealed that the sync files and data by the employees could be done easily from anywhere by using a cloud service through a link. Grandhi et al. (2019) cited that an easy back-up and recovery of the protected data as it has the off-site location to store the backfiles. One of the most time-consuming processes is the foundation of the software. With the help of the cloud storage service, it mainly provides multiple options to automate updates. Naous and Legner (2019) claimed that with the rising popularity of cloud storage, most of the

enterprises are hiring the help of the cloud. Moreover, it is used as a powerful tool for meeting the storage, computing needs and saves more money in IT investments. Al-Muhtadi et al. (2019) noted that the high demand for this storage is due to its offers such as affordability and the easiness of use.

Jouini and Rabai (2019) pinpointed that in addition to the benefits of cloud storage, there are many privacy and security concerns of adopting cloud storage. Most of the IT experts are facing inherent security risks due to this cloud storage. Barhamgi et al. (2016) cited that the main issue occurs when the enterprises handover their security of sensitive business data to the third parties. The below paragraphs mention several risks associated with the use of third-party cloud services.

**No control over data:** Nakayama et al. (2017) reported that most of the enterprises are hiring the help of cloud services like Google Drive, Dropbox, Microsoft Azure as these enterprises want to manage with new security issues such as the loss of control over data. Nakayama and Taylor (2016) mentioned that the problem arises here while using the third-party file-sharing services the data is taken outside the company's IT environment. Most of the cloud services provide the users to back up their data; a lot of data that want to share can be viewed by unauthorized persons. Liao et al. (2019) explained that the best way to avoid this type of risk by ensuring whether the provider encrypts the files during storage.

**Data leakage:** Al-Muhtadi et al. (2019) identified that most of the companies are afraid of the data leakage while adopting the services of cloud storage. As this fact shows that this cloud storage is a multi-storage environment in which all the resources are being shared. Lee et al. (2020) revealed that it is a third-party service as the data is viewed and mishandled by the provider. Grandhi et al. (2019) mentioned that a big risk occurs when it comes to sensitive business data. Tharini and Vijayarani (2020) noted that malicious hacks of cloud providers are an external threat which may lead to data leakage. Liao et al. (2019) declared that in order to avoid this problem, all the enterprises want to depend on file encryption and stronger passwords.

**BYOD:** Jouini and Rabai (2019) found that another major risk of cloud storage is BYOD. Many companies are allowing the employees the ability to work on a Bring

Your Own Device (BYOD) BASIS. As this method of using their own device on work become a trend in most of the companies as the companies don't want to spend money on buying IT equipment for the employees. Lee et al. (2020) noted that this BYOD brings security risks if it is not properly managed as many problems occur when the device is hand over to the third parties by any methods of stolen, lost or misused devices.

**Snooping:** Al-Muhtadi et al. (2019) mentioned that the files in the cloud are not secure, and it is being hacked without any security measures in it. Grandhi et al. (2019) revealed that the major risk occurs when these files in the clouds are being stored and transmitted all over the internet. This problem can be avoided by using a secure connection, and this will avoid outsiders from accessing the data in the cloud.

**Key management:** Barhamgi et al. (2016) noted that the managing of the cryptographic keys is always a security risk in the case of enterprises and its problem increased by the advent of the cloud service. Liao et al. (2019) mentioned that the securing of key management could be done by being inconspicuous, automated and active. Naous and Legner (2019) revealed that keys need to be jointly-secured to make sure that the data is not accessed without the authorization.

**Cloud credentials:** Nakayama and Taylor (2016) mentioned that the major risk arises when the enterprise's data is stored along with the customer's data as it is considered as the data is loosed via the third parties. The security strength mainly depends on the individual user's password habits. Nakayama et al. (2017) referred that the cloud credentials are a type of compromise that may not allow the attackers to use the data within the files. Moreover, this also provides some functions like making copies and deleting them etc. The problem of security threat can be avoided by encrypting the sensitive data and securing our own credentials which must be unique as this helps to invest in a secure password management service.

## **2.6 Social and cultural factors affecting cloud storage adoption**

When an organization adopts cloud computing or cloud storage into its business operations, there will be many factors which influence the enactment of this new-age technology. Moreover, cloud computing and cloud storage mainly handle and operates with the organization's sensitive data. From the observation of Sabi et al.



(2016), the management will be extra precautions while implementing cloud storage, as there are many incidents of data leakage and security issues that occurred in various parts of the world using cloud storage. However, the potential of cloud computing and storage is not something that should be ignored. According to Karim and Rampersad (2017), cloud storage has immense potential to enhance the business growth of an organization and give a decisive competitive advantage to the company. Hence, most of the companies are forced to adopt this technology mostly due to technological and business factors. Although there is a significant role for technological and related elements, these are not the only factors that influence the adoption of cloud computing or cloud storage. Various social and cultural factors are also present, which affects the adoption of cloud storage by organizations. Although Socio-cultural factors have less effect on the organization's buying behaviour of cloud storage when compared to technological factors, socio-cultural cannot be ignored as well comments Sabi et al., (2018).

Cultural factors can be defined as the internal perception of the organization or the decision-making team. Hsu and Lin (2016) mentioned that cultural factors are considered to be more internal than external. Organizational culture has a significant role in the company's adoption of new strategies and techniques. Understanding the cultural factors are often complicated, and it may vary from person to person in an organization. As a result, organizational culture is one of the toughest subjects that can be studied. However, there are theories such as Hofstede's cultural dimension theories to measure the cultural dimension of an organization. Uncertainty avoidance, power distance, masculinity-femininity, and individualism-collectivism are the dimensions present in Hofstede's approach used to measure cultural dimension.

Alkawsi et al. (2015) illustrated that uncertainty avoidance is essentially the tolerance of the individual or the organization towards potential risk or ambiguity that may occur in the future. As of the case of cloud storage and cloud computing, an organization is intimidated with a fear of losing data and possible security threats involved while using cloud computing. Even though the cloud storage providing companies have an effective strategy to tackle these challenges, people or organization is not entirely convinced, or ambiguity persists in the area of cloud storage. Management who are anxious and uncomfortable with modern technologies

such as cloud storage tend to avoid them. Power distance is another factor which affects the culture of an organization. Power distance is the measure of the relationship between the top management and low wage employees of an organization. Higher the power distance higher will be the gap in their relationship. Implementing cloud storage will tend to reduce power distance which may cause unlikens in top management employees comments Liang et al., (2017). So, top management will not entertain the adoption of such technologies which reduce power distance.

Individualism and collectivism one of the critical dimensions, which helps in understanding the effects of culture on an organization's decision-making ability. Individualism is defined as a trait in which individuals give more preference to their individual growth and work rather than family. While collectivism is a trait by which the individuals give preference to their family and relationship. According to Sabi et al. (2018), an organization that have many individuals with individualistic trait tend to adopt modern technologies to ease out their work. Companies which have a collectivistic trait is not much interested in advanced technologies, or they do not entertain them much. Masculinity and feminism can also affect in adopting modern technologies in an organization. Male gender always tends to be competitive and militaristic, since cloud storage and computation has tremendous potential to improve the competitive level of an organization. The organizations with higher MAS source or male dominion have higher chance to adopt new-age technologies than an organization with female dominance comments Alkhater et al., (2015).

Although minimal social factors also have a significant impact on the decision of an organization to adopt cloud computing or cloud storage. From the observation of Alkhater et al. (2018), social media, word-of-mouth, critical mass and education are some of the social factors that affect the adoption of present-day technologies. Social media is a significant social factor in every instance of business processes or personal life. Modern technologies and the benefits gained from them are one of the hottest areas in social media hub, and news and information about such technologies are shared massively using social media. Cloud storage and its advantage, usage and information are readily available on the internet and social

media. Hence social media and internet play a vital role in the adoption of cloud storage in an organization.

Word-of-mouth is one of the most successful marketing elements present in the market. It is not something that can be developed by an organization instead it is a perception or satisfaction level an individual feel while purchasing a product and the compels peers or friends to use the same product to get the benefit. Since cloud storage and computing has developed a perception of ambiguity and low-security features, word-of-mouth can play a very significant role in an organization's decision to implement cloud storage says Fu and Chang, (2016). Critical mass is more or like similar to the word-of-mouth except critical mass is a measurable entity. Critical mass depicts the number of people or organization who uses a product or service. More the amount of critical mass more will be the chance of others to purchase that product. Critical mass is a vital factor for a company while implementing cloud storage. The organizations will check the critical mass to understand the credibility and trustworthiness of cloud storage.

Education is another factor which affects the acquirement of cloud storage by an enterprise. Education and knowledge level will help an organization or individual to identify relevant technologies or strategies that may enhance the growth of the business. From the findings of Hashim et al. (2015), individuals with higher education can easily comprehend the technologies and understand the importance of implementing such tools to enhance growth.

## **2.7 Technical Drivers of enterprise Cloud Storage adoption**

As per the view of the Akbar et al. (2020) identified that in order to make the important data's safe and accessible, it is essential to use the best way of cloud storage. Moreover, it is a computer data storage in which the data is stored in logical pools. Jamshidi et al. (2017) mentioned that more and more small and medium enterprises are asking help from the cloud storage services to ensure the safety of the client data. Ab Rahman et al. (2017) declared that the facilities of cloud storage could be cloud computing service, web service application programming interface, cloud desktop storage etc. Cole et al. (2017) mentioned that this cloud storage is made up of a large number of distributed resources but still acts as one of the

significant advantages of this cloud storage is the durability as it has the process of creating versioned copies. Psarros and Papathanassiou (2020) defined that it is important to consider the individual needs of each company while choosing a cloud service. There are many important features for the evaluation of a good cloud storage solution:

**File versioning:** Cheng et al. (2019) revealed that this helps to edit a file without any worry. Rossi et al. (2019) pinpointed that services this feature did not overwrite the old files while making changes in that file. Old copies of files can be retrieved later after saving the multiple versions of the file. Bacis et al. (2019) identified that this process of file versioning would be a great profit for all business users who want to retrieve their important data. Gimelli et al. (2019) referred that the majority of cloud computing services file versioning, but in some case, it only accesses some of the versions and even deletes the old versions after some period of time. Sun et al. (2020) found that even if a file is deleted most of the services retrieve all the deleted data and checks the saving capacity of the deleted files.

**Automatic sync:** Sun et al. (2020) asserted that most of the business users who depend on cloud service focus on these automatic syncing capabilities. As per the view of the Bacis et al. (2019), by using these services with this feature will update the files to show the edits done earlier. It's a major problem arise if anyone forgets to sync the files before the next business and not all services having this syncing functionality will do it continuously. Rossi et al. (2019) explained the main advantage of this service is the updating of data and mainly transfers the permanent backups to an external drive at a particular interval of time.

**View and Edit files from the cloud:** Ab Rahman et al. (2017) defined that this service is an essential factor of the business-ready cloud computing platform. Jamshidi et al. (2017) referred that it is very difficult and time consuming to transfer the important files from one device to other. Moreover, business owners need to access their files each and every time. Cole et al. (2017) revealed that it is an essential factor of cloud computing service which allows to view and edit all the files from the cloud on any computer, tablet, smartphone, or another internet-connected device. Akbar et al. (2020) noted that even if the business users are in the flight can also make their edits quickly. Meena et al. (2019) mentioned that it is efficient to

double-check before the subscription. For instance, music and media focused amazon cloud drive want to download that file to the hard drive to make the edits and after finishing the downloading want to upload to the cloud. This facility is most effective when the business owners are outside their office; otherwise, it mainly affects the productivity of the organization.

**Security and file encryption:** Gimelli et al. (2019) pointed out that while running an organization, they must focus on their private data as it is considered as a big concern. So for ensuring the private data of the data, one must concentrate on accessing good features. Chowdhury et al. (2019) pinpointed it is important to check the service encrypts the data at once before leaving the servers. Psarros and Papathanassiou (2020) revealed that the advent of the encryption key helps a lot for providing the best services as it does not allows seeing the private data by their company employees. Moreover, the owners itself want to protect their company's data by providing them with strong passwords, most probably when accessing from mobile phones. Meena et al. (2019) mentioned that the notch up security features helps while sending private information about the clients to the cloud.

**Flexible storage capacity at an affordable price:** Chowdhury et al. (2020) referred that the spacing capacity of an organization depends on the number of employees. In the case of the small business owners, they mainly look for a cloud storage platform which can accommodate data up to 10 employees, but the price can vary according to space. Gimelli et al. (2019) mentioned that most of the storage platforms mainly offer a limited amount of data for a low price as the scaling up is done; the price will also increase. Rossi et al. (2019) referred that depending on the features of the organization price of 1TB storage can vary throughout every year. Cheng et al. (2019) defined that the growth of the organization depends on the best cloud storage solutions. The service of the company develops the number of employees and productivity.

**Quality customer support:** Ab Rahman et al. (2017) mentioned that technical difficulties are a major problem in the business's daily operations. Akbar et al. (2020) cited that while dealing with the storage of the backup site files, it is very important to have quality customer support within an organization. Meena et al. (2019) pinpointed that all the organizations must have a tie-up with technology providers as the help of

the experts can have peace in the mind of the employees and the owners. The depth of the problem is directly proportional to the dependency of the feature. There are two tips for this they are getting acquainted with the storage solution's documentation, and another one is don't hesitate to make contact. Cole et al. (2017) revealed that as customer support is helpful, it is more efficient to answer all the questions by acquiring help from the solution's available support documents. On the other hand, the second tip is to hire help from the professionals at the time of problems. For example, if the employees might have some type of problems in their organization and it can be solved with the help of the professional around them. Jamshidi et al. (2017) cited that doing this can avoid the occurrence of further issues and can reduce the time and money spends on it. In addition to that, most of the organizations must want a storage solution with various support options as the organization will fully be concentrated at the time of emergency.

However, it was finalized from the further findings that it is very important to consider all the features while choosing the cloud storage solution for the backup needs. It ensures the security of the protected data in the organization. So it is efficient to hire the needs of the cloud storage in every organization.

The study of Nuseibeh (2011) indicates that cloud computing is a concept which enables access to computing resources such as applications, storage, network and services. Cost-saving is one of the major and basic advantages of Cloud services. A large number of organisations use cloud services which help them to make a competitive advantage through the cost reduction. The IT expenditure could be reduced through the use of cloud services. According to Armbrust et al. (2009), the cost and risk in maintaining the advantage of cost reduction was the major purpose of cloud services initially. The entry of cloud services helps to avoid infrastructure required for the hardware and the risks in maintaining the same. It is found from the study of Stieninger et al. (2014), that large organisation can reduce the carbon emissions by 30%, and it can be 90% in small business. On the other hand, the study of Hsu and Lin (2012), enterprises are benefited by the adoption of cloud computing services such as reduction of costs, easy maintenance and effective use of resources. These advantages lead to increased profit for the organisations. Gupta et al. (2013) had the opinion that ease of use, ease of use are also major

advantages of adopting cloud computing services. Therefore, studies show that cloud computing services have become part of every organisation, and there is a difference in the utilisation of cloud services. Ease of use consists of the accessibility and availability of using cloud services anywhere at any time. The reliability of cloud services includes the dependability of use or the availability of the services whenever it is required.

There are different areas where cloud computing services can effectively be utilised. The major areas where cloud computing implemented are social media, email, Wikipedia and online chatting, accounting and payroll etc. Therefore, cloud services can be effectively implemented in various departments of organisations.

Different types of cloud development models are available such as public cloud, private cloud community cloud and hybrid cloud. Organisations choose different models of clouds according to the need operations of the organisation. According to Gangwar et al. (2015), a public cloud is available from a third-party service provider. Google app is an example of a public cloud service. The public cloud services can be adopted even by the small and medium scale industries as the cost of such services are less. As mentioned above, the advantages of cloud services are available with these services such as ease of use, cost-effective and availability and accessibility anywhere. As per the opinion of Rao and Selvamani (2015), private cloud services are managed within the organisation and outsiders do not have access to the private cloud service. A community cloud is used by a group of enterprises which have common goals. On the other hand, Hybrid cloud is the combination of both private and public cloud. With the use of cloud computing, the companies are able to handle the workload with the help of cloud computing services. There is a shift in the models of cloud computing services from the very beginning of its use, and the features of the emerging models are also different. As the same time, the security of data is questioned by the use of cloud services. As noted by Bharadwaj and Lal (2012), security measures have to be adopted by the safe storage of data. The cloud computing provides an opportunity for a large number of people to access data which may lose data protection. Therefore, the organisations should make that the process of operations and transmission of data has to be protected to minimise risk in the protection of data.

There are number of chances for data insecurity. First of all, the data is distributed to different regions, and it makes difficulty in understanding the location of data. The laws regarding cloud computing are different in different areas. So there will be compliance regarding data privacy. As observed by Iosup et al. (2011), data integrity should be maintained within the organisations when adopting cloud computing services. Authorised people should be given the responsibility of modifying the data as per the requirements. According to Höfer and Karagiannis (2011), ACID properties can be used by organisations instead of HTTP in order to preserve data. The HPTT services do not support the transaction or ensure the delivery. Data security policies should be developed and maintained by an organisation to provide security to the accessibility of data. Following these policies make sure that certain cloud survives are accessed by only a few people as per the data security policy.

Different factors were identified to be the factors responsible for the adoption of cloud computing services in organisations. It is because the trade pressure and trade partner pressure affect the adoption of cloud services. When the workload is high and the organisation growing high, there is more demand for cloud services, which increase the efficiency of the organisation (Jadeja and Modi 2012). Complexity is another factor which affects the adoption of cloud services. The organisations need to analyse whether they have the capacity to manage the cloud services within the organisation and ensure the protection of data. Technological readiness is a major factor in the adoption of cloud services (Wu, 2011). For the adoption of cloud services in an organisation, it is to make sure that the software and hardware need to be adopted and efficient staff has to be recruited and selected for management and maintenance of cloud services within the organisation. The size of the firm and its operations are also factors which are responsible for the adoption of cloud computing services.

## **Section II: QoS in Cloud Computing**

### **2.8 QoS Definition and Rationale**

As per Puthal et al. (2015) the IT services management indicates to the different services that are constructed to manage the organisational requirement of technology. Furthermore, the IT service management incorporates the overall



governance of the organisational activities that includes the assistance of technical support. The from the reports of Aazam and Huh (2016) that the key parameter in IT service management is the need to maintain and improve the level of service quality provided as a form of IT service where there is a constant revisiting of the requirements, monitoring and reporting of metrics and immediate action to ensure high level quality of service is required. The steps are further referred to as the service level management. In line with service level management, quality of service can be defined as the service that is enhanced to guarantee customer application requirements. Quality of service is also considered as a differentiating factor which can help in comparing one service provider to another.

Bahrami and Singhal (2015) indicate that the customer storage cloud computing model of IT services presents partial control to the customer over the operating environment of the service. As a result of such control, it is not only important to identify the services offered by different providers, but also important to specify and assess the level of services available through cloud computing. Furthermore, as Almorsy et al. (2016) posit, consumers move towards service oriented architecture where the quality and reliability of services become the most important attributes. However, the demand of the service is found to vary consistently across consumers. To help balance the needs of the customer with the views of the service provider, a service level agreement (SLA) is promoted. This SLA acts as the foundation to the level of service which is expected from the service provider. Sing and Chana (2016) indicate that the QoS are key parameters which form the basis of the SLA and need to be monitored consistently to identify changes in consumer demands.

However, the determination of QoS is found to be facing significant challenges due to the differences in modes of service provision, deployment and pricing (Hobfeld et al., 2012). In light of such views and given the presence of diversity in cloud service provision, the key challenge for the customers is to identify the 'right' service providers to fulfil requirements. Furthermore, there are instances where trade-offs between the functional and non-functional requirements are fulfilled by cloud service providers. Therefore, as Garg et al. (2013) posit, there is an associated difficulty in evaluating the service level of cloud providers by identifying user requirements and service performance. The authors also argue that it is not only important to assess

the QoS of different cloud services, but it is equally important to rank them based on specific metrics to identify the most relevant and suitable service provision platform. In light of such views, the following section will examine the key dimensions of QoS and prior research on QoS dimensions of cloud computing.

### **2.8.1 QoS Dimensions**

The Cloud Service Measurement Index Consortium (CSMIC) identified measures which form the service measurement index (SMI) and can be used by consumers to rank the cloud computing service performance and examine the quality (Garg et al., 2013). The SMI attributes are based on the standards set by the International Organisation for Standardisation (ISO). The SMI index identifies a list of key performance indicators which are aimed at providing a standardised measure to examine the cloud computing service quality (Buyya et al., 2011). This is done by letting the users of cloud services rate these performance indicators by applying the techniques of standardised surveys. The users, by comparing and evaluating each of the metrics based on the importance with regard to a specific type of service, the scores are generated. Thus, the main aspect of the SMI is that though the key performance metrics are standardised, scores are generated on a customised basis (Sing and Chana, 2016).

The use of the SMI framework identifies some key aspects associated with the QoS of cloud computing services.

- **Accountability:** According to Shyam and Prasad (2017), accountability attributes are vital in measuring different cloud provider characteristics and thereby building the consumer trust in enhancing cloud service provision. The accountability feature is to provide details on how security exposure or compliance related parameters are met. The accountability parameter identifies performance metrics like ownership, ethicality, auditability and compliance (Ren et al., 2016).
- **Agility:** The primary advantage of cloud computing is its ability to enforce agility in terms of adaptation. Agility as a QoS identifies the ability to integrate cloud computing into the existing framework. The agility parameter includes metrics like portability, flexibility, adaptability and elasticity (Garg et al., 2013).

- **Cost:** The cost parameters identify the cost of characteristics, services and quality of services associated with the provision of cloud computing (Sabi et al., 2016).
- **Performance:** The performance parameter identifies the functionality, service response and accuracy as key factors impacting cloud provider quality of service. The performance of the cloud is vital as it helps understand the speed of performance and whether the deployment meets specific expectations (Saravanan et al., 2013).
- **Assurance:** The assurance parameter identifies the likelihood of a cloud service to perform as expected. Every cloud service organisation aims at expanding its business and providing better services through reliability, resilience and service stability as key performance indicators (Liu et al., 2011).
- **Security and Privacy:** Data security and privacy are key concerns for customers with the hosting of information and storage of information under the control of an outside organisation (Saravanan et al., 2013). The examination of security and privacy involves the assessment of the many attributes including confidentiality, privacy and data integrity.
- **Usability:** According to Rittinghouse and Ransome (2016), the usability parameter identifies the rapid adoption of cloud services where the usability parameter is the ability of the customer to adapt to the cloud, and can include metrics like accessibility, learnability, operations and ease of installation.

The following Table 3 summarises some key research on QoS relating to cloud service availability.

Reference	Objectives	Key Implications	Metrics
<b>Garg et al. (2013)</b>	To devise a framework and a mechanism that measures the quality and prioritises the various cloud services.	<ul style="list-style-type: none"> <li>• Aids in making a significant impact on the creation of a healthy competition among cloud providers to satisfy their service level agreement (SLA) and improve their QoS.</li> <li>• Performance metrics are designed to measure quality of service of an IaaS cloud service.</li> <li>• In order to compare various cloud services, an analytical hierarchical process (AHP) based ranking mechanism is designed.</li> </ul>	<ul style="list-style-type: none"> <li>• Accuracy</li> <li>• Availability</li> <li>• Cost</li> <li>• Efficiency</li> <li>• Interoperability</li> <li>• Reliability</li> <li>• Response time</li> <li>• Scalability</li> <li>• Stability</li> <li>• Suitability</li> <li>• Sustainability</li> <li>• Throughput</li> <li>• Transparency</li> </ul>
<b>Dario Bruneo (2014)</b>	To develop a method to evaluate the performance of cloud computing infrastructures. (Only Taking IaaS)	<ul style="list-style-type: none"> <li>• Numerous performance metrics are defined and evaluated to analyse the behaviour of a cloud data centre.</li> </ul>	<ul style="list-style-type: none"> <li>• Availability</li> </ul>

<b>Saravanan (2013)</b>	<p>To formulate a framework for ranking and advanced reservation of cloud services based on a set of cloud computing specific performance and quality of service (QoS) attributes.</p>	<ul style="list-style-type: none"> <li>• The framework ensures an automatic best fit and a guaranteed delivery.</li> </ul>	<ul style="list-style-type: none"> <li>• Sustainability</li> <li>• Suitability</li> <li>• Stability</li> <li>• Security and confidentiality</li> <li>• Response time</li> <li>• Reliability</li> <li>• Privacy</li> <li>• Portability</li> <li>• Learnability</li> <li>• Interoperability</li> <li>• Instability</li> <li>• Flexibility</li> <li>• Elasticity</li> <li>• Easiness</li> <li>• Data integrity</li> <li>• Compliance</li> <li>• Availability</li> <li>• Auditability</li> <li>• Assurance</li> <li>• Adaptability</li> </ul>
<b>Shawky and Ali (2012)</b>	<p>To devise a technique to measure the elasticity of a cloud.</p>	<ul style="list-style-type: none"> <li>• The context in which the study defines the term elasticity is as physics defines it.</li> <li>• Such a definition is adopted in order to represent the basic features of a cloud computing environment and its parameters that</li> </ul>	<ul style="list-style-type: none"> <li>• Elasticity</li> </ul>

		<p>are related to elasticity.</p> <ul style="list-style-type: none"> <li>• A case study approach is adopted which highlights the basic parameters affecting elasticity.</li> </ul>	
<b>Islam et al. (2012)</b>	To propose better ways to quantify the elasticity concept and to explore the impact of the rules used to increase or decrease capacity.	<ul style="list-style-type: none"> <li>• Several workloads are applied to a public cloud.</li> </ul>	<ul style="list-style-type: none"> <li>• Elasticity</li> </ul>
<b>Andres García (2014)</b>	To highlight a cloud based platform called CloudComPaaS, which has the ability to manage the complete resource lifecycle.	<ul style="list-style-type: none"> <li>• A SLA-driven architecture for the automatic scheduling of cloud resources is provided.</li> <li>• The study also provides a SLA-driven architecture for the dynamic management of cloud resources.</li> </ul>	<ul style="list-style-type: none"> <li>• Performance</li> </ul>
<b>Xeongrong Zheng (2013)</b>	To demonstrate the effectiveness of a cloud based model called CLOUDQUAL.	<ul style="list-style-type: none"> <li>• CLOUDQUAL is validated with standard criteria.</li> <li>• CLOUDQUAL contains six quality dimensions: usability, availability, reliability, responsiveness, security and elasticity.</li> </ul>	<ul style="list-style-type: none"> <li>• Security and confidentiality</li> </ul>

*Table 2: Key Metrics of QoS*

### 2.8.2 Prior Research on QoS

*Table 3: Quality of Service in Cloud Computing*

Extant literature has identified prior research on the metrics associated with QoS determination in the cloud environment. According to Garg et al. (2013), most research on QoS in cloud computing has focused on measuring availability, reliability, scalability and response time. The studies which identify QoS related measurement in cloud computing are presented in the following Table 4.

However, researchers have identified challenges associated with the measurement of QoS and ranking of cloud providers. For instance, Al-Shammari et al. (2014) contend that the measurement of SMI attributes associated with cloud services faces issues in attribute performance over time. Garg et al. (2013), on the other hand, contend that there are instances of differences in performance value when compared to those presented in the service level agreement. Houdi (2011) further contends that there is no clear measurement model available for each attribute, making it difficult to compare multiple cloud service platforms and the lack of use of real time data. Garg et al. (2013) identify another challenge associated with the ranking of cloud service attributes, which is the assessment of functional and non-functional parameters. The author contends that non-functional parameters are hardly addressed as part of cloud QoS assessment. Furthermore, Al-Shammari et al. (2014) argue that QoS as part of cloud service assessment is rarely highlighted in literature.

The current research argues that the QoS assessment and associated benchmarking identified only addresses functional parameters, with a lack of focus on non-functional and experience parameters. This makes it necessary to address the importance of QoS functional and non-functional parameters as part of the personal cloud storage assessment framework.

## **Determinants of QoS Performance**

### **2.8.4 Elasticity and Scalability of Performance**

An application operating in the cloud and its virtual resources can be scaled upwards in order to manage QoS and down in order to decrease expenses. This escalation is known as elasticity (Ferrer et al., 2012). NIST says that elasticity is an essential factor of cloud computing: competencies can be quickly and elastically supplied, often mechanically, to swiftly scale out, and quickly released to rapidly scale in. “To the customer, the competencies accessible for supplying frequently seem to be boundless and can be bought in at any amount at any time” (Timothy Grance and Peter Mell, 2011).

Even though one of the key features of cloud computing is the illusion of infinite resources, capacity in cloud providers’ data centres is limited and can eventually be fully utilised (Calheiros et al., 2012a; Aoyama and Sakai, 2011). Growth in the scale of existing applications or surge in demand for a service may result in immediate need for additional capacity in the data centre. Current service providers handle this issue by over-provisioning of data centre capacity. That is, the average demand of the system is several times smaller than the capacity of their computing infrastructure. This strategy, and the cost of its operation, constitutes a large expense for cloud owners. Actual usage patterns of many real world application services vary over time and, most of the time, in unpredictable ways. Therefore, as we stated earlier, unexpected loads can potentially overburden a single cloud provider and lead to unreliable and interrupted services. It is overly restrictive in terms of small size or private clouds. If cloud providers were able to dynamically scale up or down their data centre capacity, they could save a substantial amount of money and overcome the above issue. Scalable provisioning of application services under variable workload, resource and network conditions is facilitated by interoperation of the clouds (Buyya et al., 2010). Cloud federation helps the peak load handling capacity of every enterprise cloud by resource sharing, without having the need to maintain or administer any additional computing nodes or servers (Rittinghouse and Ransome, 2017). The quick motion of resource supply is a primary distinctive trait of the cloud archetype in contrast to other dispersed structures.

Virtual resources can be scaled in two courses.

**Vertical scale up operations:** Denotes scaling the application performance by developing the internal resources of a functioning virtual machine. This might involve



accumulating or extracting CPU cores, CPU speed or partially assigned physical CPU time, memory and data repository. Vertical elasticity must be backed by both the hypervisor and guest operating structure to facilitate the secure extraction of virtual hardware instruments (Garg et al., 2013).

**Horizontal approach using scale out operations:** Denotes scaling of a given application performance by enhancing the utilisation expansion or the associated reduction of the number of VM occasions that backs its workload. Usually horizontal elasticity is attained by the use of a hardware or software load balancer (He et al., 2011).

Vertical scalability is restricted by the overall available sum of resources accessible in single physical devices. Alternatively, horizontal scalability is restricted by the overall sum of physical devices accessible and by Amdahl's law (Richins et al., 2018). Amdahl's law declares that the highest speed-up a computer program can attain by applying several processors is restricted by any ordered code that cannot be parallelised. With regard to cloud computing, this associates with the utmost number of requests that an application can aid, given the presence of an infinite amount of resources. This is usually hindered by the joint back-end data depository that the VM resources access instead of the computation necessities of the application itself, which often have parallel features by design in cloud computing.

According to Bai et al. (2011), the elasticity measure which forms part of a performance resource ratio (PRR) reflects the relationships that exist between the uses of resources by the application. The author contends that elasticity can be measured based on the available wait time, the available execution time and the associated allocation of resources, including CPU usage, bandwidth use and memory. Gao et al. (2011), on the other hand, indicate that in SaaS environments, multiple metrics which can be used to measure elasticity include the level of resource allocation, the type of resource that is used, the overall system performance, workload of the system, capacity of the system and the scalability of the system. The authors clearly arrive at a wide range of scalability parameters which can be extended to the personal cloud platform. Garg et al. (2012), on the other hand, identify an elasticity measurement metric which focuses primarily on how a cloud service can be scaled during peak requirements. The authors define two

important attributes. Firstly, the mean time that is taken to expand and contract the overall capacity of service; secondly, the overall capacity of the service, which is measured by the highest number of computational units which are provided by the service during the peak intervals. Islam et al. (2012) indicate that while elasticity and scalability examine performance measures, the degree of utilisation is often under examined. The author defines elasticity by using a penalties approach when there is over utilisation or underutilisation of resources which are made available to the resource. A similar approach towards elasticity is adopted by Shawky et al. (2012), who argue that the scalability and elasticity of a specific cloud can be made possible by using stress and strain concepts. The authors define stress in cloud computing as the amount of resources needed divided by the amount of resources allocated. Cloud strain, on the other hand, can be defined based on the change in available resources before and after the completion of cloud scaling operations. From the above assessment, it is argued that cloud computing scalability and elasticity are key factors which determine the overall quality of service. As observed from the empirical assessment, it is evident that elasticity has been examined from the perspective of networked computing and iaas cloud platforms. No clear evidences are available with respect to the examination of personal cloud computing platforms. Hence through the critical review of literature background that states various dimensions of cloud computing and it's the extended features, the relevance of QoS performance in determining elasticity and scalability can be comprehended.

### **2.8.5 Resource Virtualisation Monitoring**

Virtualisation literally means developing a virtual, in contrast to concrete, variant of an item. This description of virtualisation is comprehensive and can be used in several situations. To limit the applicable extent of virtualisation to systems which are distributed and cloud computing, resource virtualisation means the seclusion or combining of a portion or all of a computing tool's hardware resource for varied or common intentions respectively (Aceto et al., 2013).

Resource virtualisation can be used in three domains in appropriated systems (Xu, 2012; Erl et al., 2013; Shyam and Manvi, 2015):

- Network Virtualisation: Identifies a means of multiplexing the use of network tools while dispersing traffic, veiling the true intricacies of the latent network topography.
- Storage Virtualisation: Comprises the combining of physical storage from several networked tools, demonstrating the look of a consolidated depository tool, controllable from a central point.
- Server Virtualisation: Offers secluded access to server resources while concealing the latent implementation specifics of the hardware away from the end-user for the purpose of heightening utilisation and enhancing simplicity of management.

These offer facilities without the need to purchase the resources required to operate them. Commonly, the service and infrastructure suppliers accept a recommended series of service levels, often known as the Service Level Agreement (SLA), which is a precise explanation of temporal accomplishment and economical restraints within which hosted services must function (Zhu et al., 2012). Under this contract, the service providers agree to compensate a fixed sum of money in order to use the infrastructure and, in turn, the infrastructure supplier agrees to either supply sufficient resources to meet SLAs or to pay a compensatory fine for each SLA loss (Wu et al., 2012).

From the perspective of the infrastructure supplier, the decision as to the extent of computing resources assigned to a particular service provider may have a vital influence on its profit. For instance, diminished resource supply may result in the accession of SLA breaches, and therefore contribute to the decline in revenue, whereas increased supply of resources may lead to a rise in the total cost of ownership (TCO), which includes capital and managerial expenses. Therefore, the greatest aim for an infrastructure supplier is to heighten its revenues by reducing the number of SLA breaches and, laterally, reducing the TCO. This is a difficult aim because of the clashing nature of the two factors (Wang et al., 2013). On the other hand, the accomplishment of SLAs would certainly make the supplier provide excessive hosted services (in order to handle the maximum probable workload claim), thereby raising the TCO by investment, functioning and energy utilisation

expenses. Also, the decline of TCO (with regard to energy utilisation expenses) would cause the supplier's under-provision of hosted services, resulting in higher chances of breaching certain SLAs (Wang et al., 2013).

### **Resource Management Monitoring**

It is contended that energy expenses are among the most essential aspects influencing TCO and that this effect will develop overtime because of the escalation of electricity expenses. Thus, the decline of functional expenses is often followed by the decline of the extent of energy consumed by the physical resources of the data centre. However, this reduction should be examined from a monitoring perspective. Different methods that focus on decreasing the extent of electrical energy used by the physical infrastructure hiding the IaaS substrate are already available. These extend from energy-adept hardware and energy-wise composition techniques to server fortification, whereby several virtual devices work on the same material resource (Basu et al., 2017). Furthermore, VM migration through live operations can be used to aggressively combine VMs dwelling on several under-applied servers onto a single server, so that the rest of the servers can be positioned into an energy-saving mode. However, these methods alone are not adequate to assure application performance necessities because of the complications of cloud computing systems, where: (1) system resources must be actively and erratically shared among many autonomous applications; (2) the needs of every application must be met in order to avoid economical fines; (3) the tasks of every application are usually modified over time; (4) applications may stretch over several computing nodes; and (5) system resources will most likely be appropriated globally. In light of this view, an assessment of how resources are managed in order to meet the dynamic needs of the cloud computing platform is important.

### **Cost Management**

The eventual aim for a cloud service provider is to maximise its revenues. Apart from diminishing the number of SLA breaches (which eventually leads to a decline in the amount of fiscal fine probably paid to the service consumer), one way to boost revenues is to curtail the total cost of ownership (TCO), which includes capital and managerial expenses (Saccani et al., 2017).

## **Cost from Consumer's Perspective**

As per the consumer's outlook, this research considers the models of costing for consumers that are endorsed by providers. According to Piraghaj et al. (2017), cloud computing offers a costing version, i.e. pay for use of computing resources temporarily when necessary and discharge them when not necessary. Thus, in this manner, one can discharge devices and depositories when they are not necessary anymore (Piraghaj et al., 2017). For example, Elastic Compute Cloud (EC2) from Amazon Web Services (AWS) is found to show significant speed as part of their services to enhance reliability of the operations. Amazon's Scalable Storage Service prices additional charges every month based on the storage requirements or bandwidth requirements to transfer data via the Amazon cloud platform through the internet. Thus, Amazon declares that by numerically multiplexing several cases on a single physical device, it can be leased to several customers to enhance reliability and interoperability (Piraghaj et al., 2017).

Piraghaj et al. (2017) refer to this technique of costing as 'pay as you go'. For example, if one buys hours from a specific cloud computing platform, they can be allocated sporadically in time within the networking society; that is to say, one could use 200 server hours on one day and no server hours on another but pay only for what was used. Despite the fact that the pay as you go system could be more costly than purchasing a corresponding server within the same time frame, Piraghaj et al. (2017) contend that the expense is outweighed by the cloud computing advantages of elasticity and transfer of risk. In terms of elasticity in cloud computing, the capacity to accumulate or deduct resources at the level of one server at a time, together with used time of minutes instead of hours or weeks, allows more personal correlation of resources with workload (Piraghaj et al., 2017). The server application of the real world ranges from 5% to 20% (Hameed et al., 2016). This appears to be significantly less, but it is a declaration that the typical workload for several services surpasses the aspect limit. Certain users purposely indicate a peak lower than anticipated, as they must stipulate the maximum. However, correspondingly, they permit resources to be unproductive during the non-peak times.

This leads to a lack of clear use of resources (Piraghaj et al., 2017). There are other versions accessible in the market from the consumer's perspective. They have

chosen one out of three models: tiered pricing, per-unit pricing and subscription-based pricing (Lee, 2019). Amazon cloud has embraced the tiered pricing version, whereby cloud services are provided in many tiers and each tier offers permanent computing particularisations (i.e. memory distribution, CPU kind, speed etc.) and SLA (Service Level Agreement) at a particular cost per unit time (Lee, 2019). Per-unit pricing is often utilised with data transfer and memory application (Lee, 2019). GoGrid Cloud provision utilises the main-memory distribution, where they designate RAM per hour as the utilisation unit for their structure (GoGrid, 2012). This procedure is more flexible than tiered pricing as it permits users to appropriate the memory position according to their requirements. Lastly, the subscription-based version is usually used for SaaS. This version lets the consumers envision their recurrent costs in using cloud computing (Lee, 2019).

## **2.9 Cost from Provider's Perspective**

With regard to business, along with allowing for the cost of cloud computing, the significance of being familiar with the cost of offering cloud computing services for several reasons. Primarily, there is a probability that firms cannot relocate to public cloud as per law. Thus, the utilisation of private clouds becomes more essential. Furthermore, if firms begin a private cloud once, they could again lease its extra IT space. Hence, it is favourable for firms to be familiar with the expenses of having a private cloud. A few investigators have operated with the cost of cloud data centres. Shuja et al. (2016) explain how to decrease the expenses of the cloud data centre by recalling the cost of servers, infrastructure, power and networking. They say that expenses can be minimised by operating data centres in cooler conditions to minimise cooling costs and constructing micro data centres to decrease bandwidth expenses (Shuja et al., 2016).

Khajeh-Hosseini et al. (2010), in their examination of cloud migration, discuss the third-party cloud infrastructure. They state that if the third-party cloud infrastructure is introduced, it provides several options for firms to enhance the administration of revenue and outflow from the perspective of both the organisation and its customers. It also facilitates cash flow management for the customers, since the cloud pricing version has a basic direct cost and monthly charges. These are the advantages of using a cloud computing platform in contrast to the in-house hardware, as it can be

expensive to purchase hardware and the associated maintenance of such platforms can be considered as more expensive and time consuming. Together with that, energy expenses will also decrease, as an individual is not operating his or her own data centre, but a third-party cloud is accountable for that.

The cloud infrastructure is also quite beneficial for the finance division of the firm in terms of decreasing the burden of administration. Third-party cloud infrastructure gives new pricing versions, which aid in directing compensation for customers, sales and marketing employees (Khajeh-Hosseini et al., 2010). Khajeh-Hosseini et al. (2010a) argue that cloud computing is a disruptive technology form that is ready to transform how IT systems in firms are redistributed due to its inexpensive, easy and scalable characteristics. Shuja et al. (2016) contend that a similar set of characteristics can be applicable to personal cloud computing platforms, as there are similar arguments of scalability, simplicity and associated lowering of cost. Cloud computing can be quite inexpensive in contrast to purchasing and preserving in-house data storage, as it reduces the need for assistance related problems because there is no physical infrastructure to preserve. Nevertheless, there are several social and technical problems that should be considered before relocating to the cloud (Khajeh-Hosseini, 2010a).

In any firm, bottom level managerial costs can be significantly high, usually much more than raw hardware expenses, as the departments are dispersed through the building. With the assistance of the cloud, firms can discharge three types of low-level administration. First is system infrastructure, which comprises hardware preservation, extra components and accumulation of new devices, and the infrastructure software is tended to by the cloud. Secondly, after firms outline the backup procedure, the cloud supplier is in charge of implementing it. Finally, a sole application is set up once and becomes accessible to all approved users. However, the administration of the application - i.e. application assistance, improvement problems and user management - is not included, as transferring to the cloud does not modify much in these tasks. It is essential to remember that the low-level expenses can occasionally be more than the overall expense for the cloud service (Mazumdar and Pranzo, 2017).

Server power is costly because of methods such as cooling and alternative overhead power utilisations. If linked together, they can correspond to the cost of one conventional server. Cloud suppliers can perform much better than ordinary server centres, as they have superior management of voltage alterations, cooler surroundings, better cooling and lower electricity proportions (cloud vendors seem to gather near hydropower). Cloud suppliers are also often situated where real estate is inexpensive (Mazumdar and Pranzo, 2017). Moreover in the article, deliberated over three primary cost drivers of biomedical firms and how they are impacted by the cloud computing technology. They consider system management, unproductive potential, power utilisation and facilities (Mazumdar and Pranzo, 2017).

According to Singh and Chana (2016), extant literature on cloud computing has focused on privacy and security issues much more when compared to other QoS parameters. This is largely attributed to the dominant use of personal cloud as a key storage space for users when compared to cloud storage. Wang et al. (2011) further identify that there is a consistent movement in data from user owned desktops to dedicated personal storage spaces. However, the growth potential of this market is also strongly impacted by concerns of privacy and security. Feng et al. (2010) contend that a focus on cloud storage systems is not presented with novel security and privacy threats, which slows down and impedes rate of adoption. Rao and Selvamani (2015) argues that while most research on security and privacy analysis focuses on enterprise cloud adoption, there is a significant impact on end user (i.e. customer) privacy and exposure of private documents as documented by the recent Google cyber-attack in 2009 (Costigan and Perry, 2016) and access control enforcement problems (Vascellaro, 2012).

Over the last few years there has been a considerable increase in the number of high-profile hacking cases where large well-known cloud computing organisations have been targeted by malicious individuals and groups seeking to access their highly valuable customer's data. In some cases, this has been to make a political point (The Economist, 2011) in order to release information that some felt should have been widely available in the public domain. In other cases, this was to deliberately harvest financial details with the express purpose of making fraudulent transactions (The Times, 2011). From these press reports it seems there is a level



of naivety amongst many cloud consumer's individuals and cloud services providers' firms as to the importance of maintain the integrity of data and ensuring that it is held safely and securely. It raises the obvious question – if large brand name organisations such as Sony and Stratfor (BBC, 2011; BBC, 2012) are unable to prevent breaches of data stored in cloud, then how do small organisations cope? However, as society becomes increasingly reliant on technology it is suggested that this is something that organisations should be considering as a matter of urgency, regardless of their size.

Despite the bleak (miserable) picture painted by some journalistic reports, many leading IT and IS professionals and academics have been giving the matter deep consideration (Kajava et al, 2010).

Adisa and Rose (2013) indicate that though information security in Cloud can be promoted, their ability to grow and sustain growth as part of the cloud community is possible only if it is considered as a change wave.

Ntouskas et al. (2012) establish that small and medium cloud service providers, though an important part of the European digital economy, are identified as a weak link in maintaining data security. The authors parameterise an open collaborative environment to present a cost-effective tool for self-management of security. However, the authors also conclude that such a method does not consider usability and accessibility features. The following research article examines the need to assess the effectiveness of information security in CSP.

Lee (2012) states that usually cyber security is concerned about data protection and systems from external attacks. It was revealed that 44.4% cyber security attacks were done by insiders, but these attacks were prone to human error. About 42.3% data breach or cyber security incidents were due to outsiders' malicious actions. In addition to this, locally policy implemented was found to be inadequate.

Furthermore, Ifenido et al. (2012), in their examination of cloud data security compliance from the perspective of planned behaviour, indicate that the lack of awareness about cloud data security among CSP is largely associated with limited management of the information security as a change process, and limited efforts to promote continuous organisational learning.

According to Rebolloet al. (2015), the term information security for cloud or (Icloudsec) “*describes activities that relate to the protection of information and information infrastructure assets stored in cloud against the risks of loss, misuse, disclosure or damage*”. Chang et al. (2017) adopts a slightly wider perspective and describes cloud information security as the protection of “*information and information systems of cloud from unauthorised access, use, disclosure, disruption, modification, perusal, inspection, recording or destruction*”. A further somewhat narrow definition is put forward by Sen (2015) who suggests that in its most fundamental form, information security is “*the protection of data against unauthorized access*”. He argues that this is in fact the common denominator amongst all cloud information security management systems because it is almost invariably unauthorised access (deliberate or otherwise) which is the root cause of information security failure and subsequent damage or loss.

According to Yi et al. (2015), security and privacy concerns are primary issues which impede cloud adoption by organisations. Shi and Dustdar (2016) identifies that the enterprise switching to cloud computing models was largely dependent on privileged user access, regulatory compliance, data location and data segregation, recovery and viability as key concerns. Kresimir et al. (2010), in their assessment of security concerns of cloud computing, contend that the adoption by small organisations is hindered by security concerns more than quality parameters and that data integrity, payment and privacy are the key factors. Grobauer et al. (2011), in their discussion of the security vulnerability of cloud platforms, contend that a detailed assessment of security threats is required and that an assessment of threats should be categorised. The authors proposed the categorisation of vulnerabilities into technology specific, cloud specific and security control specific. Morsy et al. (2010), on the other hand, contend that the investigation of cloud computing identified security challenges which are unique to different stakeholders and thereby suggest the assessment of security challenges from the perspective of cloud architecture, cloud stakeholders and cloud service delivery perspective. Hu et al. (2010) evaluated four cloud storage systems including Dropbox, CrashPlan, Mozy and Carbonite. The authors concluded that an assessment of security of these customer storage decisions did not identify any guarantee for data integrity, nor was there any assumption of liability in cases of data security breach.

Concurrently, the findings of Yan et al. (2016) show that the availability of cloud computing is highly destroyed by Distributed Denial of Service (DDoS) and Denial of Service (DoS) attacks. Both attacks are intended to make the network resource or machine unavailable. The difference between two is that while the source of DDoS attacks is more than two persons, the source of DoS attacks is one person or system.

## **2.10 Review of recent studies on QoS perception of personal cloud storage**

One of the important studies on QoS perception of personal cloud storage was performed by Dai et al. (2017). Dai et al. (2017) compared and evaluated the personal cloud storage products (PCSPs) in the Chinese market in order to identify the gap between them for promoting their service level. The results of the study revealed that storage space, file editing and fast transmission speed were identified by Chinese customers as key concerns while choosing personal cloud storage products. This means that the study of Dai et al. (2017) highlighted the effect of usability and responsiveness on customer perception of QoS in personal cloud services.

Similarly, Wu et al. (2017) reviewed the customer switching behaviour in personal cloud storage services in the Chinese market. The study focused on how risk, trust, switching cost and social influences influenced customer switching behaviour in Chinese personal cloud storage market. The importance of the study was that it shed light on how crucial risk, trust, switching cost and social influences were in customer perception of QoS in personal cloud storage services by determining their effect on switching behaviour. The results of Wu et al. (2017) identified that risk, trust, critical mass, switching cost, and social norm influenced customer attitude towards personal cloud storage services. The implication of this is that factors such as critical mass, switching cost, and social norms have strong influence on customer attitude towards personal cloud storage services.

The implication of the emergence of Mobile Cloud Computing on QoS perception in personal cloud services was an important area of research that attracted considerable attention in the last few years. The prominence of mobile cloud computing is on the rise due to the high utility and accessibility of mobile cloud

computing. However, QoS in mobile cloud computing is undermined by deficiencies in the handoff process. The reason for this is that the handoff process has a significant influence on mobile computing performance and hence plays a critical role in QoS provisioning in personal cloud storage services. One of the mechanisms outlined by Liao et al. (2016) for streamlining handoff in mobile cloud computing was the dual mode self-adaption handoff mechanism. This mechanism helped in reducing bandwidth consumption and in improving quality of handoff which in turn contributed to QoS provisioning. Likewise, Qi et al. (2016) outlined a multi-service handoff mechanism for reducing the redundant signaling problem in mobile cloud computing which adversely affected mobile cloud computing performance. The multi-service handoff mechanism was identified to be energy efficient and facilitated seamless handoff. The implication of these studies is that they shed light on the challenge posed by ineffective handover in mobile cloud computing and its effect on QoS perception in personal cloud services.

Security and privacy provisions in mobile cloud computing setting have also influence on QoS provisioning. For instance, Xu et al. (2016) note that mobile authentication during the handover process in mobile cloud computing needs to be conducted in an anonymous and secure manner to ensure QoS. Similarly, delay in a handover in mobile cloud computing is another factor influencing QoS provisioning as end-to-end delay in mobile cloud computing has a significant influence on QoS. This means that mobile cloud computing services that deliver lower end-to-end delay would have higher QoS provisioning. On the hand, longer end-to-end delay delays in a handoff in mobile cloud computing adversely affect QoS provisioning.

For instance, the study of Razaque et al. (2017) developed a framework for assessing QoS in Mobile Cloud Computing with the help of Secure Seamless Fast Handoff (SSFH) scheme. Razaque et al. (2017) identified seamless handoff between mobile and cloud infrastructure as a determinant of QoS in Mobile Cloud Computing services. This indicates that seamless handoff between mobile and cloud infrastructure need to be considered while reviewing the QoS of cloud computing services as personal cloud storage services are increasingly offering mobile access. However, seamless handoff in mobile cloud computing can be considered as an extension of the responsiveness construct of QoS.

Another important factor to consider while assessing QoS perception in personal cloud storage services is the implication of privacy awareness of customers. For instance, Wang et al. (2017) developed a model for cloud service evaluation using trust and privacy awareness of users and used the concept of time decay of trust and used decay time and transaction amount to determine customer trust in personal cloud storage services. The study indicates that time decay of trust needs to be considered in the study while evaluating user trust towards personal cloud storage services.

## **2.11 QoS Perception of personal cloud storage users in the aftermath of GDPR regulations**

The General Data Protection Regulation [GDPR] came to exist in the European Union on 2018 May 25. The GDPR has replaced the EU Data Protection Directive which was adopted in 1995. Regarding the Quality of Service [QoS] especially in the cloud storages, the people would be able to protect their right from the misuse of the personal information. Moreover, throughout Europe, there will be a unified law for all the people concerning the protection of information. The customers of the cloud storage will be able to enjoy high security and protection for their data, and these types of security and protection are assured by many of the storage companies including Google in the realm of Google Cloud services for the customers (Li et al., 2019).

Data protection by design and by default is a measure included in the GDPR, and according to this, the protection and safeguards of the customers' information are ensured as a defaulted responsibility of the storage app builders and the information can only be accessed by the informed consent. Hence, it can say after the implementation of GDPR regulations, the privacy of customers' information is highly concerned by the companies. In the case of Google, the security and safeguard of customers' information became the highest priority after the implementation of GDPR (Hoofnagle et al., 2019). For ensuring the security of the customers' information, Google appointed few professionals who are experts in the areas of privacy and security. Furthermore, Google sought the aid of lawyers, public policy experts and regulatory compliance professionals to look after the safety and security of the customer's information. The integration of these professionals in the storage

security allows the Google to go on with the regulations of GDPR and thereby security of the customers' information (Suhag, 2020).

As per the understanding of Sullivan (2019), unlike before, the GDPR regulations bring complete data protection of the people, and the companies in the European Union has the responsibility to abide the GDPR regulations. Among the total stored information of the customers, a large part of the information was sensitive (De Hert and Papakonstantinou, 2016), and before the implementation of GDPR, the protection of this information was a challenging task for the companies. However, the arrival GDPR regulations allowed the companies to ensure the safety and security of the customers' information. The GDPR regulations highlighted the probabilities of a large number of penalties if the companies do not go on with the GDPR (Graham and Dutton, 2019)

The implementation of GDPR created a state of seriousness among the storage service companies, and as part of it the companies began to follow the regulation namely 'Data protection by design and by default'. It was found that the top and middle leaders of the companies are ignorant about the number of storage apps that are currently used by the companies (Kumar and Reinartz, 2018). However, the introduction of GDPR forced the leaders to be aware and concerned about all the things regarding the storage services and this ultimately ensure the safety and security of the customers' information (Graham and Dutton, 2019).

## 2.12 Impact of Time decay of trust on GDPR regulations

It was found that the people of the United Kingdom especially one out of five members had complete trust in the organisations regarding the protection of their personal information (Carey, 2018). The GDPR assured the sensitive European Union customers to protect the right of secured personal information while integrating with any actions of the organisation (Hoofnagle et al., 2019).

Many of the companies began to change the yet existed privacy system and started to co-opt the new GDPR regulations. However, unlike the beginning, there have been changed impacts from the GDPR integration and the changing time can be considered as a major reason for that (Lund, 2021). As part of this, the end users were tired of plenty of received messages in the form of consent. The end users

have been mess up with the uncountable numbers of consent messages. Besides this, there have been phishing issues due to the GDPR integration by the companies. The phishing was not anticipated while beginning of GDPR (Hoofnagle et al., 2019).

Even though GDPR covered the protection of personal information of the people of the European Union, the time taught that the regulation would not be covering some of the important security aspects of the countries. Importantly, it was identified that the national security of the European Union nations had not been covered in the GDPR regulations (Li et al., 2019). Likewise, the other aspects of the countries like the justice system, police system and military have not been covered in the GDPR. Apart from these, it is found that in the GDPR regulations, scientific analysis and statistical assessment were not considered (Graham and Dutton, 2019).

According to Ooijen and Vrabec (2019), the GDPR regulations generated acceptance and at the same time contradictions, and many numbers of amendments have proposed after considering the controversy of GDPR. A big controversy against the GDPR was the necessary cost for the integration. It was expected the companies of the United States required around 42 billion USD for the GDPR integration. Likewise, the companies of the European Union has required around 200 billion Euros for the GDPR integration. It is identified that for the large companies like Google, Facebook, the integration of GDPR could not be a financial burden. However, for the medium and small-scale business firms, GDPR will be a big financial burden (Presthus and Sørsum, 2019). Some of the companies did not have the proper understanding and knowledge related to the GDPR, and this created a suspicion among them to incorporate the regulatory measures. However, some of the companies were well aware of the GDPR, and that is too two years before the implementation. These companies were well enjoyed to comply with the GDPR regulations (Li et al., 2019).

The big business firms were highly supportive of the GDPR because it will be a big contribution to the data management system. Some of the companies anticipated that GDPR would be a positive initiative for the internet system (Clarke and Furnell, 2020).

## 2.13 Service Quality and Cloud Service Quality

The SERVQUAL model was developed by Parasuraman (Kansra and Jha. 2016) and is the most commonly used approach to measure service quality to compare the expectations of consumers before a service encounter and an examination of the actual services delivered. The SERVQUAL instrument has helped measure the customer perception of service quality by adopting a five generic dimension or factor approach (Rodrigues et al., 2017), including:

**Tangibility:** Tangible factors including physical facilities, equipment and personal appearance.

**Reliability:** The ability to perform a given service in a dependent and accurate manner.

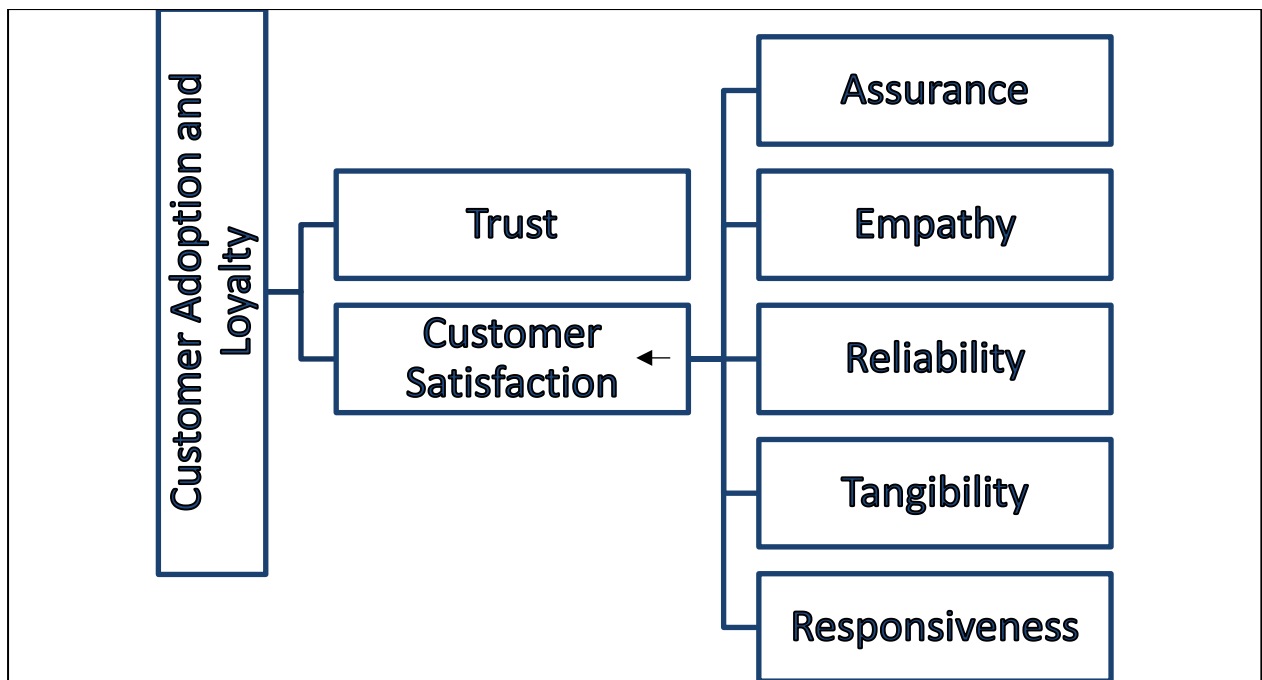
**Responsiveness:** Willingness to provide the necessary services to the customers.

**Assurance:** The employee knowledge, competence and credibility in providing service and instilling customer trust and confidence.

**Empathy:** Communication, understanding customer needs and access.

According to Yin et al. (2016), there is a significant positive relationship between the quality of service provided and the behavioural intention of the consumer, including greater loyalty and willingness to remain with the service. Extant literature has also linked service quality to outcomes like customer satisfaction (Chenetet al.,2010), trust (Gai et al., 2016) and commitment (Manuel, 2015). This is observed in the following figure.





**Figure 2.4: SERVQUAL**

Source: Adapted from Kansra. and Jha. (2016)

However, as Samimi et al. (2016) states, the provision of e-services includes the key element of technology and the lack of personal contact in the fulfilment of services. Extant literature, in the assessment of technology readiness of consumers (Gutierrez et al., 2015) and consumer-technology interaction in terms of advanced products (Bahrami and Singhal, 2015), indicates that there are differences in consumer perspectives while consuming e-services. Therefore, the service quality framework stated before may not hold the same level of validity. Therefore, the researchers have examined the relevance of the SERVQUAL framework in an electronic-service environment.

Liu et al. (2018) identify that e-service quality is linked to dimensions of ease of use, aesthetic design, security and speed of performance. Mohammed et al. (2016), on the other hand, identify the importance of performance, access, security, sensation and information. Berl et al. (2010) highlight the importance of responsiveness, reliability, functionality and enjoyment, while Wang (2013) indicate the importance of usability, security, accuracy, accessibility, timeliness, fairness and information sharing. Kansra and Jha (2016) identified that service quality includes efficiency, system availability, privacy and fulfilment as the key parameters.

Recently, the SERVQUAL model was used by Zheng et al. (2013) to identify the QoS in the cloud. The authors proposed a CLOUDQUAL model based on six dimensions of service quality, including usability, availability, reliability, responsiveness, security and elasticity. This model is derived from the e-SERVQUAL model and presents a clear framework for QoS assessment. However, as argued by Fiedler et al. (2010), the assessment of quality of experience in an e-service environment requires the assessment of the subjective views of the customer. In light of this view, the research will adopt the six dimensions of Zhang et al. (2013) by identifying subjective assessment measures rather than objective views.

Another factor which needs to be highlighted is the significant focus on the functional parameters of service quality in cloud computing. As Zhang et al. (2013) argue, functional parameters relate to the six dimensions of service which are highlighted through clear metrics. Many of these metrics were discussed in section 2.4 of this research. Zheng (2014) argues that non-functional properties detail the performance of a service by highlighting the example of Amazon which guarantees an uptime percentage of 99.9%. This clearly speaks to brand perception of the product. Similarly, Kumar (2012) contends that Dropbox has a clear service level agreement which is simple and aims at enhancing user understanding of the agreement. Furthermore, unlike Amazon, Dropbox assumes the burden of proof when it comes to SLA agreements. Therefore, the current research contends that the assessment framework should consider non-functional parameters including perceived value, user motivation and brand perception as determinants of QoS.

#### 2.14 Privacy Related Theories: General Deterrence Theory (GDT)

According to Yang et al. (2018), the use of GDT is to mitigate threats to reduce the risk of using the IS product through deterrence, prevention, detection and remedy techniques. These dimensions are discussed below.

**Remedy:** Apel and Nagin (2011) contend that there are three distinct categories of remedy including none, internal and external actions.

**Deterrence:** Whitman (2004) argues that the goal of deterrent efforts is to ensure that there is disincentive (discouragement) for IS abusers, to deter them from engaging in illegal activities. These are often considered as passive techniques and are largely

dependent on the compliance of the user with no clear mechanisms for effective implementation (Straub and Welke, 1998).

Prevention: According to Kankahalli et al. (2003), the use of preventive control is vital in enhancing protection against attack. Whitman (2004) contends that the prevention strategies including promotion of security services for the IS.

Detection: Straub and Nance (1990) contend that detection involves the attempt to discover a security breach. Probst et al. (2012) indicate that penetration testing and vulnerability assessment are key methods to enhance security challenge detection.

These parameters form the basis of GDT and can be used to identify threats to security as presented in the following figure.

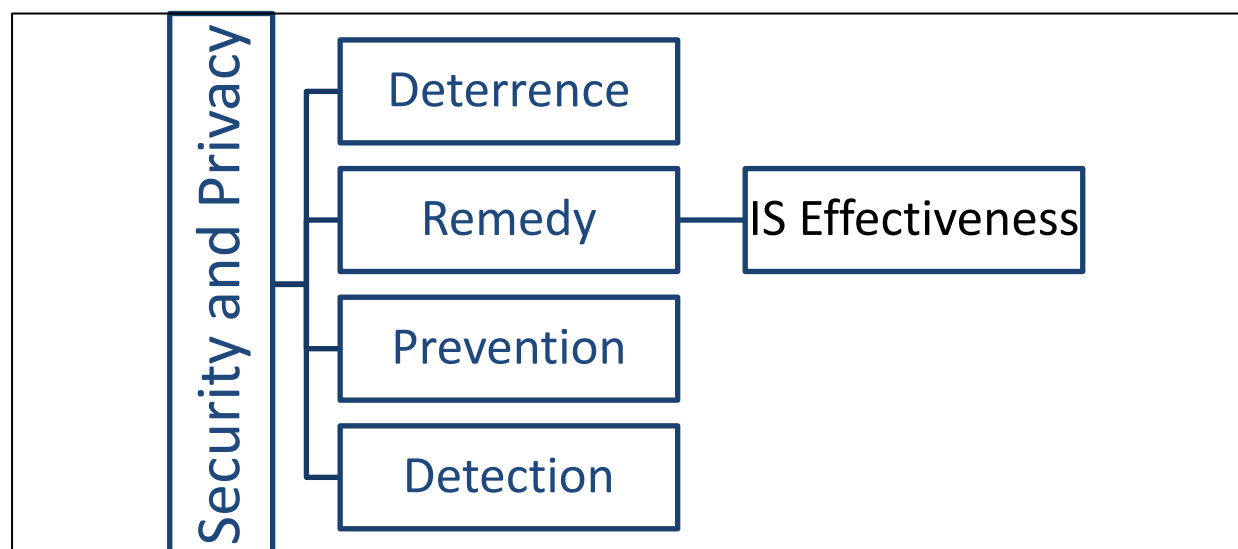


Figure 2.5: GDT Theory

Source: Adapted from Na et al. (2010)

Tian et al. (2011) contend that while companies and governments possess the ability and competence to enhance security in cloud storage, the promotion of the same for personal cloud is moderately more difficult. In their framework, they indicate that personalisation of cloud security is possible. Na et al. (2010) contend that it is common practice for consumer cloud storage services to offer a service guarantee. Furthermore, it is argued that the assessment of consumer willingness to store data,

the consumer acceptance of law enforcement monitoring and the consumer understanding of privacy agreements are key parameters to be considered.

## **2.15 Summary**

The purpose of this chapter was to present a detailed background literature on the research topic. From the above chapter, the following key conclusions are arrived at.

- The focus of this research is on personal cloud storage or customer cloud storage which uses an IaaS or a SaaS service model and a public deployment model.
- The research on personal cloud computing has focused on efficiency of performance and benchmarking of the functional parameters of customer cloud storage to identify different results. However, there has been limited focus on comprehensive QoS assessment and lack of focus on non-functional parameters, especially in the personal cloud storage arena.
- Security and privacy concerns are the most important parameters governing cloud storage adoption and most research in this area addresses enterprise level privacy and risk assessment. This identifies a need for personal cloud privacy and security assessment.
- The next chapter will provide a detailed outline conceptual framework of the current study.

## **Chapter Three: Conceptual Framework**

### **3.1 Introduction**

In the last chapter, literature reviews were the key discussion. As part of this, various dimensions of cloud computing, models and cloud computing basics were discussed. An analysis of personal cloud storage also conducted. On-demand services, broad network access, pooling of resources, elasticity and measurement of services are some of the characteristics of cloud computing. Technology acceptance model and Extended TAM model were discussed as cloud computing models. It was understood the features and characteristics of personal cloud storage platforms. The capability of utility factors on cloud storage adoption was understood. Although cloud storage adoption brings benefits, the particular have privacy and security concerns for the people, like personal data. Likewise, network lose is an important threat to cloud computing technology adoption. An exclusive discussion was conducted in chapter two by considering Service Quality and Cloud Service Quality.

The third chapter will discuss the theoretical basis of the research by highlighting the relevant theories and the association between the theories and the research focus, and will thereby identify the research gap and the study theoretical framework.

### **3.2 Research Framework**

Monitoring instruments are necessary in preserving QoS and maintaining the performance of an application. Because of the complications of the Cloud Service Stack and the dependence on a series of infrastructure apparatus (network, depository or storage and calculative resources) in the formation of a cloud, there are several monitoring difficulties which need to be overcome (Katsaros et al., 2011). Monitoring of dispersed structures and network is quite an old field of research (Zhang et al., 2010) and in cloud computing many providers examine multiple monitoring methods. The monitoring of cloud resources, stages and applications requires varied instruments and methods. It is observed that data from the dynamic character of a cloud settings platform and application performance metrics is tough to collect and monitor in the more progressive cloud deployment models, such as hybrid clouds. In light of such view, it can be argued that key factors associated with

QoS include the factors like to flexibility, elasticity and provision of required parameters.

Many cloud customers have specific restrictions regarding the legal boundaries in which their data or application can be hosted (Schubert et al., 2010). Supplying resources in specific geographic locations to meet regulations in place of those customers is an essential issue for a provider who wants to serve them. These regulations may be legal (e.g. an existing legislation specifying that public data must be in the geographic boundaries of a state or country), or defined by companies' internal policies (Calheiros et al., 2012a). Cloud interoperability provides an opportunity for the provider to identify another provider able to meet the regulations due to the location of its data centre. Therefore, the provision of cloud computing needs to be examined from a privacy provision perspective.

Another key performance linked metric can be the role of cost as a key factor. Kune et al. (2016) explore the Amazon data depository service S3 for scientific data exhaustive applications. According to them, S3 accumulates at one pricing strategy for all three data features, i.e. high endurance, high accessibility and quick access; most applications do not require everything to be amalgamated. For instance, an archival depository does need endurance but can exist with lower availability and access accomplishment. Thus, it is recommended that S3 should offer services using several restricted classes of service so that users may select their personal endurance, availability and access performance blend to improve costs (Kune et al., 2016). Thus, the expense is higher with depository service group endurance/availability/access performance all at once. Nevertheless, this is a problem only for big firms, while medium and small-scale firms are not impacted by it as they also receive cost advantages. They say that as of now, cloud provisions are most appealing for small and medium-sized firms and most customers of clouds are small firms (Lubinsky and Boris, 2009). The explanation for this is that smaller firms do not have the choice of expanding themselves into enormous data centres. Cost instability is a fundamental factor of cloud computing and when firms choose cost clarity, scalability and cost instability, a new argument and opportunity emerges (Qamar et al., 2010). Such similar trends are expected to extend to private clouds and should be considered as factors impacting QoS determination.

The focus of this section of the theoretical framework is to understand the factors impacting quality of service in personal cloud computing platforms from a non-traditional QoS metrics platform. According to Heart (2010), an examination of IT service quality requires a focus on partnership, trust, consumer perception of brand image and loyalty as key factors. The author arrived at a positive link between trust and partnership when considered in relation to a SaaS platform. Similarly, Zargar et al. (2013) argue that when there is use of control mechanisms in IT services, there is a positive link between trust, communication and cooperation within the relationship. The link between customer satisfaction and service quality has been explored by Ma et al. (2005), who examine IT service provision and contend that when there is an improvement in quality of service provided, there is an improvement in customer satisfaction, and that such an improvement can be moderated by the consumer perception of the brand image and brand communication platforms.

However, it is important to examine how service quality and loyalty are linked, especially in the IT services sector. For instance, in general, perceptions of service quality are found to be positively linked to existing activity signals (Bhargava and Sun, 2008; Zeithmal et al., 2002). Furthermore, Fan et al. (2009) also argue that the efforts that need to be undertaken in order to improve service quality should involve a clear assessment of how the brand is perceived by the customer. Such explicit signals of service quality like brand image perception positively impact consumer attitude and satisfaction with quality of service. However, as argued by Reichheld and Scheffer (2000), to gain customer loyalty and promote service quality it is important to gain their trust through good service provision. Furthermore, Rosanas and Velila (2003) contend that the continued use of a particular service or product will come about only if and when customer trust is gained. Therefore, customer perception of service quality, while impacting brand loyalty, is also dependent on customer perception of trust.

On the other hand, Liu et al. (2009) identify that customer perception of service quality can be linked to satisfaction with prior experience of IT services. Bardhan et al. (2010) also indicate that IT service providers often work to increase quality assurance by examining the methods which can help contribute to improvements in design and delivery. Lyons et al. (2012) examine the role of service quality and

customer satisfaction by linking the same to consumer perceptions of the type of service provided, especially in two-pricing models. Since most personal cloud service platforms adopt such a freemium approach, the views of Lyons et al. (2012) can be considered to have considerable significance to the current research. The authors identify that when there are two types of pricing system for a similar service, the customer patronage of the service and the expectation of quality from the service are dependent on what they believe can be accessed at a lower cost. Similarly, Wagner and Hess (2013), in their examination of digital music platforms, contend that the presence of free versions often have a negative impact on user intention to pay for premium versions. However, the authors also contend that users often have limited expectations from free versions, and do not react negatively when there is a service failure. Therefore, customer satisfaction and quality of service can be linked to customer expectations and customer trust.

According to extant literature (Lockett et al., 2011), the importance of partnership as a key aspect of service quality is well examined in the IT service industry. Chen et al. (2015) indicate that when there is a healthy partnership between service providers and the firms which undertake the service, then there is better provision of service quality. Garrison et al. (2015) also argue that there are multiple factors which affect the type of working partnership that is existent between firms and service providers, including communication, cooperation and conflict resolution. Ou et al. (2014) contend that such partnerships can extend beyond services provided to a firm to services provided to an individual. Therleksen (2015) argues that brand management and brand communication aim at establishing a personalised relationship between service providers and individuals. Therefore, the role of partnership can now be extended beyond firms to individuals and is considered a key focus of the current research. Goo et al. (2007) indicate that the importance of partnership in IT services like the provision of application services has been moderate. For instance, the authors contend that the ASP providers and small firms, though they have a good relationship, often show polarised views with respect to risk taking. As argued in this research, privacy and protection are key factors impacting customer expectations. In the light of such a view, the current research argues that personal cloud storage consumers may expect equal responsibility to promote privacy.



According to Zargar et al. (2013), since services are different from physical goods, it is important to understand the role of trustworthiness of the ASP and the willingness to provide services as a part of service quality. As Yang et al. (2018) argue, due to the imprecise nature of service provision and the lack of consistency in partnership requirements, the perception of the service provider as a partner can be considered as a key factor contributing to consumer service perception.

From the above evidences, it is evident that both standard and non-standard QoS parameters can be linked to the provision of good quality of service on cloud computing platforms.

From the above theoretical assessment, two primary areas of research gap are identified.

- a. There is a need for a comprehensive assessment of functional and non-functional parameters of personal cloud storage QoS.
- b. There is a need for security and privacy assessment from the perspective of the consumer as well as from that of the personal cloud service provider as a key component of service provision.
- c. 3.3 Theoretical framework

Based on the findings emerging from the review of recent literature, the conceptual framework is derived. The conceptual framework is given below.

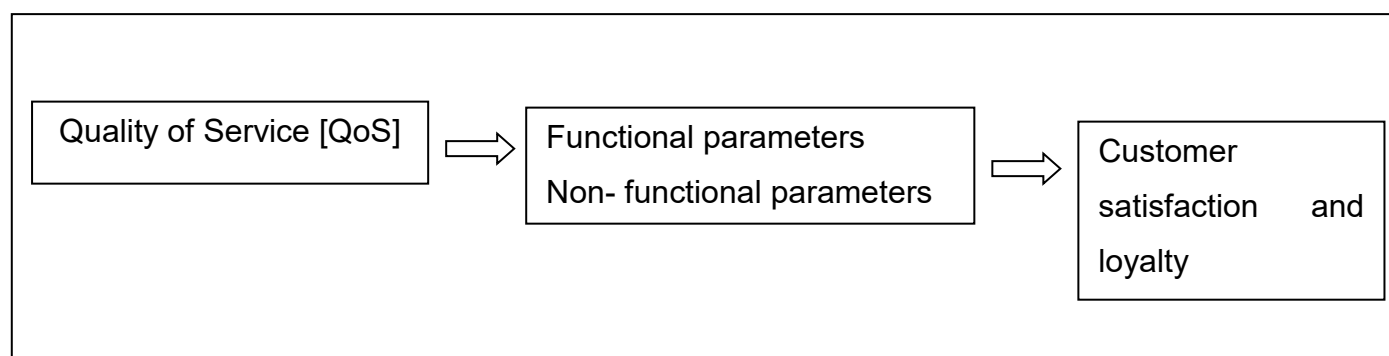


Figure 3.1: Conceptual framework

The above conceptual framework indicates that QoS perception of users in enterprise cloud storage service influences customer satisfaction through the functional and non-functional parameter of personal cloud storage service. Customer satisfaction, in turn, drives customer loyalty and commitment. However, the security

and privacy element of enterprise cloud storage services determine user trust in enterprise cloud storage services and hence influence customer loyalty and commitment.

The aforementioned conceptual framework depicted the contributory factors associated with Quality of Service, privacy and security. The framework illustrated security and privacy in the context of the organisation and the customer as well. The security was observed as a crucial element in the organisational aspects as it was embedded in the aspects of detecting the threats, incorporating preventive measures and remedies alongside the deterrence of the security concerns and privacy issues. The detection of privacy and security issues were perceived as an important aspect of instilling trust in the service utilisation. The security and privacy aspects with regard to the customer depicted the aspects of compliance to the GDPR regulations, the extent of service utilisation, knowledge about policy agreements, willingness to store and the adherence to prevailing legislations. The customer's compliance with the GDPR regulations and prevailing laws are a crucial factor in ensuring that the customers and service providers are bound together. Besides, the understanding of the privacy agreements plays a pivotal role in gaining perspectives on the extent of service options and its limitations as well. Moreover, the familiarity or magnitude of service utilisation is imperative in the intricacies of policies and contractual agreements involved.

The conceptual framework further depicted the functional and non-functional aspects of the quality of services. The functional parameters depicted the aspects of reliability, availability and responsiveness. The availability and reliability were observed to be innate elements attributed to the overall functionality and quality of service offerings. The responsiveness; however, was deemed as an innate element that influenced the satisfaction of the customers and endorsed their loyalty and commitment towards the service offerings. Moreover, the functional parameters were observed to be the primary influencers that invoked customer interests and affinity towards the service offerings. The non-functional elements associated with the quality of services were also crucial influencers in the customer's adherence to the brands or service providers. This included parameters such as usability, elasticity, brand perception, user motivation, switching cost, perceived value, social norms and critical mass. The non-functional elements are often attained by the familiarity of the customers with the

service providers and are often indirectly associated with their utilisation experience. Besides, the non-functional influencers are perceived as key influencers in the customer's inclination to sustain or cease the service offerings from a specific provider. Thus, the conceptual framework highlighted contributors of trust, loyalty and commitment though concerns associated with privacy, safety and quality of services.

It can be understood from the conceptual framework that quality of service has a direct link with customer loyalty and customer satisfaction. As part of this, if the functional and non-functional parameters are adhering to the QoS, loyalty and satisfaction of customers could improve. Regarding the functional parameters, usability, responsibility and availability may matter for customers. Likewise, perceived-value is a non-functional parameter that also affects the loyalty and satisfaction of customers. In short, the QoS can determine the loyalty and satisfaction of customers with reference to cloud computing services. By considering this, the second hypothesis of the current study can be considered as true, as the quality of service would encourage customers to adopt the cloud storage service.

### 3.4 Hypothesis

H0: Quality of Service will not affect cloud storage service adoption of the enterprise

H1: Quality of Service will affect cloud storage service adoption of the enterprise

### 3.5 Summary

Through this chapter the researcher clearly deliberated the theoretical basis of the research by highlighting the relevant theories and the link between the theories and the research focus and also analyse the gap in the present study. Moreover, the conceptual framework design outlines that the effect of Quality of Service on enterprise could storage service adoption.

## **Chapter Four: Research Methodology of the Study**

### **4.1 Introduction**

The research is that process which is mainly performed by an individual analysing a particular topic logically and systematically so that it will help in enhancing the knowledge level. In addition to this Neuman (2013) opines that the researches are those investigations, which are performed based on the observations and reasoning thus it will facilitate knowledge discovery. However, Mackey and Gass (2015) elucidate that the research study in the business and management context are mainly linked with one of the two situations. First one is associated with the development of a solution for the practical problems and is often referred to as applied research. The second one is linked with the academic theories, which are taking the role of pure research. Whereas while considering the researcher that are at doctoral levels they are purely evaluated based on the novelty and originality (Taylor et al., 2015). Further, such investigations are regarded as the applied research, pure research a combination of both the category. In addition to this, the notion of Lewis (2015) explains that the primary purpose of all research is to develop new insight from the existing ones and obtain a new interpretation of the predefined facts. Moreover, the research studies help in replicating the current studies in a deeper aspect or in interpreting the facts from a different perspective, which is capable of answering the research question (Silverman, 2016).

Further, from the observation of Flick (2015) research study is always associated with the gathering of data and is all about theories and facts. Apart from this Chen (2011) while determining a design for conducting the research study, the philosophies are given higher importance as they play an essential role in completing the research study by clarifying the research design and facilitates the choice of an appropriate one. Moreover, there are different categories of research philosophies, and each is associated with specific research methods that are helpful in conducting the study.

The current chapter details the various strategies and plans that have been adopted by the researcher in answering the research question that is systematically described in the research question. To achieve this several philosophical and

methodological ideas and concepts are utilised for conducting the qualitative research study. As per Kazdin (2011) having a detailed knowledge of the different research approaches will help the researcher in obtaining the approaches that are best suitable for the current study. Thus in this section, the researcher will be dealing with existing relevant theories and facts associated with the research methods that will be helpful for the researcher. Various existing studies and papers will be utilised by the researcher in obtaining a detailed overview of the research methods.

Further, in the research study, the research methods hold a prominent role in the course of a research study (Brannen. 2017). Such that it is necessary to justify the selection of the research strategy, research approaches and the corresponding data collection methods that are associated with the epistemology of the research (Kitchin and Tate, 2013). In addition to this Carspecken (2013) opines that the research methodology is not actually what the chosen method is, but it is the justification to the decision which methods are appropriate to the context and why it is suitable when compared to others. Thus the section will focus on determining the proper research methods and state the relevant justifications.

Further, the primary goal of this chapter is to detail the current study's research methodology which has been applied in this study. The chapter delves into the research design and data collection methods, and thus it incorporates a discussion of why the selected specific research method has been chosen in preference to others, as well as highlighting the advantages and challenges of utilising the chosen research instrument (Questionnaire Numerical) and Interviews (Non-Numerical). The chapter provides a summary of the various methods and approaches used and their justification. The current section will also detail the ethical considerations which are a part of the study.

This research will be based on positivism research philosophy as it enables the adoption of the philosophical stance of the natural scientist and employs the deductive research approach in line with survey and interview research strategies for gathering the data. Thus the researcher will be utilising both the qualitative and quantitative research methods in completing the current research study. The present research is primarily involved with collecting primary data. Moreover, the primary data, in the case of the current study, is obtained via questionnaires and interviews.

A closed-ended questionnaire was used by the present research to gather the necessary quantitative primary data. The study also uses a semi-structured interview method to gather additional relevant primary data. Further, the quantitative data is analysed using SPSS software to arrive at underlying trends. The qualitative data will be evaluated with the effective utilisation of the thematic analysis to arrive at basic, organisational and global themes. Thus the chapter will provide a detailed description of the various methods that are adapted to conduct the study and will provide the justification for the reason of selecting the corresponding methods.

## **4.2 Ontological and epistemology consideration**

Typical research is conducted based on the human knowledge of the topic. It is also based upon the nature of the problem, which provides a basis for the research process. It is a familiar doubt to arise while going through the research that why should one go through the philosophical position of the researcher (Angeli and Valanides, 2009). The understanding of the philosophical assumptions and statements that define how things in the world tend to exist is also considered to be an essential aspect one should know. Of note, Al-Ababneh, M. (2020) claim it is only through realising this truth or fact regarding the various phenomenon of the universe that one can draw ample knowledge to explain why these happen, whereupon these lead onto attaining either quantitative and qualitative information or both. Amendments to this knowledge related to what has been discussed above are to be made if needed. On this ground, there arise various philosophical assumptions that form part of a research activity where these are primarily governed by two concepts, namely, ontological and epistemological (Sherratt and Leicht, 2020). Thus, it can be logically ascertained that most of the debates among the philosophers are connected to the various aspects that come within the realm of these ontological and epistemological categories. Hence, these two concepts affect the philosophical stance significantly, which as well determine the way a research should progress on (Poucher et al., 2020).

When specifically mentioning about the ontological perspective of a research study, this largely concerns with reality as it exists on earth, where only figures and facts are meant to be drawn and therefore, typically carry a quantitative understanding (Mkansi and Acheampong, 2012). Notably, positivism belongs to this branch of

philosophy and researchers adopting this strictly adhere to gathering knowledge of the various phenomena happening around without any tinge of interpretations or manipulations as such (Baumgartner et al., 2021).

Research studies that rely on the Epistemological stance deal with the quality of the knowledge within the research scope (Sherratt and Leicht, 2020). This is unlike what can be seen with the ontological approach, and pertains to develop an understanding, which bears from human intellect, and where one can come across varied perspectives that adds to the qualitateness of the study; in short, obtaining a qualitative rigour to the same (Brun and Doguoglu, 2016).

Outside the realm of philosophers and philosophy, even the social and scientific researchers are connected to these two concepts of philosophy and so are their works. Hence it plays a major role in the methodology section of the research (Yilmaz, 2013). As elucidated by Sutton and Austin (2015), it is also assumed that the various philosophical assumptions a typical researcher takes within the context of their study, the training they had, will play a crucial role in determining the same. The understanding and awareness of the philosophical aspects connected to the research topic offer tremendous boost to the quality of the research. Moreover, the understanding of these philosophical aspects helps the researcher to induce creativity (Poucher et al., 2020). Further, the importance of these factors upon typical investigation cannot be overlooked. Where these branches of research philosophy come within the domain of Research Methodology, the latter is referred to as a set or a combination of techniques that can be employed to obtain relevant, as well as in-depth insights into a specific issue (Rahi, 2017).

The better understanding of the relation between these three concepts, those, being Ontology, Epistemology, and Research Methodology is a major requirement when the designing of any research has to be done (Leavy, 2017). A more profound knowledge of the research philosophies is provided by examination of ontological assumptions in detail. Considering the case of social research, these include constructionism, phenomenology, and subjectivism (Nelson and Cohn, 2015). Regarding the case of the present study, the topic is to understand the customer perception regarding the quality of service that can be availed through the personal cloud-storage, where firms providing these have included Google, Drop Box, and

OneDrive (Bogner and Menz, 2009). Through the selection of the ontology, it defines the way in which we consider the research topic. Considering the fact that there are mainly two types in which a typical research topic can be investigated, either objective or subjective, researchers can identify such by undertaking a critical analysis of the topic, whereupon they can omit approaches that are irrelevant to the nature of the study (Alharahsheh and Pius, 2020). For instance, if it is identified that a research project carries with it an objective nature, the person conducting the same can omit the opinion or perceptions from getting involved in the research topic and the research is completed entirely through the assessment of facts and figures (Idowu, 2016). Similarly, the subjective nature defines the method in which typical analysis is achieved by involving the opinions and perceptions of the researcher along with the study (Denzin et al., 2017).

Through the type of ontology selected by the researcher, he/she defines the nature of reality within the context of the research topic. In this research, the researcher is considering the objective method for the ontological aspect of the study. For this research, the interpretivism aspect is selected for the conduction of the study (Ryan, 2018). In this aspect, the opinions of the participants are considered by the researcher to understand customer satisfaction from the maintenance of the cloud services (Tuli, 2010). Through inducing an objective element of ontology, the researcher removes the personal opinions and considerations from the construction of the research. The research is entirely based on the perception of the research participants (Duff, 2018).

While considering the case of epistemology, it defines the nature of the knowledge. Since the researcher chooses a subjective nature of the reality for the completion of the research, the kind of the type of data to is similar. Hence, the subjective quality of information is chosen for the study (Walls et al., 2011). Through the subjective nature of data, the researcher only has the role of collecting the required data for the research; he/she will not add their opinions and perceptions to the mix (He et al., 2019).

The epistemological aspect is considered to possess similarities with ontological elements considering human behaviour. Various epistemological interpretations consist of deduction of reasonable certainties (Jun and Fletcher, 2014). These



reasonable certainties are then mixed with multiple logical and mathematical components. The interpretivism philosophy is used by the researcher to understand the influence of the service quality on customer satisfaction (Rahi, 2017). The interpretive aspect of epistemology is found to assist the researcher in differentiating between personal disparities and socio-cultural aspects (Tuli, 2010). These aspects are then removed from the research to provide various observations connected to the research topic. One of the major problems to face through this method is the acknowledgement of multiple changes introduced by variations in perspectives (Alharahsheh and Pius, 2020).

Considering the case of a realist person, they always enjoy the hard faces of truth rather than the sugar-coated lies. Hence they still prefer realities from social scenarios and physical aspects (Idowu, 2016). The realistic foundation within ontological research connected with post-positivism is evident. The ontology combined with post-positivism considerable relation with realism produces the required success through inducing innovations and contemporary knowledge (Jonassen and Land, 2012). The inability of humans to thoroughly understand the reality through the senses influences the post-positivist perspective regarding realism (Duff, 2018).

The foundation of socio-cultural upbringing is these perceptions of reality. The social constructivism is directly connected with the ontological implications of post-positivism (Jun and Fletcher, 2014). This social constructivism describes both the predictability of creative elements and free will. The objective understanding of societal developments and human interactions by classifying the same into predefined patterns and algorithms were argued by constructive social post-positivism (Maxwell, 2014). The human resource management of the business aspect which contains synergy and correlation are significant functions that drive the progress and the sustainability of the organisation (Leavy, 2017).

The epistemological aspect of post-positivism can be understood through relationships, knowledge transfer and scientific methodologies (Al-Ababneh, 2020). The independence between the research and the researcher produces the regularities and other various recurring patterns. According to Baumgartner et al. (2021), the continual analysis of the connection between the regularities and

connected with the social upbringing have resulted in the knowledge transfers within the post-positivists paradigms. Considering the case of epistemological aspect, the main focus is on whether the research uses observable phenomenon or subjective versions of meanings of the research topic (Poucher et al., 2020). Regarding the example of the positivist approach, it promotes to adopt various methods within research which are used for studying social reality. This aspect also suggests that if the researchers have included multiple elements such as extreme care within the research aspect, improvement can be attained in many ways (Ryan, 2018). As the theoretical underpinnings are essential for providing the authenticity of various developmental efforts and for recognising the areas which require extended focus. Hence it applies to business development (Sider, 2009). When the study of natural phenomenon is compared with psychological, cognitive, social and behavioural research, it exhibits disparities through interpretations and descriptions (Alharahsheh and Pius, 2020).

Adding to this the various aspects of conceptual knowledge and linguistic elements are essential for creating efficiency in operation along with creating efforts for maintaining connections with clients, multiple HR functions and customers (Duff, 2018). Hence various epistemological paradigms describe the need for establishing great communication. These epistemological paradigms also provide information interchange and conceptual framework (He et al., 2019).

Within this research aspect, the researcher primarily focuses on the opinions and perspectives of the customers from the users of cloud service. Hence the primary focus is put upon the perceptions and beliefs of the customers who use cloud storage for their works (He et al., 2019). Since this work focuses on the opinions and judgments of the cloud service users, this study is categorised within the interpretive type of study (Smith and Ceusters, 2010). It is found from the study of Ryan (2018) that within different kinds of researches in the interpretive aspect of the study. Within this aspect, an inductive process is included so that new theories could be built from the data collected through the research. But the researcher plans to take sensible and realistic methods for the selection of various ways for the completion of the study. Through the introduction of a pragmatic approach for the selection of various

methods for the completion of the research, such as the deductive method for the study, helps to assess the opinions and perspectives better (Al-Ababneh, 2020).

#### 4.3 Research approach

In this research study, the researcher has adopted the deductive research approach for analysing the personal cloud storage service. According to Barratt et al. (2011) research approach or research, the method is a plan and procedure for conducting the research study, and it consists of the phase of broad assumptions to data collection methods, data interpretation methods and data analysis methods. Hence the research approaches are generally used to identify the nature of the research issues. Likewise, Maxwell (2012) mentioned that the approach of data collection and analysis are the two essentially divided categories of the research approach. Further, deductive research approach, abductive research approach and inductive research approach are the three major types of research approach (Alharahsheh and Pius, 2020).

As per the observation of Sekaran and Bougie (2016) the inductive research approach or in another word inductive reasoning deals with the creation of new theory emerging from the data. Moreover, this type of research approach is mainly connected with the qualitative research study and does not comprise the design of the hypothesis. Gray (2013) mentioned that the inductive research approach is also known as “bottom-up “ approach and it generally starts with research aims, research objectives and research question, and that is essential to attain through the research study, and it provides an alternative to theory. Gale et al. (2013) mentioned that the inductive approach generally starts with general observation and researcher leanings to cultivate empirical generalisations and researcher has defined the phenomenon that is being researched. Further, the inductive approach is based on learning from experience, and it does not imply disregarding theories when formulating research objectives and research questions (Alharahsheh and Pius, 2020).

Bryman (2016) mentioned that the Deductive approach is described as a research reasoning form the particular to general and hence through deductive research approach the researcher has developed a hypothesis based on the present research studies and researcher has tests the hypothesis is useful in given situation. In simple

terms, Glaser (2014) mention the deductive approach starts with existing theory and leads it into a new hypothesis or is reasoning from the all-purpose to particular. Deductive research approach is also known as “top-down” approach. The main difference between the inductive approach and deductive approach is the relevance of the research hypothesis to the research, says Žukauskas et al. (2018). Moreover, the qualitative data uses inductive research approach, and quantitative data uses the deductive research approach.

The abductive research approach is also known as abductive reasoning. From the observation of Singh (2015) the abductive research approach is set to describe the weakness associated with inductive approach and deductive approach and initiate with an incomplete set of proceeds and observations to the likeliest credible explanation for the set. Further, in this approach, the process of the research is devoted to puzzles or explanation of surprising facts, incomplete observation specified at the beginning of the research study (Rahi, 2017). Further, this research approach is essential because it is often infinite and any number of possible explanations for a research question (Rowley, 2012). As per the observation of Holmström et al. (2009), the research approach selection is generally associated with the type of research issue is being addressed and besides, through researcher personal experience, the research issues are addressed.

By adopting the deductive research approach, the researcher has conducted a systematic literature review on the current trends in personal cloud service, and hence the researcher has understood user requirements (Glaser, 2014). According to Gioia et al. (2013), the significant advantages of the deductive research approach is it offers a possibility to explain causal relations between the variables and concepts of the research topic and quantitatively measure the concepts of the research study. Hence, in the current research study, the deductive research approach has aided the researcher to understand the relation between the personal cloud storage service and the quality of services (QoS). One of the primary reasons for selecting the deductive research approach is the deductive research approach is highly associated with the positivism research philosophy. Using a deductive approach requires testing of an already formulated theory (Mauldin, 2020). A deductive approach is the most commonly used research approach in the academic

world, where laws present the bases of explanations. One of the simple reasons for this is that when an issue is clearly defined, and there is a need to understand and quantify the relationships between variables or parties, then deductive logic (Schutt, 2019). This, in turn, allows the expectancy of phenomena and calculation of their incidence and thus provides control of them (Collins and Hussey, 2009). A deductive approach requires the formulation of a hypothesis that links the various variables and concepts related to the research question. The testing of the hypothesis follows this. In the current research, the hypotheses test the determinants of QoS and security and the associated impact on customer trust, satisfaction and adoption. Further, the deductive research approach helps the researcher to propose and develop a framework that addresses the challenges faced by personal cloud computing service such as the user requirements, privacy and quality of services (QoS).

#### **4.4 Research design**

Saunders et al (2009) observe that for many inexperienced researchers the process of designing a formalised research methodology can be a daunting task. In order to assist with this task Saunders et al (2009) have designed a research framework which provides a structured means of establishing the most important aspects to take into consideration when preparing a research methodology and supporting research instrument. They have called their research framework *The Research Process Onion*, so called because Saunders et al (2009) believe that investigating a research area is akin to peeling back the layers of an onion in order to reach the core of the research problem. A schematic of the framework is shown in **figure 1** below.

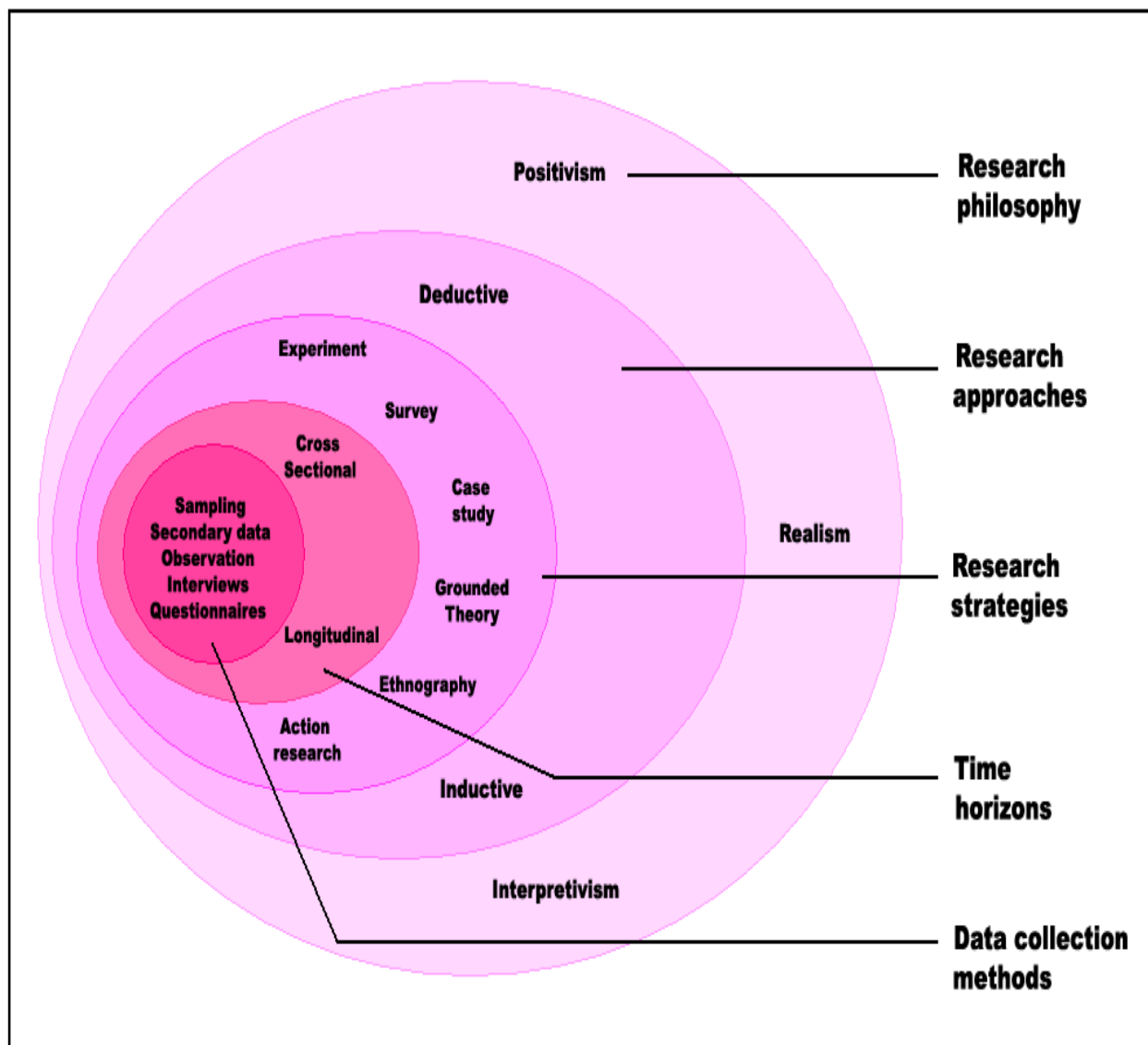


Figure 4.1: The Research Process Onion, source Saunders et al (2009:108)

It is this framework which will be used to form the structure of the remainder of the chapter and thus identify the most suitable research methodology for this study.

The research design is a step-by-step method that a researcher utilises to carry out a scientific study. As per the opinion of Abdulkadiroğlu et al. (2017) research design is the overall synchronisation of recognised components and data ensuing in a reasonable outcome. In order to decisively come with a precise and reliable finding, the research design should monitor a strategic methodology in line with the different type of research selected. The research design mainly focuses in the logical issue, and not a logistical issue and its main function are to assure that the evidence attained enhance the researcher to address the research issue logically,

unmistakably as possible efficiently. Turner et al. (2017) mentioned that the way in which researchers advance research designs is basically influenced by whether the research questions is descriptive, explanatory or any other types of research designs and also affects what data is gathered. Moreover, Iacono et al. (2018) stated that the social research needs a design before data collection and research design is not just a work plan in which details what has to be done to finish the project but it is the type of work plan that will own from research design of the project. The necessity for research design stems from an incredulous approach to research and a view that scientific information must always be provisional and its main purpose to limits the uncertainty of much research evidence. Ioannidis et al. (2014) pinpoint that, good research design will anticipate competing definitions before gathering information and hence essential data for examining the relative advantages of these competing descriptions is attained. Research designs are rarely evaluated with quantitative and qualitative research techniques. Furthermore, social survey and experiments are recurrent monitors as prime examples of quantitative research and are examined against the weakness and strength of statistical, quantitative research techniques and analysis. In addition to that Lewis (2015) analysed that research design is distinct from the method by which information is gathered.

Many research techniques texts complicate research design with methods, and it is rare to watch that research design treated as a model of data collection instead of a logical structure of the investigation. Lewis (2015) stated that well-developed research design should attain some specific features such as recognise the research issue properly and justify its selection especially in connects to any authentic alternative design that could have been used. Furthermore, a good research design should synthesise and review previously published literature connected with the research issue and explicitly and precisely explain assumptions central to the issue. Moreover, the perfect research design efficiently explains the information, which will be essential for satisfactory testing of the assumptions and define how such information will be attained and describe the methods of analysis to be applied to the data in predicting whether or not the assumption is correct or not (Kratochwill, 2015). The research design is majorly divided into three such as are explanatory research design, exploratory research design and descriptive research design. The explanatory research design is mainly focused on defining the aspects of the research study in a comprehensive manner. The explanatory research design is

carried out for a problem, which was not well reached before, produces an operational explanation, demands priorities and offers a better researcher model (Tetnowski, 2015). Exploratory research design mainly utilised to provide conclusive evidence and also aid the researcher to attain a better understanding of the problem. Ponelis (2015) evaluated that for conducting the exploratory research design, the researcher was able to alter his/her direction as an outcome of exposure to new insights and new data. Moreover, this research design is utilised to determine the mode of the problem and also to explore the research questions and does not intend to deliver conclusive and final resolutions to current issues. The descriptive research design is a scientific technique which includes explaining and observing the behaviour of a subject without impacting it in any way. Furthermore, Thomas et al. (2017) defined that descriptive research design is a valid method for investigating certain subjects and as a forerunner to more quantitative studies.

For the current study, the researcher has outlined the purpose of research design in mixed method research. Mixed methods research represents more of an approach to examining a research issue than a methodology (Palinkas et al., 2015). With the help of this mixed method research design, the researcher was able to attain essential data by analysing and integrating qualitative and quantitative research. Furthermore, this research design helps the researcher to understand the research comprehensively than either quantitative or qualitative approaches alone, and it helps to identify the resolution for the research issue without any difficulties. By utilising the mixed-method research, the researcher was able to provide stronger, more forceful evidence to support a conclusion or set of recommendations for developing a framework allowing for the evaluation of personal cloud services (PCS) depended on the key attributes of QoS and privacy. Apart from that, by utilising the mixed method research, the researcher can able to conduct the study effectively by producing more in-depth knowledge and understanding of the research issue that can be utilised to upsurge the generalizability of findings applied to theory or practice. Besides that this design helped to generate new insights, new knowledge or uncover hidden insights, relationships or patterns that a single methodological approach might not reveal and hence the researcher can easily to build and propose framework that addresses the challenges that personal cloud computing services encounter in terms of privacy, user requirements and Quality of Service (QoS).



#### **4.5 Research strategy**

A research strategy is a systematic plan of action that provides instructions to thoughts and efforts of the researcher while conducting the research study. Saleh et al. (2015) stated that the research strategy is empowering to carry out the research in a step by step format and on schedule to generate quality outcomes or findings and comprehensive reporting. Moreover, research strategy aid the researcher to stay concentrate on the research topic, decrease complications, improve quality and most fundamentally, save resources and time. Similarly, Marean et al. (2015) explain that the research strategy is the fundamental elements of the application, defining the rationale for the research and the experiments that the researcher does to achieve the desired objectives and goals of the research study. As per the opinion of Bragge et al. (2015) research strategy defined as the general procedure of how the researcher will go about responding to the research questions. Likewise, Gates and Cysique (2016) analysed that research strategy strengthens the researcher to response the research questions or the sub-questions which frame the structure and flow of the research study. Hence the need for criticising a research strategy is depended on the objectives and aims of the research study. Furthermore, the choice of research strategy is directed by the research question and objectives and also the availability of the amount of time, the extent of existing knowledge is essential. The major three types of research strategy are case study research strategy, interview research strategy and survey research strategy. Survey research strategy is mainly utilised to explaining the features of the large population. Converse (2017) point out that when compared to other research strategies, survey method offers broad capability which certifies an adequate sample to collect targeted outcomes in which to create conclusions and take significant decisions. Besides that Survey research strategy is also utilised to answer questions that have been upraised, to resolve issues that have been observed and also to evaluate the necessity and set goals. Furthermore, Bryman (2017) mentioned that, in the research study, the survey strategy aid the researcher to explain the certain aspects of a given population quantitatively. Moreover, the survey method helps the researcher to determine whether or not specific objectives of the study have been met and also to create baselines against which future comparisons between dependent and independent variables can be made. Additionally, survey strategy utilised to evaluate trends

across time and generally to define what exists in what measure and in what context of the research subject. Hulland et al. (2018) examine that in survey research, dependent and independent variables are utilised to explain the scope of the research study, but cannot be obviously handled by the researcher. A survey strategy is simply a data gathering device for conducting survey research, and it means for collecting data about the actions, features or opinions of a huge group of people (Fulton, 2018).

As per the observation of Lucas (2014) interview research strategy in qualitative research is the communication where the question is asked to stimulate information. In the interview strategy, the interviewer is commonly a paid researcher or professional who stances questions to the interviewee in an irregular series of usually short-term answers and questions (Parr et al., 2015). Likewise, Thomas (2017) estimate that interview research strategy is utilised for attaining the story present in the participants which are essential for achieving conclusion for the research study. Moreover, the interviewer can reveal comprehensive data on the research topic. The interview is the personal form of research than the questionnaire, and in the personal interview, the interview method is conducted straightly with the participants or respondents. Brannen (2017) described that interviews might be useful as the follow-up to specific respondents to questionnaire and it can be divided into four types such as Informal, conversational interview, General interview guide approach, Standardized open-ended interview and Closed, fixed-response interview. There is predetermined questions are asked in the informal, conversational interview, and general interview guide approach provides more concentration than other types of interview, permits a degree of freedom and adaptability in attaining the information. In standardised, open-ended interview, open-ended questions are asked to all interviewee and enable quicker interviews that can be more easily examined and compared. Furthermore, in Closed, fixed-response interview, all interviewees are asked the same questions and asked to select answers from among the same set of alternatives and this format is useful for those not experienced in interviewing. A case study research strategy is the most flexible method of all research design and it requires the researcher to recollect the holistic features of actual life events while researching empirical events. Therefore Cronin (2014) explained that case study research strategy is a comprehensive empirical enquiry about an organisation or

individual and it is majorly utilised to describe casual connections in real life involvements that are too difficult for either survey or interview strategies. A case study can be defined as a single case or combination of series of cases, and it is a simple and brilliant way for a presenting herself/himself to the scientific world. Moreover, Kratochwill, (2015) stated that case study research strategy is best appropriate to considering the why and how questions or when the researcher has litter control over the research subject. Likewise, the case study is an experimental investigation in which investigates a contemporary sensation within its real-life context when the boundaries between context and sensations are not precisely evident and in which multiple sources of evidence are utilised.

In the current study, the researcher has utilised both interview strategy and survey strategy. The qualitative information essential for the study was assimilated through the conducting the interview, and quantitative information is obtained while conducting the survey method. The information acquired from both research strategy helped the researcher to achieve more reliable and authentic results to the research study. The interview conducts among the three developers of sky drive, Google Drive and Dropbox help the researcher to understand the significance of popular cloud services and also to advance and propose the framework that discourses the challenges that personal cloud computing services face in terms of privacy, user

#### **4.5.1 Participants and Host Organisation:**

The prime respondents and participants of this research will be respondents from general public cloud users and cloud computing professionals and developers from sky drive, Google drive and Drop box. These people are consumers and cloud computing professionals of any cloud service providers listed above in the UK.

#### **4.6 Research Method**

Typically, there are three types of data collection method: quantitative, qualitative and mixed (Saunders et al., 2009). According to Denzin and Lincoln (2008), quantitative data refers to data that is numerical in nature. Quantitative data can be collected from questionnaires and data can be analysed and represented through graphs and statistics. Qualitative data refers to data that is non-numerical in nature and is usually gathered from interviews (Bryman and Cramer, 2011). A mixed

research method involves the use of both qualitative and quantitative data (Saunders et al., 2009). The current study makes use of a mixed method. A quantitative study is used to identify the effectiveness of QoS determinants. This is done through the examination of different functional and non-functional operations as well as customer-level security assessment. The qualitative method will re-examine this data to identify the underlying organisational level security assessment and the motivation for change of existing operations to improve QoS.

#### **4.7 Data Collection**

Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, and evaluate outcomes.

In this study, two types of data collection methods have been relied, including primary data collection and secondary data collection. The secondary data for this study has been amassed from a wider range of secondary literature sources, including white papers, books, journals and other relevant, authentic online sources. The key criterion placed for choosing these sources was that they should comply with the standards set in accordance with the inclusion criteria. The key focus has been on the relevance of the articles and this has been assured by considering the key words such as “Quality of Service (QoS), Quality of Service (QoS) dimensions and cloud storage service adoption”. The “key-word focused search” helped in filtering out the articles and reports that are relevant for this study.

With this collected secondary data, the researcher could build a strong theoretical background for the study. This collected secondary data has been structured in a way that it involved the explicit findings on the similar research context. In addition, it has been noted to include the theoretical models on Quality of Service (QoS) alongside the various parameters associated with cloud storage adoption. With these findings, a new conceptual framework for explaining the relationship between the research variables could be delineated.

In addition to this secondary data, the key data gathered for this study included the data gathered through surveying and interviewing. These key sources served as the primary data collection sources for the study.

#### **4.7.1 Primary Data Collection**

The current study is primarily involved with collecting primary data. Primary data refers to information that is collected from a sample population that is directly relevant to the research question (Creswell and Clark, 2007). Primary data, in the case of the current study, is collected via survey questionnaires and interviews.

Primary data collection in this study involved two processes; Interview and Survey. The data collected using interview generated the qualitative data for the study, whereas the data gathered using survey underpinned the quantitative information. The interview was carried out with the technical experts of the three service providers (OneDrive, Dropbox and Google Drive) whereas the survey had been done with the 200 users of OneDrive, Dropbox and Google Drive.

As noted by Backman and Kyngas (1999), the interview has been selected for gathering qualitative information for this study because of the wide array of advantages. The principal benefit is that it attributed a greater level of flexibility with the process of information gathering. Through the adoption of this process, the researcher could explore a diverse range of opinions, which are of higher relevance to the topic. In addition, the suitability of interview is justified by a plethora of existing cases (Glennerster et al., 2013; Cook, 2012).

On the other hand, as argued by Shawyer et al. (2009), primary data collection is disadvantaged by the increased probability for the occurrences of the different types of biases. As noted by Hutchinson and Dorsett (2012), the fundamental biases include formulation bias, interviewer bias, selection bias, measurement bias and respondent biases. As referred by Shawyer et al. (2009), the deviation from the facts presented either in the process of collection or analysis is regarded as the bias. It posits serious implications by virtue of its ability to affect the research conclusions. Therefore, it is of utmost concern to address the bias appropriately while conducting data collection and analysis.

The researcher has been cautious in removing the biases during the data collection and analysis process. Primarily, the formulation bias had been tackled by the integration of objectivity. The questions for both interview and survey have been formulated in a way that it adhered to the research objectives. The possible

influences of the external environment have been eliminated by the carrying out of a face-to-face interview process. Similarly, in the interview process, a partiality could have arisen towards a certain concept or statement, which would become the focal point for the rest of the interview. The interviewer bias is removed by the use of a structured research instrument in both cases of interview and survey (Bowen, 2009).

Another important bias that interferes the accomplishment of the research process effectively is Selection bias. According to the findings of Rankin et al. (2009), this is the bias effect which could be introduced as a part of the selection process. This is mainly resulted from the lack of randomisation exercised in the selection process. The addressing of these biases would be detailed in the following sections.

#### **4.7.2 Research Instruments**

This method allowed the respondents to freely air their views and opinions without any restrictions (Silverman, 2010). The primary purpose of collecting data using structured interview method is to access subjective information from the technical and managerial personnel working in personal cloud storage services. The data collected from technical and managerial personnel working in personal cloud storage services provided detailed and insightful information regarding the factors that determine QoS perception of customers of personal cloud storage services (Silverman, 2010).

As discussed in the above section, the adoption of a structured questionnaire for interview has helped in removing the interviewer biases. The interview questionnaire has been constructed by relying on the research objectives and the key focus areas are given below:

(The interview questionnaire is provided in the Appendix).

1. The quality criteria or metrics for evaluating the cloud service
2. The quality expectations customers have with the personal cloud storage systems
3. Practices employed by cloud service providers in meeting quality expectations of the users
4. The influence of QoS criteria on user satisfaction
5. Challenges faced by cloud service providers in meeting these expectations.

As noted by Cook (2012), to remove biases and errors, it is necessary to carry out pilot testing of the questionnaire. The pilot testing of the interview was done with the peers. From the pilot testing, it was contended that the differentiation of services in terms of commercial cloud storage is useful in investigating the specific expectations of the users. The interview had been scheduled over a total of three weeks. Each Week was reserved for the experts belonging to a particular company among the chosen three firms.

The key purpose of the survey was to confirm whether the proposed conceptual model is valid. The questions of the survey have been constructed in a way that it investigated the influence of QoS perception of customers in mediating their satisfaction regarding the cloud storage services. The focus of the survey questionnaire has been on the differential influence exerted by both functional and non-functional parameters. The role of security and privacy elements in determining customer trust has been another focus. The survey questionnaire is constituted of two sections mainly. The primary section investigated the demographic information whereas the latter section addressed the following sections:

- Applications of cloud computing security
- Perceptions of cloud computing and information security
- Non-Functional Parameters and Functional Parameters
- Organisational parameters of privacy and security
- Customer parameters of privacy and security
- Customer Retention loyalty and advocacy loyalty
- Customer trust and satisfaction

Furthermore, the questionnaire used a five-point Likert scale which helped in an easier comparative evaluation. The detailed questionnaire is given in the appendix.

#### **4.8 Sampling and Data Collection**

Sampling is a statistical method of collecting representative data from a large population. As per the observation of Levy and Lemeshow (2013), sample selection is an essential area in the research study. Scheaffer et al. (2011) mentioned that proper collection of samples and sample size strengthens a research study,

protecting money, resources and valuable time. The term sample size is defined as the size of samples selected from the population through adopting the sampling methods and selecting the adequate samples from the population depicts the characteristic nature of the population. Castillo (2012) reveals that the various sampling methods are adopted depending on the research aim and objective and whether the research questions seek a confident answer about the population of interest. Probability sampling and non-probability sampling are the two categories of the sampling method.

As per the observation of Palinkas et al. (2015), probability sampling method is to utilise some form of random sampling technique to generate a sample. Etikan et al. (2016) mentioned that, in probability sampling method, the researcher must guarantee that every individual of a population has a known and equal chance of being selected and that can be attained if the researcher uses randomisation. Simple Random Sampling, Systematic Random Sampling, Mixed/Multi-Stage Random Sampling, Stratified Random Sampling and Cluster Random Sampling are the common types of probability sampling.

Non-probability sampling technique is a type of sampling method, and that utilises a non-random process like convenience sampling or researcher judgment. This sampling method is mainly used when the researcher aims to do pilot or exploratory, qualitative study and thus in this sampling method is not all individuals of the population has a chance of participating in the research.

Consecutive Sampling, Judgmental Sampling, Quota Sampling, Snowball Sampling and Convenience Sampling are the major types of the non-probability sampling method. Convenience sampling is probably the most common types of the sampling technique method. The convenience sampling is also referred to as accidental sampling, grab sampling or opportunity sampling. The convenience sampling is a category of non-probability sampling, and it is most commonly adopted for pilot testing. In this type of sampling, the samples are selected from a group of individuals easy to contact or to reach. The convenience sampling method is easiest sampling method and using this sampling method the researcher can transfer a connection to the online questionnaire to peoples on mobile phones and social media sites.



This study utilised convenience sampling method for extracting respondents for interview, which is a non-probability technique. As per the observation of Heckathorn (2011) convenience sampling method is also referred as availability sampling, this sampling method is a type of non-probability sampling technique, and in this sampling technique, the subjects are selected due to their convenient availability and closeness sampling technique to the researcher. By adopting the convenience sampling method, the data collection can be facilitated in a short of time. The essential advantage of using convenience sampling in the case of the interview was that it allowed the sample to be chosen based on the convenience of both of the parties. The population for the sampling involved the entire managers of the cloud service providers in the market. The representative sample size was three managers from each of the company. The respondent profile, however, involved the managers (3 each from two companies and 2 from one company). Thus, altogether, eight respondents were participated in the interview. This indicated a response rate of 88.8%.

Similarly, in the case of survey, the research participants were the users of the cloud service and are contacted using online services as well as email contacts to take part in the research. It is an important process to take the time to identify the population of interest for the specific research question. Here the participants are users of the cloud service, and they are usually interested in responding to the research questions. The sample that is chosen by the researcher includes the general public using cloud services, which are the consumers of different cloud services providers in the UK. The sample size of this research has been chosen based on convenience sampling technique. The key reason behind the selection of this technique is that this technique assured the access of the population interested in the usage of cloud services.

Thus, a sample size of 200 was chosen. Moreover, the fact that this sampling technique involved comparatively lesser time and effort in getting quantitative results even though all the participants do not possess equal chances, better to say, probability to put in their views has, however, been right enough for the ultimate number of participants selected that in turn, brought out findings that were worth quantifying and qualifying for this research topic (Taherdoost, 2016). Then, it would

be needless to say that the number of users selected for the survey portion of this study amounted to 200, where some of them had to be omitted for the sheer reason that they are not availing personal cloud storage service from any of the selected firms in this scenario of the research. The identities of these consumers and cloud computing professionals cannot be exposed, due to privacy issues.

#### **4.9 Presentation and analysis of the research data**

The quantitative data is analysed using SPSS software to arrive at underlying trends. SPSS has an user interface that makes it very convenient and intuitive for all categories of users. It is very simple and easy to enter and edit data directly into the programs with SPSS programs. (Crossman, 2014) SPSS was specifically designed for statistical processing of large amount of data at an organisational level (Robbins, 2012). SPSS has the advantage of a specialized design which helps to segregate calculated statistics and graphs from the raw data without losing its accessibility (Robbins, 2012). In addition to that, SPSS software includes a convenient platform for undertaking statistical tests. Apart from this, SPSS can link numerically coded data to its original meaning (Robbins, 2012). Majority of the data being electronically stored in numerical manner,

By using SPSS in the present analysis, the concepts regarding the data management became very clear to the researcher, thus adding to the easiness of using SPSS. By using SPSS, it became easy for the researcher to define a set of variables followed by which it was easy to enter the available data to create the analysis. By adopting SPSS, it enabled the researcher to identify independent and dependant variables along with intervening variable and Intervening variable. SPSS package integrates a set of software tools for data entry, data management, statistical analysis and presentation. SPSS includes complex data and file management, statistical analysis and reporting functions [13]. Waghmare and Sakhale (2015) observed that in order to achieve the objectives of SPSS formulation of models are very important. After forming such models, they are optimized through the optimization technique. By employing SPSS, the researcher was able to utilise full range of data management system and editing tools and in-depth statistical capabilities.

The regression analysis has been used for examining the survey responses. Each variable was considered for analysing the individual influence exerted by each element. The basis of this analysis would be an equation formulated on the basis of the conceptual framework. The difference in the rating as revealed by the Likert scale rating were relied for generating the final inferences on the influence of the variables on others. SPSS analysis began with the evaluation of the descriptive statistics on each variable, referring to the mean and standard deviations. The adoption of this approach helped in the identification of the distribution of variations in a given set of data. For example, in the case of applications of cloud computing security, the mean and standard deviation of the variables such as encouraging others to use the Cloud computing security application, cloud storage usage high and low were considered. The distribution of responses with regard to these variables was evaluated using descriptive analysis for making judgements on the variable with higher response distribution. This way, each of the variable referring to the measuring metrics were analysed for gaining insights on the impacts and link between the chosen research variables.

Another approach used in the statistical analysis of the data was normality assessment. Normality assessment enabled the identification of the normality of the distribution of the responses. The key objective behind the conduction of normality assessment was to establish the link between QoS perception of personal cloud storage service users and customer loyalty. As discussed above, the adoption of an approach based on Multivariate regression, the proposed theoretical model has been tested. The basis of this testing was an equation which represented the relationship between Customer loyalty (CL) and that of customer factors, organisational factors, functional parameters and non-functional parameters. The main implication of using this test was that it facilitated the testing of the fit of the proposed conceptual model.

The qualitative data is analysed using a thematic analysis to arrive at basic, organisational and global themes. Analytical importance of theme, (ii) meaning of theme, (iii) meaning of category, (iv) theme and category in terms of level of content, and (v) theme development are the important elements theme or domain analysis.

Proper information is available about the details and differences of qualitative content and thematic analysis and it is considered as two ways of qualitative

descriptive research. However, finding out the key features of theme as the data analysis product and its developmental strategy is not clear. The thematic analysis methodology requires the generation of a stage like model of theme construction for qualitative content analysis and thematic analysis (Mojtaba et al., 2016). Analytical importance of theme, (ii) meaning of theme, (iii) meaning of category, (iv) theme and category in terms of level of content, and (v) theme development are the important elements theme or domain analysis. The entire process of domain analysis can be split into three main heads: (a) the reduction or breakdown of the text; (b) the exploration of the text; and (c) the integration of the exploration.

While analysing the qualitative data by thematic analysis, domains are identified, which include the key topics and the interrelation between the key elements. The theme analysis generally includes four aspects (1) To identify the main issues expressed by the interviewees and these main issues are classified as themes or domains (2) Categorisation of the main domains to sub categories with each sub category dealing with a separate concept (3) elaboration and specifications of each subcategory (4) To analyse the interrelationship among the different domains

The important elements in domain identification includes identifying the texts, indexing the texts, identifying the topics line-by-line and the compilation of the entire topics across all interviews to develop a preliminary list. While designing such a preliminary list, it is seen that some concepts will repeat frequently whereas some other topics will be occurring only in wider gaps which can be designed the status of subtopics. Furthermore, after analysing the relationship between different topics, related topics can be categorised into single heads, thus creating broader domains

The present study undertakes the thematic analysis by describing the meaning of theme and provide a method on theme construction which is used for the qualitative content analysis and thematic analysis of the qualitative data. In this work, an analytical overview of qualitative data is undertaken through analysing the meaning of the theme. Mojtaba et al. (2016) observed that theme development for qualitative descriptive data analysis contribute meaningful, credible and practical results.

#### **4.10 Ensuring reliability, replication, and validity of the findings**

Considering the case of any research function, factors such as reliability, replication and validity hold an essential position. The reliability of data obtained through the research is the factor which describes how reliable is the data collected within the context of the research topic (Voss, 2010). While the replication of the received data implies whether the collected data can be replicated through the same methods used by the researcher, the validity suggests whether, through the interview questions, the researcher was able to receive the same type of data which is required through the research.

Within this research, the researcher has interviewed three representatives from various companies and about 200 customers of these respective companies. The major aim of this project is for understanding the various services provided for the cloud service users and multiple services offered by the different such service providers (Thomas and Magilvy, 2011). The interview with the representatives of the companies provided the idea about various services provided by the company and the survey conducted among the customers of the company helped to produce their response towards the services offered by the company. Multiple companies selected for the research are Google Drive, Dropbox and OneDrive.

The reliability of data is an important aspect considering any research function. The collected information has to be reliable so that the researcher can make definite statements and theories from the data collected. Hence considering the case of the interview with the representatives of the three companies, the style of the meeting was made to be structured. This decision by the researcher was built upon the need to cover all the areas of the services provided by their company (Fusch and Ness, 2015). Since this aspect of the research required meeting and dealing with professional, the interview was also structured accordingly. After the collection of the details of the services provided by the company, the questionnaires for the customers of these companies are created.

Considering the case of the questionnaire produced for the survey of the customer, it is for collecting the opinions and perceptions of various people upon the cloud service provided by the companies (Thomas and Magilvy, 2011). Since the questions are fabricated entirely upon the details provided by the officials of the company, the chances of questions being out of the context or being irrelevant is

wholly ruled out. Hence the data or the opinions obtained through the survey are assured to be reliable. Similar is the case of the interview questions. Before the conduction of the interview, these questions were analysed a sufficient number of times so that these questions helped to collect the required and reliable data. One of the main tools which has been relied in this study for assuring the reliability was Cronbach's alpha test. As noted by Fusch and Ness (2015), Cronbach's alpha test is regarded as a measure of reliability. This because, it measures the internal consistency such as in the case of survey for estimating the collected data. The reason is that this test is used for estimating the inter-correlation amid the items in the survey questionnaire. The findings of Thomas and Magilvy (2011), deem that the reliability of a research instrument could be assured with a higher score of Cronbach's alpha. Likewise, a cut off value is taken for assessing the acceptance of the research instruments in a study. Therefore, the use of this tool helped in identifying the reliability of the survey questionnaire used in this study. Another tool used in this study for assuring the validity is the Goodness of Fit of the model. Thus, the use of statistical tools for testing the constructs could attribute a considerable level of reliability to the study. Likewise, the validity of the study has been assured by the adoption of a mixed research approach. In addition, the sample size and analysis method used in this study were found to be appropriate. This, in turn, has contributed towards the generalisability of the findings. However, the generalisability is questioned by the use of convenience sampling in the case of extracting interview sample. The adoption of this technique might have led to the poor representation of the population.

Considering the case of replication of data acquired through the research, this aspect discusses whether such collected data from the study can be created again through the same methods. In the interview aspect, replication of data cannot be done. This is mainly because as the participants change, their opinions and perceptions also change hence the data procured through the interview cannot be replicated. As within the meeting, only questions are asked, and the answers provided are entirely by the participants, the data or the responses obtained cannot be replicated even with the same questionnaire.

While considering the case of the survey, the data can be replicated easily. This is mainly because compared to the interview aspect the response of the participants is constrained within the question and the options. Hence most of the reactions from the participants are considered to be able to be replicated. The responses of the participants are then run using Cronbach's alpha test. The use of this test provides the consistency among the collected data through the research aspect.

The validity of the data collected through the research implies how much the received data is connected to the main aim of the study. Through conducting various analyses, there are chances for investigations to miss the mark through the completion of the research function (Morrow et al., 2010). The interview process is controlled through carefully fabricating the questions to be asked to the representatives of the companies through continuous evaluation of the problems to be asked. The issues are checked to be strictly within the context of the research topic. Hence, it is through this way the researcher has made sure the data collected is valid.

While considering the case of the survey, the survey questionnaire is created through considering the reply of the representatives of the companies and is checked more than once to be within the research aspect (Cronin, 2014). Through the provision of the options, the reply of the participants is then fine-tuned to be within the research aspect. Hence through these methods, the researcher is planning to make the data collected through the research aspect to be valid. Therefore, the validity of the data collected through the interview and survey are also made accurate.

#### **4.11 Ethical and accessibility issues**

The current study will be looking at sensitive issues; hence, it is very important that all ethical guidelines are followed while carrying out the research. The researcher will take all due considerations into account when carrying out the research necessary for the study. The participants will be approached and their permission will be sought only after they have been given all the details pertaining to the study, including the study's goals and the research questions involved, and any doubts that the potential participants may have been addressed. The participants will be assured that they

can back out of the study at any time of their choosing. Furthermore, the participants also will be assured that they do not have to provide personal details of any kind and that any answers they provide will be kept strictly confidential and anonymous. The data collected will only be used for analysis and, once the study is completed, the data will be erased.

#### 4.12 Research limitations

The use of interview method delivered a greater level of flexibility with the process of information gathering (Baumgartner et al., 2021). Moreover, interview supported the researcher in exploring various opinions, which are of higher relevance to the topic (Backman and Kynga, 1999). However, due to the time limitation, the sample size of the interview was limited to 3 representatives only. The strict time limit in the University guidelines for presenting the discussion limited the number of samples. The study might have been improved if it was possible to include the viewpoints of range of representatives of the organisations (Bell et al., 2019).

Since the secondary data was readily accessible in distinct sources, the study was benefited by consuming less time and reaching a clarification (Creswell and Clark, 2007). But the research was cautioned to select the information that was specific to the topic. The study might have improved through the inclusion of more number of articles which can support for arguing the statements related to the research subject and in reaching out to better conclusions (Denzin and Lincoln, 2017).

Similarly considering the case of the interviews, a lot of individual travel had to be done for visiting the three company representatives. The face-to-face interview session has helped in a comprehensive understanding of the responses by evaluating the facial expressions and body language of the representative (Bogner and Menz, 2009). However, as claimed by Poucher et al. (2020) the cost required for the travel was a considerable issue. Moreover, time was also a major constraint since the travel has to be completed within the restricted time slot. The research may have enhanced if it was possible to conduct an online interview session with more than 3 representatives of the organisations.

#### 4.13 Conclusion



This research is for understanding the service quality of the companies which provide cloud computing service. This chapter incorporates the selection of various methods for the completion of the study. It is supported by the reasons for choosing the specific techniques for the completion of the study. The various services provided by the companies are understood through the company representatives. The responses of the customers towards these services are collected through the customers of the specific companies. The reactions of the customers are received through the survey, and the details of the services provided by the companies are collected through interviews.

In this report, the various aspects of the research are explained deeply. The primary reason for diving in deeply for the explanation of these aspects is primarily for helping the researcher to understand these methods. The researcher should possess a profound understanding of the various techniques which can be used so that the inclusion of these methods can be done wisely. The tools or methods should be used effectively to complete the research function efficiently. Hence the description of various ways and the selection of the correct method are described in detail within this chapter. Therefore, facilitating a better understanding of the research topic and its various aspects.

The researcher is planning to use both qualitative and quantitative types of data are used for the completion of the research. Since the study mainly focuses upon the satisfaction of the customers upon the various services provided by the particular cloud computing providing companies, quantitative data has to be collected for understanding the responses to the services offered by the companies. Through analysing this data, the opinions and perceptions of the customers can be clearly understood. At the same time, qualitative information is required from the representatives of the companies. This type of data is necessary to understand the various services provided by the companies.

The interview is conducted upon the representatives of Dropbox, Google drive and one drive. The Dropbox is a file hosting company located at San Francisco, which provides file hosting service through cloud storage facility. It offers various services such as personal computing, file synchronisation etc. A representative of this company described their provisions to the customers. Google drive is a similar file

storage service provided by Google. But this service is directly connected to the Gmail account of the user. Hence personalisation is one of the significant advantages of this company when compared to others. One drive, on the other hand, is the file hosting company entirely owned by the Microsoft organisation in connection to its online office suites.

Within this research, the researcher has mentioned and described the ontological and epistemological considerations about the various methods used for the completion of the study. The nature of knowledge contained within the collected data is explained through the epistemological aspects. The quality of reality carrying the research aspect is described through the ontological aspect. The researcher has also represented the research approach considered by the researcher for the completion of the current research study. The research design is also described by the researcher to address the issue logically and hence assessing the facts. Other aspects such as data collection and research method are also included by the researcher.

## **Chapter Five: Findings and Discussion – Expert Interviews**

### **5.1 Introduction**

The purpose of this chapter is to present the findings of the expert interviews that were conducted. The chapter revisits the study evidences gathered through the detailed structured interviews with technical and managerial personnel from personal cloud storage service providers (Google Drive, Dropbox and OneDrive) and identifies views to support the findings of the questionnaire.

### **5.2 Respondent Profile**

<b><i>Respondent profile</i></b>	<b><i>Position</i></b>	<b><i>Age of respondent</i></b>	<b><i>Years of experience in the company</i></b>
<b><i>Company 1</i></b>			
R1	Cloud Service Delivery Manager	42	2
R2	Cloud sales executive	28	1
R3	Operational services delivery group manager	37	3
<b><i>Company 2</i></b>			
R4	Cloud Service Delivery Manager	33	3
R5	Cloud sales executive	29	3
R6	Cloud system administrator	32	1
<b><i>Company 3</i></b>			
R7	Cloud Service Delivery	33	1.5

	Manager		
R8	Cloud system administrator	32	2

*Table 5: Respondent Profile*

The interview transcripts have been analysed using a thematic analysis strategy. Firstly, open codes were generated as a part of this process. The basis for the identification of these open codes was the repetitive occurrence across the transcripts. This is followed by the categorisation of themes and sub themes.

No.	Code
Code 1	QoS
Code 2	Customer satisfaction
Code 3	Customer trust
Code 4	Customer loyalty
Code 5	Responsiveness
Code 6	Security
Code 7	Ease of use
Code 8	Efficiency
Code 9	User experience
Code 10	Operatability
Code 11	Attractiveness
Code 12	Platform independence
Code 13	Challenges

Code 14	Security and data privacy issues
Code 15	Lengthy authentication process

*Table 6: Categorisation of themes and sub themes*

Main Theme	Sub theme
1. Functional and Non-Functional parameters are equally significant in determining QoS	<ul style="list-style-type: none"> <li>• Functional parameters contribute to QoS</li> <li>• Non-functional parameters contribute to QoS</li> </ul>
2. Decision-making about enterprise cloud storage service adoption is not dependent on QoS alone.	<ul style="list-style-type: none"> <li>• Decision-making about enterprise cloud storage service adoption is dependent on functional parameters</li> <li>• Decision-making about enterprise cloud storage service adoption is dependent on non-functional parameters.</li> <li>• Decision-making about enterprise cloud storage service adoption is dependent on the security and data privacy provided by the service provider.</li> </ul>
3. Security and privacy issues impact customer trust and loyalty	<ul style="list-style-type: none"> <li>• Security breaches deter customer satisfaction</li> <li>• Unwarranted access deteriorates customer trust</li> <li>• Hacks and recoverability impact customer trust</li> <li>• Lack of accountability impacts customer trust.</li> </ul>

4. The concerns of the clients regarding the security risks associated cloud-based solutions are predominant.	<ul style="list-style-type: none"> <li>• Clients regard security as one of the most desired parameter in the case of cloud storage services.</li> <li>• GPR compliance of the cloud storage service provider improves customer perceptions regarding the service provider.</li> </ul>
5. Customer trust erodes over time.	<ul style="list-style-type: none"> <li>• Customer switching behaviour is a common trend.</li> </ul>

*Table 6: Main themes*

### **5.3 Thematic analysis**

- Theme 1: Functional and non-Functional parameters are equally significant in determining QoS

The participants were asked to differentiate between the use of functional and non-functional QoS measures and the importance that these measures in impacting their decision making. This research contends that the responses highlighted are found to be mixed. Some respondents believe that focusing on both the elements is important. This is attributed to the greater trust that customers may have in the brand name or the perceived value rather than other quality features. The response of R6 underpinned the need for focusing on both functional and non-functional parameters. Similarly, R1 expressed that value of a brand is equally significant as that of the scalability and speed. On the other hand, there are some respondents who believe that the primary element which directly contributes to improvement in customer satisfaction and ensures that there is positive customer expectation is functional attributes. They believe that when the functional attributes are met, it indirectly improves non-functional attributes. The R2 response with regard to this question underlines this fact by stating that the improvement of the functional features such as overall capability, scalability and access will enhance the brand recognition. This is

because, the meeting of these specific demands ensures customer satisfaction and this in turn build up the non-functional values of the brand.

The importance of functional attributes and their ability to contribute to quality measurement is linked to customer knowledge. Therefore, there are those who take a balanced view and contend that while non-functional elements are important, it is the functional element which finally acts as the differentiator. Considering the response of R7, it could be stated that the functional parameters are more significant than the non-functional parameters. On the other hand, the response of R6 claimed the significance of both aspects in assuring the QoS. Another major aspect as revealed by this response is regarding the relative significance of each of the elements.

From the above analysis, it can be concluded that there are multiple elements which contribute to the perception of quality. However, it is clear that an understanding of non-functional elements and their actual contribution to the measurement of quality of the cloud is important. Clarke and Furnell (2020) concluded that the ranking of cloud service attributes and the associated QoS parameters is quite difficult as the functional and non-functional elements are rarely revisited. The authors contend that non-functional parameters are hardly addressed as part of cloud QoS assessment. Thus, from the analysis, it could be contended that Functional and non-Functional parameters are both significant in determining QoS.

***Theme 2: Decision-making about enterprise cloud storage service adoption is not dependent on QoS (Quality of Service) alone.***

Another key theme as derived from the analysis is that the enterprise decision making regarding the adoption of cloud storage service is not solely reliant on the Quality of Service (QoS). Nevertheless, the majority of the responses underpinned that the quality of service in cloud service is the ensuring of several parameters that meet the needs and specific preferences of the clients. Fundamentally, these features include pricing of storage plans, storage levels, faster support access, file syncing, folder sharing, sync any folder and sync folders. The findings also show that the main objective of quality of service is to align these services in a way that the different customer needs are met as referred by the respondents, one and two (R1

and R2). Another major aspect as revealed by the responses is the offering of consistency in services. The importance of the speed in accessing services (i.e. upload or download) has also been substantiated by the findings.

As per the respondents R4, QoS should embed characteristics such as responsiveness and ease of use. The failure to offer immediate response is also deemed to be affecting the overall quality of the personal cloud computing services. Apart from these elements, other factors like automatic upload and network storage capabilities are also highlighted as potentially important elements. For instance, R3 responded: "I'd say this should also be as automated as possible—for example, network storage and reduced time of upload without the requirement of human interaction is a key element. Automatic upload to the cloud in the One Drive is definitely a key element that forms part of the QoS platform..."

Similarly, cloud storage options and back up plans are given more importance by commercial cloud service users as the storage requirements of the enterprises are much higher. This is because, processing of high-volume data is more crucial for commercial cloud computing services.

The respondents believe that unique service capabilities like meeting customer needs and providing consistent and all-round support are some key elements which can be considered as the other differentiators as responded by R2 and R8. From the above interview responses, it can be contended that many elements which relate to QoS, additionally includes recoverability of backups, service consistency, response timing and tolerance to faults are important. Another key inference, as understood from the analysis is the significance of platform independence of the cloud storage services. Nevertheless, one of the critical facts, as elucidated from the transcripts, is that security is a key factor that should be appended with the quality of service. The key security parameters as desired by the clients include accountability, integrity, audit trails and confidentiality. The overall demand regarding the security was that there should be a clear restriction to the unwarranted access. The offering of various access controls with the storage service should be augmented by adequate security. This means that the lack of security with the plans could derail customer trust. Nevertheless, the easiness in using two-factor authentication is essential. According to the opinions of the cloud storage service providers, account hijacks and loopholes



for facilitating the unauthorised access could lead to the breach of customer satisfaction.

Thus, from the responses, it could be seen that it is challenging to determine the most important determinants of QoS. This is further challenged by the variations in the offering of service provisions, storage plans and pricing by the different service providers. From the responses, it could also be noted that both functional and non-functional parameters place equal significance in the client consideration of cloud storage service adoption. The literature review has presented similar findings on the key factors that are influential on the adoption tendency of service providers (Hobfeld et al., 2012). The literature review shows that there have been trade-offs between the various parameters offered by the cloud service providers including functional and non-functional features. As noted by Shanker and Pandey (2020) in the literature review, these trade-offs have increased the difficulty in choosing the cloud service providers.

The participant views on the commercial platform expectation in terms of QoS included traditional QoS measures like latency measurement, jitter, scalability, etc. Therefore, it is considered important to revisit the context of the research and arrive at unique evidences which can contribute to an improvement in performance. The importance of specific elements of QoS like scalability and virtualisation can be compared to existing evidences from research. Likewise, evidence of the importance of security and trust could be seen in the literature review too (Sullivan, 2019). Similar to the participants' view, the need for extending the QoS by integrating assurance on security and data privacy are found to be key in the decision-making. This means that a range of multiple factors influences the decision-making on cloud storage service adoption (Schutt, 2020).

***Theme 3: The concerns of the clients regarding the security risks associated with the cloud-based solutions are predominant.***

From the overall responses, the primary concerns were found to be the cost, security, privacy, brand image alongside the other functional parameters such as responsiveness and usability. This means that the enterprise cloud service providers regard a range of parameters while choosing the service. Nevertheless, analyzing

the trends, the increased concern regarding the security was vivid. According to the responses, one of the key factors that deter the intent of users in adopting cloud service options is due to the fear of vulnerabilities. This means that the users regard cloud storage options are more susceptible to security attacks and breaches. According to the responses, users perceive that the probability of occurring breaches is higher in the case of enterprise cloud storage. The increased efforts are taken by the service providers in this aspect underpin these arguments. According to the findings of Schutt (2020), as shown in the literature review, the cloud service providers handle security integration with the importance which is deemed by the increased investments in these activities. The findings of Shanker and Pandey (2020) also pointed out the significance of these parameters. According to these findings, some of the key efforts include data confidentiality, encrypted search and database, homomorphic encryption, distributive storage, data concealment and hybrid technique. These findings also support the finding that the key concern of the enterprise cloud storage service users is the security.

#### ***Theme 4: Security and privacy issues impact customer trust and loyalty***

The participants in the study strongly believe that the consumer quality requirements and expectations can influence the provision of quality and that meeting these requirements can be instrumental in achieving customer satisfaction. However, it is also acknowledged that meeting the independent needs of individual customers can be quite challenging and the personal cloud platform should be prepared for the same as noted in the literature review (Dai et al., 2017). The responses show different methodologies and practices adopted by organisations for assessing customer satisfaction and the extent of meeting customer expectations. According to the response of the R1, the service provider makes use of the delivery of comprehensive reviews. For instance, the conduction of a survey helps in assessing what went wrong. These reviews also reveal that the areas that should be improved by the service provider.

According to the respondent, R8, the services should reflect assurance and trust. In comparison with the corporate customer or such as in the case of commercial cloud computing as propounded in the literature review, cloud computing confronts with

more challenges due to the presence of intricate security requirements in the case of commercial services and these posit significant thrust than the cost element.

The participants also believe that customer quality requirements vary between the providers which could be attributed to lack of knowledge of traditional QoS features. This may influence customer expectation of the platform. The major customer expectation is the immediate access as per the response (R7) and hence, it is critical that efforts should be carried out by organisations for meeting these demands. The responses, additionally, presented the challenges that interfere with the meeting of these requirements and these include the infrastructure latency.

This challenge is aggravated as the customers are not aware of the technical elements behind the SLA. The importance of security and QoS nexus and the need to meet both, have also been highlighted. The responses show that the customers value privacy as most significant in comparison to the factors such as accessibility.

The customer expectation and customer satisfaction are an important element that should be an end goal of the QoS assessment process for mediating the adoptions. The role of trust, commitment and security are strongly highlighted. This reflects existing evidences in research. As Sullivan (2019) argued, an examination of IT service quality requires a focus on partnership, trust, consumer perception of brand image and loyalty as key factors. The author arrived at a positive link between trust and partnership when considered in relation to a SaaS platform.

Moreover, from the interview, some of the respondents have opined for enhancing the trust among the customers who are using the cloud services the organisation will provide the customers with encryption where they can store their data with more secured form in cloud services. Therefore, by providing the encryption keys with the customers, the trust among the customers will be enhanced.

From the literature studies, as per the opinion of Heart (2010), it has been observed that for improving the service quality in IT the organisation must possess the partnership with the key factors such as trust, consumer perception, brand image and loyalty. On analysing the SaaS platform, it has been recognised that there is the positive link between the trust and the partnership. Similarly, from the report of Rustagi et al. (2008) argue that when there is the use of control mechanisms in IT

services, there is a positive link between trust, communication and cooperation within the relationship. This is more evidenced from the interview responses which have shown that they tend to switch to other options at the event of breaches and threat of unwarranted accesses made by unauthorised personals. In addition, the responses clarify the role of unauthorised processing and accidental disclosure, loss, access, alteration or destruction in deterring their trust and satisfaction with a brand. The prominence attributed by the customers on security parameters is further ascertained by the question on GDPR.

In the qualitative analysis, the various respondents involved have been requested to express their opinions concerning the customer's perception on the quality of personal cloud storage service in the aftermath of implementation of GDPR enacted by the EU. From the interview, it has been noted that the majority of the customers are expecting changes regarding the quality of personal cloud storage services regarding the factor security in the aftermath of GDPR enacted by the EU. For instance, it has been observed from the respondents that:

R1: "Yes, the customers who are using personal cloud storage services will expect changes after the implementation of GDPR enacted by the EU. That is the customers will expect more concerning the principle "Privacy by Default" as it enhances the security in the services offered by the organisation in default...."

R2: "After the successful implementation of GDPR enacted by the EU in May 2018 the consumers using the personal cloud storage services has expected the changes concerning the security of the individual's data stored in the cloud storage. After the implementation of GDPR, the organisations that are offering cloud services must utilise proper organisational and technical security measures to protect the stored information in cloud services against the unauthorised processing and accidental disclosure, loss, access, alteration or destruction..."

R3: "In my opinion, yes to an extent the consumers expected changes in the perception of quality of personal cloud storage services in the aftermath of GDPR enacted by the EU. As the GDPR is a set of data protection laws that help them all over the individuals in the country and it is mainly used for data protection of the individuals....."

It has been observed that the unused data in the cloud storage services will not be stored longer as that information has been used only for the predefined purpose. Thus it has been observed from the interview that after the implementation of GDPR for the data storage in clouds there are certain retention periods, and it is also noted that the data stored in the cloud that are unused will be expired after specific time and this profoundly affects the customers those who are using cloud services for the data storage. This has been observed from the respondents as noted from.

R4: "In my viewpoint, yes there are specific changes in customer perception of quality of personal cloud storage services in the aftermath of GDPR. As customers know after the implementation of GDPR the personal data will not be stored longer as it is only used for the predefined purpose."

From the interview, it has also been noted that the privacy of the data stored in the cloud storage services has enhanced in two different ways after the implementation of GDPR. That is the cloud storage user can know the details concerning how the data has been accumulated, used and stores and whenever it is requested by the clients to delete the information from the cloud storage then it will be omitted. Moreover, it has also been observed that after the implementation of GDPR the data security has been increased. For instance, as noted from the interview as.

R6: "Yes, the customer expectation has wholly changed concerning the quality of personal cloud storage services in the aftermath of GDPR that is implemented by the EU. After the implementation of GDPR, the privacy of the data stored has been strengthened more in two ways. The primary purpose is that the organisation responsibility is to protect the user data has increased, and secondly, the consumers can know how their data has been used, accumulated and stored....."

R7: "Yes, there are a lot of changes in customer perception after the implementation of GDPR enacted by the EU in the quality of personal cloud storage services. As the customers know after the implementation of GDPR in cloud services, there are various changes involved in terms of security that is it strengthens privacy, data control and visibility, data sovereignty and also enhances the confidentiality by security and design."

R8: “Yes, there are a lot of changes in customer perception of quality of personal cloud storage services in the aftermath of GDPR enacted by the EU. As after implementing the GDPR the security of the data stored in the cloud will be enhanced. That is after the implementation of GDPR all organisations are decided must implement ‘Privacy-by-design’....”

From the literature studies, it has been noted that after the implementation of GDPR enacted by EU the cloud storage customers will be able to enjoy high security and high data protection in the cloud and this type of protection and security are assured by many organisations of cloud storage such as Google in the realm of Google services for the customers (Lund, 2021; Ooijen and Vrabec, 2019; Li et al., 2019). Likewise, from the literature studies, it has also been noted that in GDPR the data protection by design and by default is measure includes and according to this, and the safeguard and protection of the consumer’s information are ensured as a defaulted responsibility of the storage app builders, and the informed consent can only access the information. However, from the report of Clarke and Furnell (2020), it has been observed that the large organisations like Google, Facebook, the integration of GDPR could not be a financial burden. However, for the medium and small-scale business firms, GDPR will be a big financial burden and some of the organisation did not have the proper knowledge and understanding related to the GDPR, and this created a suspicion among them to incorporate the regulatory measures. Thus, it can be concluded from the viewpoints of respondents and the report of Clark and Furnell (2020) that after the implementation of GDPR regulations the security of consumer’s data is highly concerned by the organisations and it has affected the organisation both positively and negatively.

#### ***Theme 5: Customer trust erodes over time.***

The participants involved in the interview were asked to convey their opinion concerning the trust of customers towards their opinion regarding cloud storage services whether changes over time and also asked to opine their opinion regarding whether there will be decay in customer trust after using the service for a long time. Most of the respondents participated in the interview has opined that there is no chance for decay in customer trust after using the service for a long time if the organisation maintains proper communication and transparency concerning their

policies with the customer. As revealed by the responses, the communication between the client and cloud vendor would help in retaining the trust of the customers. In addition, it is necessary to assure transparency related to the infrastructure, policies and maintenance procedures. The long-term relationship with the clients could be assured by the maintenance of data security.

Nevertheless, the probability of affecting the customer trust is higher in the case of disruptions in these parameters. The need for updating the customers regarding the changes and updates in the policies has also been noted. On the other hand, some of the respondents who participated in the interview have opined that there is the probability of chance for decay in customer trust after using the service of the particular organisation for a long time. For instance, it has been noted from the interview that the offering of transparency is significant with related to the underlying infrastructure and support procedures.

The respondents involved in the qualitative analysis were requested to express their viewpoints regarding the main factors that are contributing to customer switching behaviour in personal and cloud storage services. From the interview, it has been identified that the main factors that are contributing to customer switching behaviour in cloud storage services are cost, security risk and privacy breaches. However, from the interview it has also been identified that most of the customers do not prefer to switch from one cloud storage services to the other as it is most time consuming for transferring the files from one cloud service provider to the other cloud service. Thus, it could be interpreted that that the customer switching behaviour related to personal cloud storage services is relatively weaker as it is extensively time consuming. The main factor that stimulates the customers to switch from one personal cloud service to the other is a Perceived risk of incumbent service. However, the customers will not prefer switching from one service to other as it is the huge time-consuming process for the customers for transferring data from one storage device to the other storage device.

On the other hand, it has also been observed that some of the respondents have opined that the consumers who are using cloud storage prefer to shift from one cloud service to the other vendors offering cloud storage service if the organisation offering cloud service has certain security issues in storing the information in the cloud

services as opined by the respondents. The switching behaviour is prominent in the case of commercial cloud computing services specifically if the organisations are confronted with the security issues.

From the various evidences of literature studies, the various factors contributing to customer switching behaviour from one cloud service to the other has been listed. As per the report of Wu et al. (2017), it has been noted that various factors highly influence customer switching behaviour. Moreover, the study also focused on how risk, switching cost, trust and social influences influenced customer switching behaviour in Chinese personal cloud storage market has been studied. Further, it has also been observed that through that study the main element of the study was to recognise how the factors such as crucial risk, trust, switching cost and social influences influenced the customer perception of QoS in personal cloud storage services by analysing their effect on switching behaviour. Moreover, from the study of Schutt (2020), it has been identified that the main factor that influenced the customer attitude towards personal cloud storage services are the risk, trust, critical mass, switching cost, and social norm. It has also been observed that the main implication of the current study is that the factors such as critical mass, switching cost, and social norms have the strong influence on customer attitude towards personal cloud storage services.

Thus, from the evaluation of responses against the literature review, it could be contended that the compliance with a wide range of parameters are essential in assuring a loyal bond between the service provider and the client. This also indicates that the disruption in these parameters could disrupt the trust of the customers gradually. Therefore, to facilitate the adoption of cloud storage options by the customers, service providers should place emphasis on these elements equally.



## **Chapter 6- Findings Part 2: Customer survey**

### **6.1 Introduction**

Quantitative Data for the current study was collected from 200 personal cloud storage service users using closed-ended survey questionnaire. The information was collected from consumers who were using OneDrive, Google Drive and Dropbox in the UK. The collected information is analysed with the help of SPSS. These findings will be evaluated considering the derived conceptual model.

### **6.2 Construct Measurement Scale**

As mentioned earlier, in order for finding the challenges confronted while using personal cloud computing services survey strategy was employed in the present study. The conceptual framework developed with the assistance of the knowledge gained through the literature review was utilised for developing the questionnaire which helps in assessing the perception of customers regarding the quality of services. The conceptual framework has pinpointed several factors leading to customer loyalty and commitment through the services such as security and privacy and quality of services. The first five questions were asked for understanding the general background of the respondents participating in the survey. Likert scales were used in the questionnaire to assess the perception of the customers using cloud computing services. As per the observation of Wakita et al. (2012), Likert scale is a psychometric scale used for rating the concepts. The knowledge regarding information security while using cloud services were analysed through the sixth question. Likewise, the applicability of the cloud services was assessed through the seventh question. The questions from eight to twelve were framed with the intention to analyse the challenges confronted while using the cloud computing services with a special focus on security concerns. Thirteenth and fourteenth questions analysed the impact of customer trust and satisfaction on achieving customer loyalty followed by two questions evaluating the retention loyalty and advocacy while using a particular cloud computing services. The knowledge regarding the protocols and other related legal constraints occupied with the usage of the cloud computing services were also assessed through the eighth question of the survey. The awareness of the customers regarding the level of security offered to the personal cloud services was

assessed through the twelfth question in the survey. The organisational level security and privacy concerns of the cloud services such as deterrence, remedy, prevention and detection were intruded in the eleventh question of the survey. The reliability, elasticity, availability at all time, user-friendliness and responsiveness were questioned in the ninth question of the survey. Similarly, the tenth question was put forward to evaluate the non-functional parameters leading to customer satisfaction by assessing the opinions of the customers regarding the elements such as user motivation, critical mass, switching cost, social norm, brand perception and perceived value. Thus it could be interpreted that the developed questionnaire is effective for analysing the challenges and advantages of cloud computing services. The entire data collected through the survey strategy will be evaluated through the regression analysis. The differences in the scale rated in the Likert scale questions will be cross-examined to analyse the impact of each variable which was pinpointed in the conceptual framework. An equation was considered which consist of the variables pinpointed in the conceptual framework leading to the establishment of customer loyalty and commitment. Moreover, the entire study postulates that the major factors leading to customer loyalty are trust and customer satisfaction and thus the factors contributing to these factors were assessed with the help of the questionnaire.

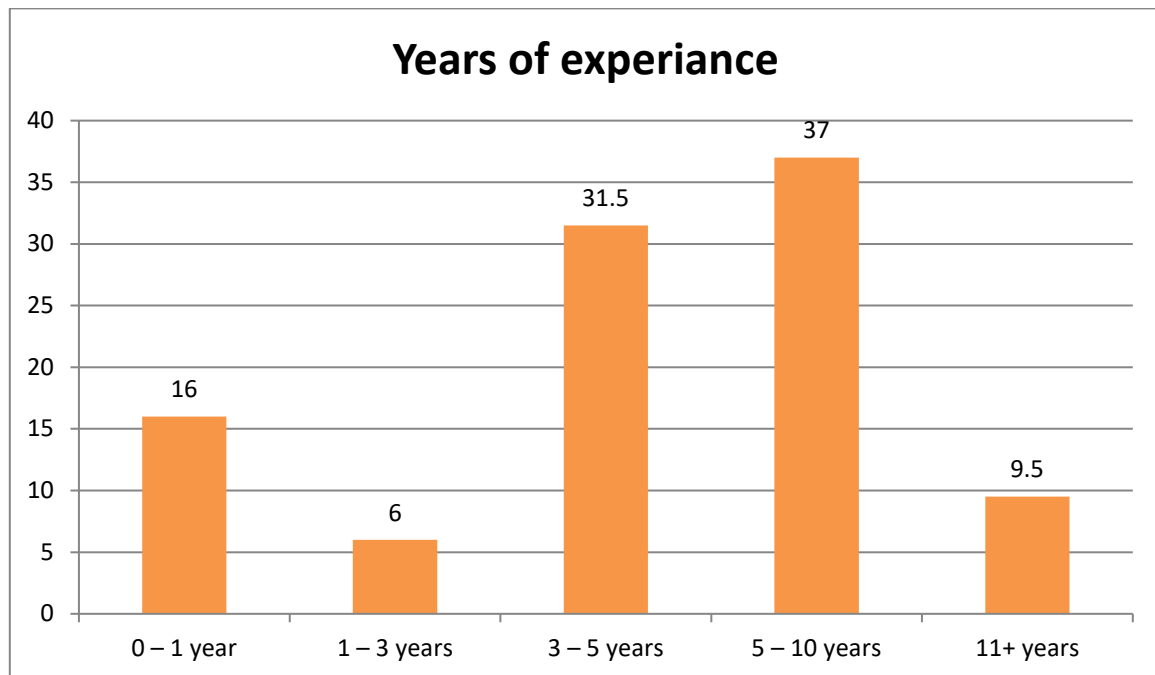
### **6.3 Study sample profile**

#### **6.3.1 Qualitative cods used**

The study intends to use multivariate regression framework for testing the theoretical model suggested in the present study. According to the theoretical framework, qualitative codes such as CF (Customer Factors) and OF (Organisational Factors) are have been considered to study/measure the data sets such as security and privacy perceptions of user. The codes such as FP (Functional Parameters) and NFP (Non-Functional Parameters) have been considered to measure the QoS perception of a user. CL is used to represent data set customer loyalty, which is the sum of CF, OF, FP and NFP.

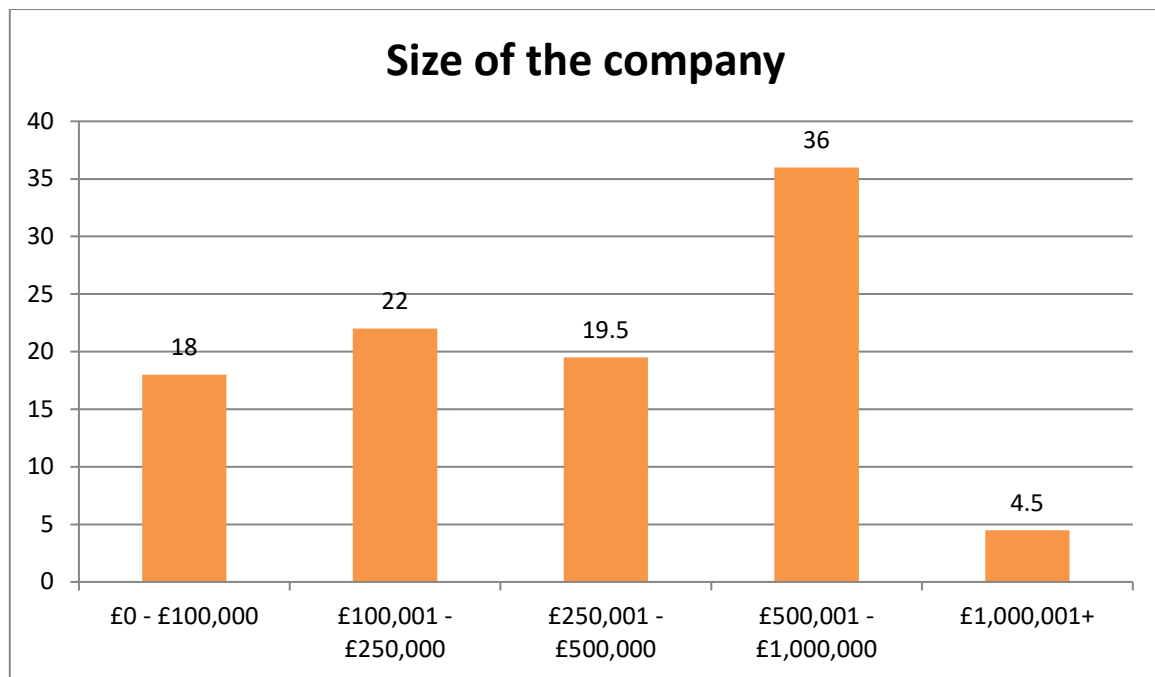
#### **6.3.2 Company profile**

The section provides in-depth knowledge of the profile of the samples that are involved in the survey. The participants of the survey are the 200 personal cloud storage service users. The users are the employees from various companies who are using OneDrive, Google Drive and Dropbox in the UK. The current section will thus detail and illustrate the responses of the participants corresponding to the questions with the help of charts and diagrams.



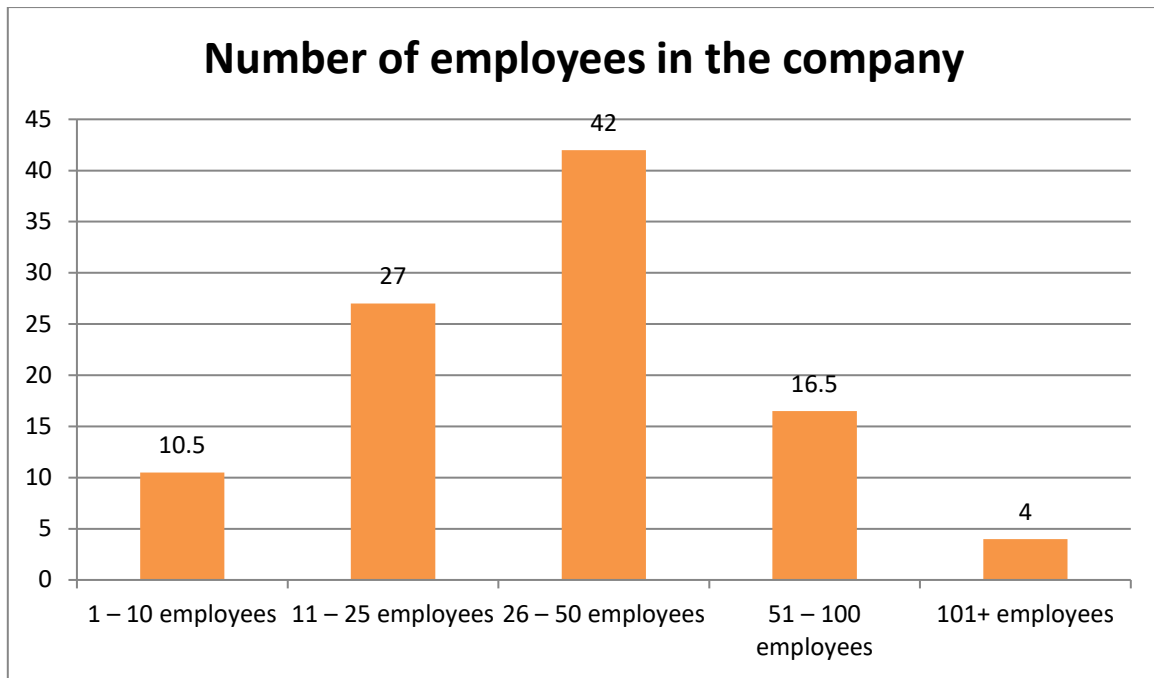
*Bar Chart 5.1: Years of experience*

The above Bar Chart 5.5 indicates the response of the survey participants towards the question regarding the years of existence of the company where they are working. From analysing the reaction of the participants, it is evident that the majority of the survey participants are working at the firm has an experience of 5 to 10 years (37%). Similarly, it is observed that the least number of participants are from the companies that are established within the period of 1 to 3 years (6%). Whereas there are only 9.5% of participants from firms with more than 11 years of existence.



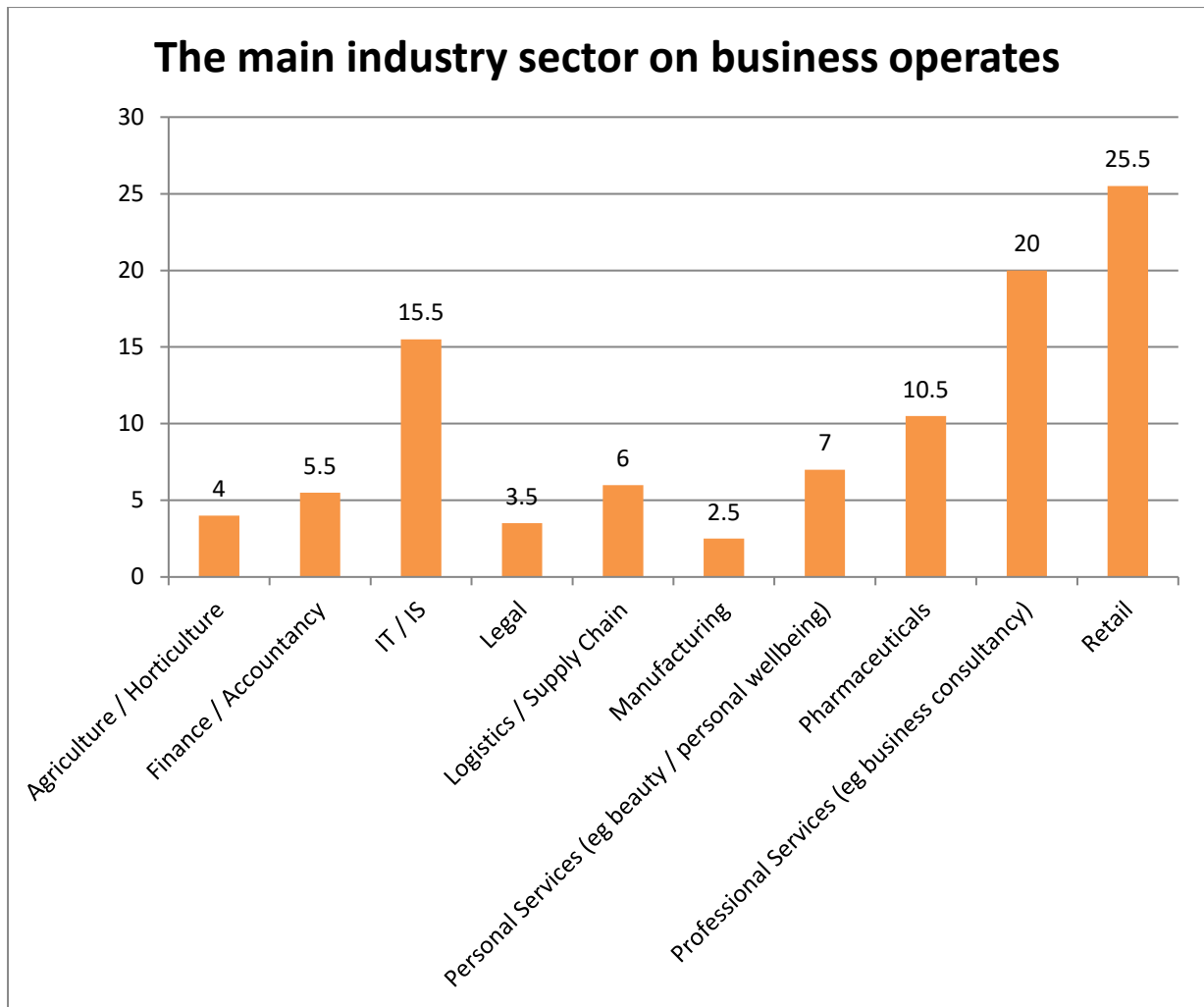
*Bar Chart 5.2: Size of the company*

Further, the survey participants were asked about the size of the company they are working based on the approximate turnover. The Bar Chart 5.2 is indicating the response of the 200 survey participants on the size of their company based on the approximate turnover they achieve. By analysing the graph, it is clear that among the survey participants the highest numbers of employees are from the firms with a turnover amount ranging from £500,001 to £1,000,000. Likewise, it is noticed that there are only 4.5% of employees are from companies with a turnover above £1,000,001 which is the lowest participation rate.



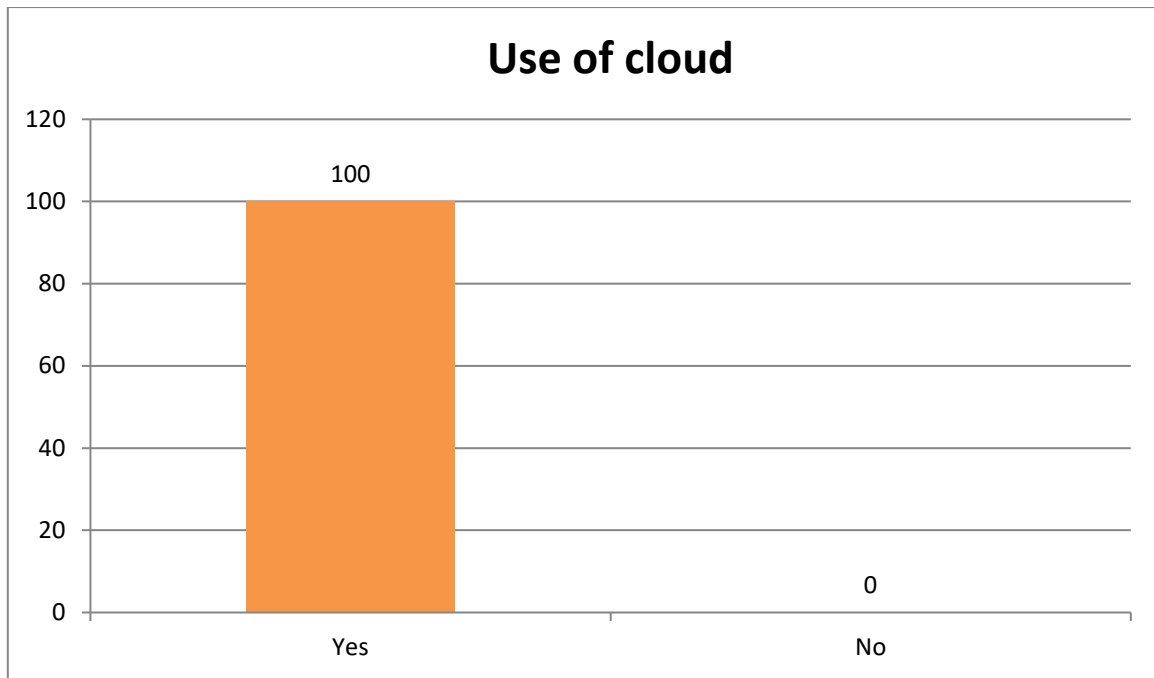
*Bar Chart 5.3: Number of employees in the company*

Bar Chart 5.3 is illustrating the total number of workforce existing in the company where the survey participants are employed. From the analysis, it is reflected that the highest number of employees is mentioned as more than a value 101 and lowest range of workforce is indicated between the field 1 to 10 employees. However, it is noticed that among the 200 survey participants the least number of participants are from the companies having a workforce of more than 101 (4%). Similarly, the analysis reveals that the highest participation is marked by companies with the total number of employees ranging from 26 to 50 (42%).



*Bar Chart 5.4: The main industry sector on business operates*

The above Bar Chart 5.4 is indicating the primary industry sector in which the business of the company where the survey participants operate. The graph is obtained based on the response of the 200 survey participants. There were ten categories of business sectors provided to the employees such as Agriculture / Horticulture, Finance / Accountancy, IT / IS, Legal, Logistics / Supply Chain, Manufacturing, Personal Services (e.g. beauty / personal wellbeing), Pharmaceuticals, Professional Services (e.g. business consultancy) and Retail. From analysing the diagram, it is obtained that the majority of the survey participants are from the companies which belong to the retails sector (25.5%). Likewise, it is noticed that the least participation is marked by the employees working in companies that are operating in the manufacturing industry (2.5%).



*Bar Chart 5.5: Use of cloud*

Later the 200 survey participants were asked to mark their response towards the question that whether they are using cloud services and have some means of identifying and /or protecting information assets. The Bar Chart 5.5 is representing the response of the survey participants to the corresponding query. By analysing the graph, it is evident that the 100% of survey participants are using cloud services and has some means of identifying and /or protecting information assets.

## 6.4 Descriptive statistics

### Demographics

Variable name	No.	Mean	Standard deviation
Year of existence	200	3.18	1.19
Size	200	2.87	1.21
Employees	200	2.77	0.98
Sector	200	6.88	3.02

Cloud service usage	200	1.00	0.00
---------------------	-----	------	------

*Table 7: Demographics*

The above-given table details the demographics of the 200 companies selected for the study. From the table, it can be noted that the mean value of companies regarding the years of existence is 3.18, which notes that the existence of the 200 companies lies between 3 to 10 years. The mean value of the company size in terms of the turnover is 2.87. It denotes that the turnover of the companies lies between £100,001 to £500,000. In addition, the mean value of the number of employees is 2.77, which is 1 to 50 in number. Considering the sectors which the companies are belonging the mean value is found to be 6.88. Hence, it can be understood that the majority of the companies are belonging to the manufacturing and personal services sector. Furthermore, the standard deviation for the sectors is identified to be 3.02, and it can be understood that the difference in the responses was high regarding the sector. Moreover, the 200 companies are found to be using the cloud storage service.

### **Perceptions of cloud computing and information security**

<b>Variable name</b>	<b>No.</b>	<b>Mean</b>	<b>Standard deviation</b>
Cloud computing knowledge	200	2.87	1.21
Knowledge of information security	200	2.77	0.98
High level of awareness	200	3.66	1.19
Awareness updated	200	3.42	1.32
Awareness of cloud storage	200	3.00	1.13

*Table 8: Perceptions of cloud computing and information security*



The above table denotes the perceptions of the individuals regarding the information security of the cloud computing service. It can be noted that the mean value of cloud computing knowledge is 2.87. Hence, it denotes that the majority of the individuals had responded that they disagree with the statement that they possess a clear idea about cloud computing to share with a friend or colleague. A similar scenario has been observed with the knowledge of the individuals regarding the information security of the cloud storage. However, the mean value regarding the high-level awareness of the individuals is 3.66. It notes that most of the individuals agree with the statement regarding the importance of cloud computing information security.

### **Applications of cloud computing security**

<b>Variable name</b>	<b>No.</b>	<b>Mean</b>	<b>Standard deviation</b>
Cloud storage attitude High	200	3.13	1.25
Cloud storage attitude Medium	200	2.31	1.25
Cloud storage attitude Low	200	2.21	1.17
Cloud computing security application usage	200	3.29	1.33
Encouraging others to use the Cloud computing security application	200	3.29	1.35

*Table 9: Applications of cloud computing security*

The above table contains the details regarding the cloud computing security applications. The mean value of high attitude of the individuals regarding the security of the cloud computing service is found to be 3.13. From the figure, it can be understood that most of the individuals have a neutral opinion regarding the statement. In addition, it can be identified that the majority of the individuals disagree with the statements that they possess a moderate or low attitude regarding cloud storage. Moreover, the response is found neutral among the majority of the

individuals regarding the encouraging others for using the cloud computing security application.

### Challenges with cloud computing and security

Variable name	No.	Mean	Standard deviation
Cloud computing security cost	200	3.29	1.35
Cloud computing security cost vs benefits	200	2.79	1.27
Compatibility issues	200	2.83	1.50
Ongoing cost	200	3.63	1.24

*Table 10: Challenges with cloud computing and security*

The above table denotes the responses of the individuals regarding the challenges which they face on the cloud computing and its security. From the table, it can be easily identified that the majority of the individuals agree that the ongoing cost is the main issue which they face with the cloud computing and its security. The literature review, similarly states that ongoing cost is one of the major challenges (Ferrer et al., 2012). However, the proposed theoretical model does not regard the cost as the main challenge. The conceptual model perceives the compliance with GDPR laws along with the need for meeting privacy demands of the customers as the most significant challenges. Despite the measures taken with regard to the underpinning of the deterrence and remedies, the current scenario indicates the increased violation of privacy. The interview responses, similarly, deem the increased privacy and security concerns. In addition, it has been recognised that the individuals have a neutral attitude regarding the compatibility issues and the cost of cloud computing than its benefits.

### Functional Parameters

Variable name	No.	Mean	Standard deviation

User friendliness of cloud storage service	200	3.47	1.36
Satisfaction with the 24x7 accessibility	200	3.33	1.28
Reliability of the Cloud storage service	200	3.13	1.49
Accommodation of the needs	200	3.63	1.24
Solving queries and concerns	200	3.54	1.45

*Table 11: Functional Parameters*

The functional parameters regarding the cloud storage are mentioned in the above-given table. From the table, it can be identified that the mean value of the individuals regarding the accommodation of the needs is 3.63. Thus it can be stated that the majority of the individuals agree that they find the cloud storage service as accommodating their needs. In addition, the lowest mean value in the table is identified in association with the reliability of the cloud storage service. Hence it can be recognised that the individuals have a neutral opinion regarding the reliability of the cloud storage service.

### **Non-Functional Parameters**

Variable name	No.	Mean	Standard deviation
Recommendation of the cloud storage service	200	3.63	1.24
Emotional attachment	200	3.47	1.36
Motivated for using the cloud storage service	200	3.33	1.28
Influence of the peers and friends	200	3.31	1.44
Switching the cloud storage service	200	3.63	1.24
Influence of social norms for using the cloud storage service	200	3.61	1.31

*Table 12: Non-Functional Parameters*

From the above table, it could be analysed that most of the participants were willing to recommend the personal cloud storage services to the friends which indicates the advantages of the services offered. Similarly, the majority of the participants revealed that they hesitate to switch from the personal cloud storage services and the main reason pinpointed by the users was that the transferring of the data is difficult between different cloud services. These findings support the literature review and the conceptual model. Furthermore, it was identified from the above analysis that social norms prevailing in the market greatly influence the consumer's choice of using a particular cloud storage services. These findings contradict with that of the interview responses which stated the lack of influence of critical mass on the adoption of cloud computing services. However, the role of social norms is underpinned by these responses similar to that of literature review and survey responses (Yang et al., 2018). Besides, these survey responses demonstrate the significance of both functional and non-functional parameters.

#### **Organisational parameters of privacy and security**

Variable name	No.	Mean	Standard deviation
Deterring of the issues	200	3.73	1.18
Remedies for the issues	200	3.47	1.36
Prevention of the issues	200	2.79	1.27
Effective in detecting the issues	200	3.63	1.24

*Table 13: Organisational parameters of privacy and security*

While assessing the privacy and security concerning the organisational parameters, it was noted that most of the participants agreed that deterring the issues affecting the privacy and security that may confront while using the cloud services are manageable. Furthermore, it was identified that the cloud services used by the respondents are effective in detecting the issues affecting the security. However, the

majority of the respondents remained neutral while asked about the efficiency of the services concerning finding the remedies for the issues encountered when using the services and the capability to prevent the issues.

### **Customer parameters of privacy and security**

Variable name	No.	Mean	Standard deviation
Understanding of the privacy agreements	200	3.58	1.40
Willingness to store the data	200	3.67	1.26
Complying with the existing laws	200	3.53	1.40
Meeting the GDPR regulations	200	3.42	1.33
Trust decay	200	3.44	1.45

*Table 14: Customer parameters of privacy and security*

It was evident from the above table that most of the customers consuming the cloud services were satisfied with the privacy and security services offered and thus was willing to store the personal information in the services. Furthermore, it was noted that the majority of the customers has been aware of the privacy agreements by reading through the privacy agreement. Moreover, the respondents revealed that the customers believe that the privacy agreements incorporated while using the cloud services satisfy with the prevailing regulations in the market regarding the user data. While assessing the opinions concerning GDPR regulations and decaying trust after a long time, most of the respondents remained neutral.

### **Customer trust and satisfaction**

Variable name	No.	Mean	Standard deviation
Customer trust	200	3.86	1.20

Customer satisfaction	200	3.61	1.16
-----------------------	-----	------	------

*Table 15: Customer trust and satisfaction*

While assessing the customer trust and customer satisfaction about the use of cloud services, it could be interpreted that the majority of the customers showcased higher satisfaction level and customer trust while using the services. From the above table, it could be analysed that customer trust was leading than customer satisfaction. Moreover, it was noteworthy that the standard deviation of both the customer satisfaction and trust is very low indicating that there exists only very low deviation from the received results. Moreover, the high satisfaction and trustworthiness toward the services indicate a positive relationship with the customers and the personal cloud service providers. The conceptual model demonstrates that the deliverance of features such as responsiveness, scalability and agility could build up customer satisfaction eventually leading to loyalty. In addition, the interview responses underpinned the need for extending a communication between the clients and vendors for retaining them. The factors that led to this higher degree of customer satisfaction, hence, could be regarded in relation to these factors.

### **Customer Retention loyalty and advocacy loyalty**

Variable name	No.	Mean	Standard deviation
Retention loyalty	200	3.87	1.18
Advocacy loyalty	200	3.44	1.39

*Table 16: Customer Retention loyalty and advocacy loyalty*

Assessment of customer retention loyalty and advocacy loyalty are significant factors to assess while evaluating the efficiency of the personal cloud services. The retention loyalty of the customers was found to be high among the respondents which highly recommend that the qualities of services offered are up to the demands of the customers. Moreover, while assessing the advocacy loyalty, it was noted that the majority of the customers recommend the use of the personal cloud services.

Thus it could be implied that the customers were able to develop an emotional connection through the use of the personal cloud services.

## 6.5 Cronbach's Alpha test

Cronbach's alpha test was used in this study to test the reliability of the research instrument used in the study. Cronbach's alpha test analyses the internal consistency of a research instrument (survey questionnaire) in order to estimate whether the collected data can be considered as a group. This test estimates the inter-correlation between the items in the research instrument. A higher score in Cronbach's alpha is deemed ideal in a research study as it pertains to the high reliability of the research instrument. For practical purposes, a score of 0.7 is used as a cut-off range for assessing the reliability. Under this approach, a research instrument with score above 0.7 will be found acceptable in a research study.

Scale	Cronbach's alpha
Functional Parameters (FP)	0.99
Non-Functional Parameters (NFP)	0.99
Organisational factors (OF)	0.96
Customer factors (CF)	0.99

*Table 17: Cronbach's Alpha*

The Cronbach's Alpha test in the current study revealed that the research instrument used in the study had very high reliability. The results of the test shows that three of the four factors tested in the current study had Cronbach's Alpha score of 0.99 while the fourth factor (OF) recorded Cronbach's Alpha score of 0.96. This means that the research questionnaire used in this study has high internal validity and internal consistency. This also indicates that the data collected in the study has high reliability.

## 6.6 Normality Assessment

The normality of distribution of the survey data is assessed in this section with the help of normality assessment. In this study, the association between customer loyalty and QoS perception of personal cloud storage service users with the help of a

theoretical model. As per the theoretical model proposed in the study, the customer loyalty in a personal cloud storage service is a function of QoS perception and security and privacy perceptions of a user. CF (Customer Factors) and OF (Organisational factors) measure security and privacy perceptions of a user while FP (Functional Parameters) and NFP (Non-Functional Parameters) measures the QoS perception of a user. Normality tests estimates whether the collected data is distributed normally.

Measurement Items	N	Skewness		Kurtosis	
		Statistic	Std. Error	Statistic	Std. Error
FP1	200	-0.35	.17	-1.24	.34
FP2	200	-0.31	.17	-1.16	.34
FP3	200	0.01	.17	-1.53	.34
FP4	200	-0.69	.17	-0.40	.34
FP5	200	-0.40	.17	-1.42	.34
NFP1	200	-0.69	.17	-0.40	.34
NFP2	200	-0.35	.17	-1.24	.34
NFP3	200	-0.31	.17	-1.16	.34
NFP4	200	-0.15	.17	-1.44	.34
NFP5	200	-0.69	.17	-0.40	.34
NFP6	200	-0.41	.17	-1.27	.34
OF1	200	-0.73	.17	-0.24	.34
OF2	200	-0.35	.17	-1.24	.34
OF3	200	0.30	.17	-1.11	.34
OF4	200	-0.69	.17	-0.40	.34
CF1	200	-0.44	.17	-1.39	.34
CF2	200	-0.69	.17	-0.48	.34
CF3	200	-0.38	.17	-1.31	.34
CF4	200	-0.38	.17	-1.22	.34
CF5	200	-0.30	.17	-1.36	.34

The normality tests result show that the items considered in the study are normally distributed. This is because skeweness and kurtosis values of the items are within the cut-off range of  $\pm 2.58$ . From this it can be understood that the items considered in the study are approximately normally distributed.

### Jarque-Bera Test of Normality

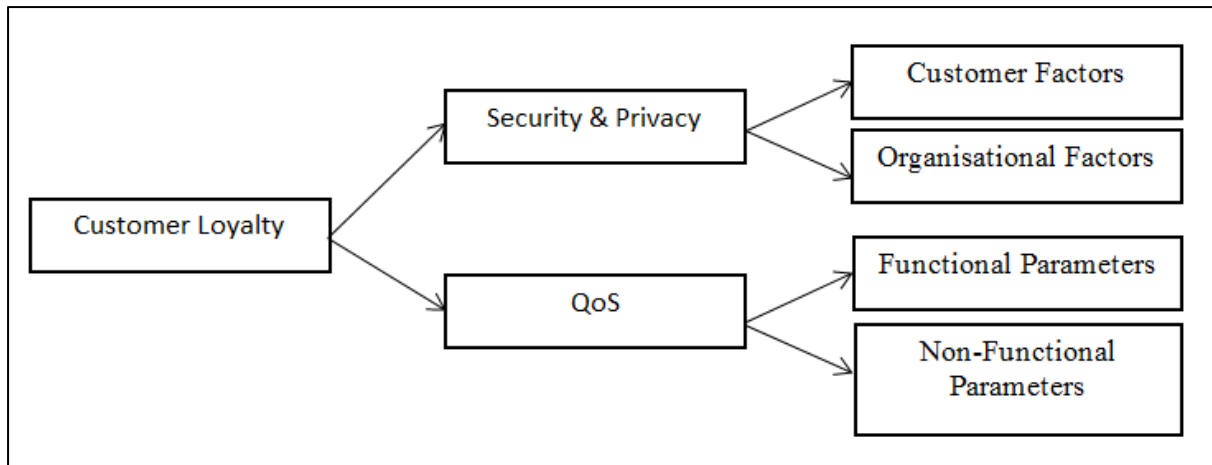
Measurement	Sample	Skewness	Kurtosis	JB Test	p-value
-------------	--------	----------	----------	---------	---------



Items	size	Statistic	Std. Error	Statistic	Std. Error		
FP1	200	-0.35	0.17	-1.24	0.34	0.329556	0.848082
FP2	200	-0.31	0.17	-1.16	0.34	0.236541	0.888456
FP3	200	0.01	0.17	-1.53	0.34	0.000386	0.999807
FP4	200	-0.69	0.17	-0.4	0.34	0.586908	0.745683
FP5	200	-0.4	0.17	-1.42	0.34	0.534102	0.765634
NFP1	200	-0.69	0.17	-0.4	0.34	0.586908	0.745683
NFP2	200	-0.35	0.17	-1.24	0.34	0.329556	0.848082
NFP3	200	-0.31	0.17	-1.16	0.34	0.236541	0.888456
NFP4	200	-0.15	0.17	-1.44	0.34	0.077046	0.962209
NFP5	200	-0.69	0.17	-0.4	0.34	0.586908	0.745683
NFP6	200	-0.41	0.17	-1.27	0.34	0.468052	0.791341
OF1	200	-0.73	0.17	-0.24	0.34	0.58297	0.747153
OF2	200	-0.35	0.17	-1.24	0.34	0.329556	0.848082
OF3	200	0.3	0.17	-1.11	0.34	0.209961	0.900342
OF4	200	-0.69	0.17	-0.4	0.34	0.586908	0.745683
CF1	200	-0.44	0.17	-1.39	0.34	0.622404	0.732566
CF2	200	-0.69	0.17	-0.48	0.34	0.624764	0.731702
CF3	200	-0.38	0.17	-1.31	0.34	0.42132	0.810049
CF4	200	-0.38	0.17	-1.22	0.34	0.379792	0.827045
CF5	200	-0.3	0.17	-1.36	0.34	0.278852	0.869857

Jarque-Bera Test of Normality is performed for assessing the normality of the factors considered in the study. The results of the JB test reveal that that JB test statistic for all the factors considered in the study are closer to zero. This implies that the factors considered in the study are normally distributed. The p-value of JB test statistic of all the factors are greater than 0.05 which also indicates that the null hypothesis that the collected data is normally distributed can be accepted.

## 6.7 Structural equation modelling



*Figure 5.1 Structural equation modelling*

Multivariate regression model is used in this study for testing the theoretical model proposed in the current study. As per the theoretical model, the CF (Customer Factors) and OF (Organisational factors) measure security and privacy perceptions of a user while FP (Functional Parameters) and NFP (Non-Functional Parameters) measures the QoS perception of a user. This in turn is represented as:

***Customer Loyalty (CL):  $CF+OF+FP+NFP$***

This model posits three research hypotheses as detailed below:

*H1: Customer Factors (CF) and Organisational factors (OF) have significant effect on customer trust towards the personal cloud storage service.*

*H2: Functional Parameters (FP) and Non-Functional Parameters (NFP) have significant effect on customer satisfaction towards the personal cloud storage service*

*H3: Security and privacy perceptions and QoS perception of a user have significant effect on the loyalty of a user towards the personal cloud storage service*

The current study aims to test the above research hypotheses with the help of multivariate regression analysis. The result of the multivariate regression analysis is presented in the below section.

### **6.7.1 Model fit**

<b>ANOVA<sup>a</sup></b>						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	259.76	20	12.99	132.11	.000
	Residual	17.60	179	.10		
	Total	277.36	199			
a. Dependent Variable: Retention Loyalty						

*Table 18: Model fit*

The fitness of the theoretical model proposed in the current study is estimated by estimating Goodness of Fit of the model. The above table summarises the results of the goodness of fit of the model. The table shows that the theoretical model proposed in the current study has strong goodness of fit. This is evident from the high mean square value of the regression model and the very low mean square value of the residual.

## 6.8 Hypothesis testing

The research hypotheses are tested in this section using multivariate regression analysis. The results of the regression analyses are summarised in the below table.

<b>Hypothesis</b>	<b>T value</b>	<b>P value</b>	<b>Beta</b>
<b>H1</b>	.72	.000	.00
<b>H2</b>	3.15	.000	.00
<b>H3</b>	2.13	.000	.00

*Table 19: Results of hypothesis testing*

The results of the regression test are interpreted below.

*H1: Customer Factors (CF) and Organisational factors (OF) have significant effect on customer trust towards the personal cloud storage service.*

Research hypothesis H1 had posited that Customer Factors (CF) and Organisational factors (OF) have significant effect on customer trust towards the personal cloud storage service. This is found to be true in the regression analysis. The results of the regression analysis indicate that the proposed model can explain 94% of the variation in the customer trust towards the personal cloud storage service. This association was found to be statistically significant as the p-value (.000) is less than 0.05. From this it can be understood that Customer Factors (CF) and Organisational factors (OF) have significant effect on customer trust towards the personal cloud storage service.

*H2: Functional Parameters (FP) and Non-Functional Parameters (NFP) have significant effect on customer satisfaction towards the personal cloud storage service*

Research hypothesis H2 had posited that Functional Parameters (FP) and Non-Functional Parameters (NFP) have significant effect on customer satisfaction towards the personal cloud storage service. This is found to be true in the regression analysis. The results of the regression analysis indicate that the proposed model can explain 94% of the variation in the customer satisfaction towards the personal cloud storage service. This association was found to be statistically significant as the p-value (.000) is less than 0.05. From this it can be understood that Functional Parameters (FP) and Non-Functional Parameters (NFP) have significant effect on customer satisfaction towards the personal cloud storage service.

*H3: Security and privacy perceptions and QoS perception of a user have significant effect on the loyalty of a user towards the personal cloud storage service*

Research hypothesis H3 had posited that Security and privacy perceptions and QoS perception of a user have significant effect on the loyalty of a user towards the personal cloud storage service. This is found to be true in the regression analysis. The results of the regression analysis indicate that the proposed model can explain 94% of the variation in the customer loyalty towards the personal cloud storage service. This association was found to be statistically significant as the p-value (.000) is less than 0.05. From this it can be understood that Security and privacy

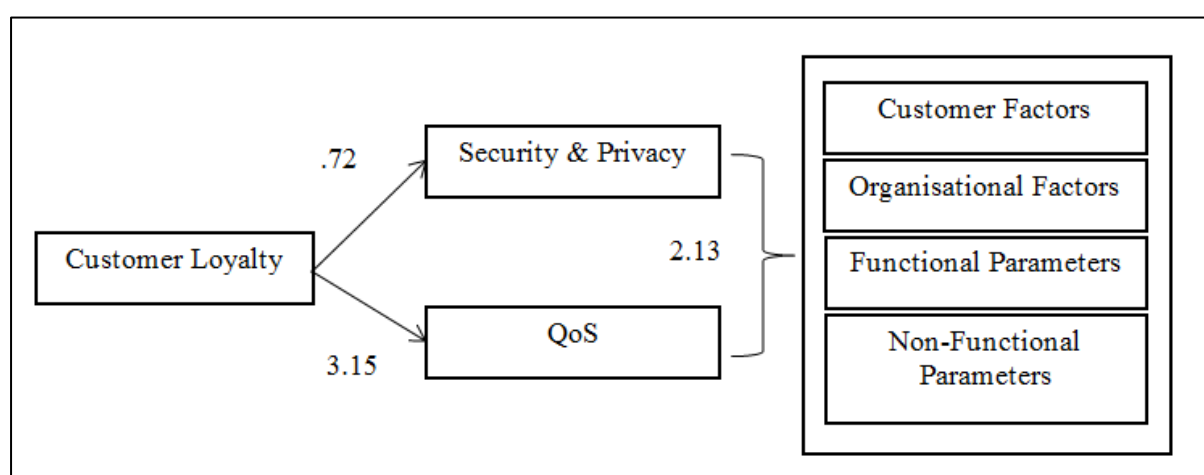
perceptions and QoS perception of a user have significant effect on the loyalty of a user towards the personal cloud storage service.

From the interpretation of the regression analysis results, it can be understood that research hypotheses H1, H2 and H3 holds true in the current study. Apart from this, the overall model proposed in the study was also found to be statistically significant in the current study. This is depicted in the model summary given below.

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.97	.94	.93	.31

*Table 20: Regression model*

The above given model summary shows that 94% of the variation in customer loyalty in personal cloud storage service can be explained with the help of security and privacy perceptions and QoS perception of a user.



*Figure 5.2: Theoretical model results*

## 6.9 Summary

From the overall analysis of the survey, Cronbach's Alpha test and the Hypothesis testing, it could be inferred that the personal cloud computing services are becoming

popular and highly utilised by UK customers. However, the amount of tension associated with the usage of these services is found to be getting higher. The analysis conducted in the chapter has revealed that the changing or fluctuating prices of the personal cloud computing services is the major issue faced by the customers. The increasing price of cloud computing services makes it hard for customers to continue with the service. In addition, the high switching cost of the services makes it difficult for the customers to shift from one service provider to another. Another problem identified from the analysis is the lack of trust in the personal cloud service. It has been identified that the violation of the privacy policy such as the misuse of the personal data by the cloud computing service providers or the third parties worsens the situation and forces the customer from discontinuing the service.

Furthermore, the study had proved that the proposed or formulated hypothesis such as the H1: Customer Factors (CF) and Organisational factors (OF) have a significant effect on customer trust towards the personal cloud storage service; H2: Functional Parameters (FP) and Non-Functional Parameters (NFP) have significant effect on customer satisfaction towards the personal cloud storage service and H3: Security and privacy perceptions and QoS perception of a user have significant effect on the loyalty of a user towards the personal cloud storage service are accurate and supportive.

## **Chapter 7: Discussion and evaluation**

### **7.1 Introduction**

This chapter is framed for mainly evaluating the findings. At the time of the evaluation, research aim, research questions, and research objectives will be considering. The evaluation will also consider the entire findings. There will be two sections in this chapter besides the introduction, which are discussion and evaluation and conclusion.

### **7.2 Discussion and evaluation**

The determinants that influence the use for enterprise cloud computing services were assessed in this research. Five characteristics have mentioned by Sen (2015); Armburst et al. (2010); Hamdaga and Tahvidari (2012); Yakimenko et al. (2009); Jula et al. (2014); Yang et al. (2017); Armburst et al. (2010); Jula et al. (2014) and Shaikh and Sasikumar (2015) that may influence the use for enterprise cloud computing services, which are on-demand services, broad network access, pooling of resources, elasticity and measurement of services. The thematic analysis has shown that merely the Quality of Service [QoS] is not inspiring the organisations to use enterprise cloud computing services. This means that there are other determinants playing here, that can be linked with the characteristics mentioned in the literature reviews.

It could observe from different sources that cloud storage service adoption is the best method for improving the business performance of firms (Chowdhury et al., 2020). Here, the integration of technology helps the firms to improve business performance (Karim and Rampersad, 2017). However, firms have important challenges by employing the cloud storage service and most important among them are data leakage and security issues (Karim et al., 2021). From the thematic analysis of the research findings, some of the concerns regarding the adoption of cloud-based solutions can be understood. As part of this, the respondents mentioned some challenges, which are the cost of the integration of new technology, privacy issues and security issues. From the responses, the cost challenge can also be considered as a challenge for cloud storage service.

Different attributes related to the QoS that affect the privacy of enterprise cloud services. As part of this, accountability is highly important. Shyam and Prasad (2017) observed that trust of customers could be improved if the cloud service providers are accountable. Secondly, agility needs to note down here that affect the privacy of enterprise cloud services (Sharma and Madan, 2020). Regarding this, the existing framework can be clearly adapted to cloud computing. In this context, data loss will be less. Here portability, flexibility, adaptability and elasticity will also be ensured by integrating the cloud services (Garg et al., 2013). Saravanan et al. (2013) argued the performance attribute that affects the privacy of enterprise cloud services. The privacy of the enterprise cloud services assures through high accuracy, on-time responses and functionality (Pierantoni et al., 2020).

Both the findings and literature debate allowed the researcher to meet the key objective of the research that was to assess the cloud services by deliberating the attributes of QoS. Here the privacy and security as the key requirements of users are considered. As part of this, the universal nature of cloud services could understand, and this facility permits the users to access information from any location (Bsharat and Ibrahim, 2020). Here, the unification of data is mainly occurring. However, users often concerned about the security and privacy of professional or personal information (Ali and Osmanaj, 2020). However, QoS allow users to self-rescue from threats. In this way, confidentiality, data integrity and privacy are able to protect by users. The literature has shown QoS performance related determinants, such as resource management monitoring, scalability and elasticity (Wang et al., 2013). The identified determinants have the capability to affect customer satisfaction, as customers may be willing to use the services if the service provider is able to meet those (Xie et al., 2021).

### 7.3 Conclusion for discussion and evaluation

The evaluation section was useful for understanding the determinants which impact the consumer use for enterprise cloud computing services. Different attributes related to the QoS that affect the privacy of enterprise cloud services (PCS) could recognise. Finally, an evaluation of the entire findings could conduct.



## **Chapter 8- Conclusions and Recommendations**

### **8.1 Introduction**

The purpose of the current section is to draw the main conclusions of the study primarily. For this, the findings attained by interviewing technical and managerial staffs from personal storage device providers such as Google Drive, Dropbox and OneDrive are accessed in support of literature studies. Together with this, the information gathered from customers who are using personal storage device providers in the UK is cross- compared to deliver at required conclusions. In addition to this, the chapter provides suitable recommendations for cloud computing companies to further improve their services.

### **8.2 Conclusions**

Objective 1: To accumulate basic details related to the determinants that influence the use of enterprise cloud computing services.

Identifying the influence of cloud computing services at the enterprise level was the primary objective of the current research which have been completed with utmost precision. The literature review has highlighted the importance of on-demand services as an essential factor that supports enterprise management in different factors in which decision making is a prior one (Mell and Grance,2011). The interview analysis confirms this statement in which the importance of cloud computing in assisting decision making is evident. Both functional and non-functional parameters show positive attributes to enterprise cloud computing. The basic structure of cloud computing that supports resource management is comprehended from the study in which the security risks and associated characteristic have been studied, which comprises the primary objective.

Objective 2: To conduct a systematic literature review to propose and validate a framework that addresses the challenges that enterprise cloud services face in terms of QoS.

A systematic literature review has been assistive in the current study for comprehending the different characteristics of the company in which the resource pooling, service measure and elasticity is observed to be implying to the quality service output. A suitable framework that accurately addresses the enterprise for ensuring QoS in cloud computing have criticised different models such as the technology acceptance model and SERVQUAL model was discussed. Ten studies (between the year 2011-2015) related to QoS in cloud computing was adopted for developing a systematic review in which the usefulness and behavioural intention mentioned in the technology acceptance model was confirmed by the survey analysis results. However, the SERVQUAL model emphasised the importance of assurance and responsiveness as essential in adopting cloud computing at the enterprise-level which can be observed as implying the QoS dimension of this feature (Armburst et al., 2010). Thus both the frameworks encapsulated the dimensions for identifying the main changes of QoS in cloud computing, while one focuses on customer's perception, the other concentrates on formal enterprise standards.

Objective 3: To use the outcome of the literature to develop a framework allowing for the evaluation of enterprise cloud services (PCS) based on the key attributes of QoS and user requirements.

The study, after identifying the key attributes of QoS, further aims to develop a framework that supports critically evaluating PCS as per user requirement. This objective has been achieved through both interview and survey analysis in which the questions regarding the effectiveness of PCS was satisfactory for conducting the research (Garg et al., 2013). The interconnection of customer trust and cloud service accountability along with agility and privacy concerns have been identified through the interview and survey analysis, which supports the literature data regarding effective QoS standards. Thus, it can be inferred as the existing framework will be supportive for evaluating PCS with the aid of fundamental attributes of QoS. This conclusion can be therefore identified to be achieving the third objective of this study.

Objective 4: To identify and detail the proper research methods for evaluating the research questions and state the relevant justifications.

This study has chosen interpretive study structure as the nature of research variables demands an in-depth assessment of the different perspective of cloud computing users in terms of QoS. This decision was attained through developing adequate rationale on the structure of the interpretivism method to connect the research findings to the primary objectives which combine with the inductive process assisted in abstracting data from existing theories. Thus the basic pattern of research development was achieved through critically considering the ontological and epistemological factors (Angeli and Valanides, 2009). Furthermore, for developing a comprehensive research question that will be straightforward for precise justification, the systematic literature review integrated with the deductive approach was adopted. The primary research approach has been another support for obtaining the answers to the research questions, which was effective in reducing the complexity of the research.

Objective 5: To discuss and analyse the findings of the expert interview to comprehend the major parameters that assure the loyal bond between the service provider and the client.

The interview carried out with the support of technical experts at OneDrive, Dropbox and Google Drive was mainly structured for abstracting data on the level of loyalty cloud computing have gathered among the customers. The loyalty factor among the service provider and the customers is specifically stated in the SERVQUAL model as the main component that determines QoS efficiency. The interview analysis has furthermore focused on this factor in which the loyalty of customers that identifies the authenticity of data privacy delivered by the service provider was prioritised. The findings support this factor which can be identified as a link to the theoretical data and research study outcome. However, data privacy is not only identified to be effecting the loyalty factor but also the credibility and level of security on data production.

Objective 6: To conduct a survey amongst users of the most popular cloud services (Dropbox, OneDrive and Google Drive) to verify the QoS and Privacy attributes identified from the literature.

Cloud computing services provided by Dropbox, OneDrive and Google Drive while indicating a satisfactory level of concern from the customers, the lack of confidentiality developed from tension on data security level is evident from the study. This factor determines the fact that customers still have moderate consideration of the QoS level of cloud computing. On the other hand, the price concerns are furthermore discussed in the survey analysis, which can be linked to the TAM framework stated in the literature review. The attitude of customers towards the cloud computing feature furthermore is linked to factors such as GDPR regulations and issue detection of cloud computing services, which is less emphasised in the TAM framework. However, the literature indicates the importance of legal aspects adjoining customer trust and QoS, which have to be balancing the benefits received at the customer's end.

Objective 7: To reflect a fuller discussion and evaluation of the findings of the study to draw the main conclusions of the study.

The systematic literature review indicates the main characteristics and dimensions supporting cloud computing and QoS which is underpinned with theoretical support. The critical assessment of interview and survey analysis depicts a similar outcome as stated in the literature, while certain exceptions are observed in dimensions such as cost of service and privacy issues. The study discussed all the objectives with the support of literature data, which furthermore indicated the gravity of legal concerns associated with data protection. However, the study has identified the advantages of cloud computing services in providing accurate flexibility, adaptability and elasticity for customers which can be identified to be enhancing the QoS credibility. Finally, factors such as accuracy and on-time responses have been identified to be effecting customer loyalty while the tension of data leakage still prevails.

#### Empirical and practical contribution

The current study has high practical application to check on Quality of Service (QoS) on enterprise cloud storage service adoption. Besides, the researcher will also gain knowledge on the service quality importance in a real-world business context by considering the case of enterprise cloud storage service adoption.

### 8.3 Recommendations

The key challenge which is faced by the enterprise cloud service providers that deter the adoption and retention level of the service users is the inability to keep upgraded with the evolving enterprise needs. In addition, it could also be understood from the thematic analysis that the critical determinants of cloud storage adoption include both QoS parameters (functional and non-functional). Additionally, the dominance of security concerns among the users' spectrum could also be evidenced by the thematic analysis. However, regression analysis contradicted this by stating the increased significance of some parameters over others. These findings are more significant as these results are generated from the user perspective (survey analysis of the cloud service users.) Therefore, to facilitate the adoption levels of cloud service storage options, it is necessary to address these concerns of the customers.

***Place significance to the improvement of functional parameters:*** As evidenced by the regression analysis, customers regard factors such as responsiveness and availability as important. The solving of their concerns and queries at the earliest and in the viable ways help in assuring the satisfaction of the customers. This is supported by the proposed conceptual framework which has stated the link between these elements and customer trust and loyalty in the case of enterprise cloud storage service options. This means that the service provider should place a higher significance in responding to the users alongside the assuring of security. In addition, availability is another major sought out factor as revealed by the regression analysis. This means that the service providers should extend measures by which the evolving needs of customers could be addressed such, as the need for an increased storage option.

### 8.4 Future scope and recommendation to upcoming researchers

The key recommendation is to narrow down the area of focus of the study. This study tried to explore the impact of a wide range of factors including functional parameters, non-functional parameters and security risk and privacy in facilitating the adoption of cloud storage services. In addition, this study considered the mediating factors such as customer trust and customer satisfaction in impacting the retention of enterprise cloud storage service usage. This broadened focus deprived the optimal

validity and reliability of the study. Despite the use of mixed research methods alongside the regression analysis and structure equation modelling, this study confronted with difficulties in inferring an explicit finding on the link between these variables. Therefore, it is suggested to narrow down the focus on either of any areas; such as the security and privacy risk concerns or quality of service dimension of cloud storage service options. In addition, it is directed to append the sample size for increasing the validity of the study. Another key suggestion is to use a more accurate sampling technique with minimal bias such as simple random probability technique for assuring the equal representation of the samples with respect to the chosen population.

### **8.5 Limitation of the research**

One of the fundamental limitations of the current research is that the researcher has utilised only a limited number of articles for arguing the statements related to the research subject. Inclusion of more number of articles could advance the research area and help in reaching out to better conclusions. Time and cost constraints are the other two limitations of the current study. The strict time limit in the University guidelines for presenting the discussion limited the number of samples. Deficiency in getting the existing reviews on the research subject posed a challenge to the researcher in accumulating the secondary information relevant to the study again.

## **References**

Aazam, M. and Huh, E.N. (2016) Fog computing: The cloud-iot/IOE middleware paradigm. *IEEE Potentials*, 35(3), pp.40-44.

Abdelmaboud, A., Jawawi, D.N., Ghani, I., Elsafi, A. and Kitchenham, B. (2015) Quality of service approaches in cloud computing: A systematic mapping study. *Journal of Systems and Software*, 101, pp.159-179.

Abdulkadiroğlu, A., Angrist, J.D., Narita, Y. and Pathak, P.A. (2017) Research design meets market design: Using centralized assignment for impact evaluation. *Econometrica*, 85(5), pp.1373-1432.

Aceto, G., Botta, A., De Donato, W. and Pescapè, A. (2013) Cloud monitoring: A survey. *Computer Networks*, 57(9), pp.2093-2115.

Adisa, F., and Rose, J. (2013) "The Mediating Role of Absorptive Capacity in Knowledge Transfer: ERP Implementations in Small and Medium Sized Enterprises in Sub-Sahara Africa", *International Journal of Enterprise Information Systems (IJEIS)*, 9(2), 1-19.

Al-Ababneh, M. (2020) Linking ontology, epistemology and research methodology. *Science & Philosophy*, 8(1), pp. 75-91.

Alharahsheh, H. and Pius, A. (2020) A review of key paradigms: Positivism VS interpretivism. *Global Academic Journal of Humanities and Social Sciences*, 2(3), pp.39-43.

Almorsy, M., Grundy, J. and Müller, I. (2016) An analysis of the cloud computing security problem. *arXiv preprint arXiv:1609.01107*.

Al-Shammari, S. and Al-Yasiri, A. (2014) *Defining a Metric for Measuring QoE of SaaS Cloud Computing*. PgNET Conference.

Angeli, C. and Valanides, N. (2009) Epistemological and methodological issues for the conceptualization, development, and assessment of ICT–TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers & education*, 52(1), pp.154-168.

Aoyama, T. and Sakai, H. (2011) Inter-cloud computing. *Business & Information Systems Engineering*, 3(3), pp.173-177.

Aoyama, T. and Sakai, H. (2011) Inter-cloud computing. *Business & Information Systems Engineering*, 3(3), pp.173-177.

Apel, R. and Nagin, D.S. (2011) General deterrence: A review of recent evidence. *Crime and public policy*, 4, pp.411-436.

Armbrust, M., Fox, A., Griffith, R., Joseph, A. D., Katz, R., Konwinski, A. and Zaharia, M (2010) A view of cloud computing. *Communications of the ACM*, 53(4), pp.50-58.

Awadallah, N. (2016) Usage of cloud computing in banking system. *International Journal of Computer Science Issues (IJCSI)*, 13(1), p.49.

Backman, K. and Kyngas, H.A. (1999) Challenges of the grounded theory approach to a novice researcher. *Nurse Health Science*, 1, pp.147-53.

Bahrami, M. and Singhal, M. (2015) The role of cloud computing architecture in big data. In *Information granularity, big data, and computational intelligence* (pp. 275-295).

Bahrami, M. and Singhal, M. (2015) The role of cloud computing architecture in big data. In *Information granularity, big data, and computational intelligence* (pp. 275-295).

Bai, X., Li, M., Chen, B., Tsai, W. T. and Gao, J. (2011) Cloud testing tools. In *Service Oriented System Engineering (SOSE), 2011 IEEE 6th International Symposium on IEEE*, pp. 1-12.

Bardhan, I. R., Demirkan, H., Kannan, P. K., Kauffman, R. J. and Sougstad, R. (2010) An interdisciplinary perspective on IT services management and service science. *Journal of Management Information Systems*, 26(4), pp.13–64.

Barratt, M., Choi, T.Y. and Li, M. (2011) Qualitative case studies in operations management: Trends, research outcomes, and future research implications. *Journal of Operations Management*, 29(4), pp.329-342.



Basu, D., Gupta, G.S., Moretti, G. and Gui, X. (2017) Energy Efficiency Comparison of a State Based Adaptive Transmission Protocol with Fixed Power Transmission for Mobile Wireless Sensors. *J Telecommun Syst Manage*, 6(149), pp.2167-0919.

Bauer, H. H., Falk, T. and Hammerschmidt, M. (2006) eTransQual: A transaction process-based approach for capturing service quality in online shopping. *Journal of Business Research*, 59(7), pp.866-875.

Baumgartner, T.A., Hensley, L.D., Zhu, W. and Kulinna, P.H. (2021) *Conducting and Reading Research in Kinesiology*. Burlington: Jones & Bartlett Learning.

BBC (3<sup>rd</sup> June 2011) Sony Investigating another hack [online] available at <http://www.bbc.co.uk/news/business-13636704> retrieved 9<sup>th</sup> Jan 2012

BBC (8<sup>th</sup> Jan 2012) Hacked Stratfor Security keeps site offline [online] available at <http://www.bbc.co.uk/news/technology-16352891> retrieved 9<sup>th</sup> Jan 2012

Bell, E., Bryman, A. and Herley, B. (2019) *Business Research Methods*. Oxford: Oxford University Press.

Berl, A., Gelenbe, E., Di Girolamo, M., Giuliani, G., De Meer, H., Dang, M.Q. and Pentikousis, K. (2010) Energy-efficient cloud computing. *The computer journal*, 53(7), pp.1045-1051.

Bhargava, H. K. and Sun, D. (2008) Pricing under quality of service uncertainty: Market segmentation via statistical QoS guarantees. *European Journal of Operational Research*, 191(3), pp.1189–1204.

Bogner, A. and Menz, W. (2009) The theory-generating expert interview: epistemological interest, forms of knowledge, interaction. In *Interviewing experts* (pp. 43-80). Palgrave Macmillan, London.

Botta, A., De Donato, W., Persico, V. and Pescapé, A. (2016) Integration of cloud computing and internet of things: a survey. *Future Generation Computer Systems*, 56, pp.684-700.

Bowen, G.A. (2009) Document analysis as a qualitative research method. *Qualitative research journal*, 9(2), pp.27-40.

Bragge, P., Piccenna, L., Middleton, J.W., Williams, S., Creasey, G., Dunlop, S., Brown, D. and Gruen, R.L. (2015) Developing a spinal cord injury research strategy using a structured process of evidence review and stakeholder dialogue. Part I: rapid review of SCI prioritisation literature. *Spinal Cord*, 53(10), p.714.

Brannen, J. (2017) Combining qualitative and quantitative approaches: an overview. In *Mixing methods: Qualitative and quantitative research* (pp. 3-37). Routledge.

Bruneo, D. (2014) A stochastic model to investigate data center performance and qos in iaas cloud computing systems. *IEEE Transactions on Parallel and Distributed Systems*, pp.25.

Bryman, A. (2012) *Social Research Methods*, 4th edition. Oxford University Press.

Bryman, A. (2016) *Social research methods*. Oxford university press.

Bryman, A. (2017) Quantitative and qualitative research: further reflections on their integration. In *Mixing methods: Qualitative and quantitative research* pp. 57-78

Bryman, A. and Bell, E. (2007) *Business research methods*. Oxford University Press: USA.

Bryman, A. and Cramer, D. (2011) *Quantitative data analysis with IBM SPSS Statistics 17, 18 and 19: A guide for social scientists*. Routledge. New York.

Buyya, R., Broberg, J. and Goscinski, A. M. (2010) *Cloud computing: Principles and paradigms* . John Wiley & Sons.

Buyya, R., et al. (2009) Cloud computing and emerging IT platforms: Vision, hype, and reality for delivering computing as the 5th utility. *Future Generation computer systems*, 25(6), pp. 599-616.

Buyya, R., Garg, S. K. and Calheiros, R. N. (2011) SLA-oriented resource provisioning for cloud computing: Challenges, architecture, and solutions. In *Cloud and Service Computing (CSC), 2011 International Conference on IEEE*, pp. 1-10.

Buyya, R., Ranjan, R. and Calheiros, R. N. (2010) Intercloud: Utility-oriented federation of cloud computing environments for scaling of application services. In

*Algorithms and architectures for parallel processing*, Springer Berlin Heidelberg, pp. 13-31.

Calheiros, R. N., Toosi, A. N., Vecchiola, C. and Buyya, R. (2012a) A coordinator for scaling elastic applications across multiple clouds. *Future Generation Computer Systems*, 28(8), pp.1350-1362.

Carey, P. (2018) *Data protection: a practical guide to UK and EU law*. Oxford: Oxford University Press, Inc..

Casas, P., Fischer, H. R., Suetter, S. and Schatz, R. (2013) A first look at quality of experience in personal cloud storage services. In *Communications Workshops (ICC), 2013 IEEE International Conference*, pp. 733-737.

Castillo, E., Gutierrez, J.M. and Hadi, A.S. (2012) *Expert systems and probabilistic network models*. Springer Science & Business Media.

Chaisiri, S., Lee, B. S. and Niyato, D. (2012) Optimization of resource provisioning cost in cloud computing. *Services Computing, IEEE Transactions on*, 5(2), pp.164-177.

Chan, Z.C., Fung, Y.L. and Chien, W.T. (2013) Bracketing in phenomenology: Only undertaken in the data collection and analysis process. *The Qualitative Report*, 18(30), pp.1-9.

Chang, V., Kuo, Y.H. and Ramachandran, M. (2016) Cloud computing adoption framework: A security framework for business clouds. *Future Generation Computer Systems*, 57, pp.24-41.

Chen, C.S., Liang, W.Y. and Hsu, H.Y. (2015) A cloud computing platform for ERP applications. *Applied Soft Computing*, 27, pp.127-136.

Chenet, P., Dagger, T. S. and O'Sullivan, D. (2010) Service quality, trust, commitment and service differentiation in business relationships. *Journal of Services Marketing*, 24(5), pp.336-346.

Chitra, B., Sreekrishna, M. and Naveenkumar, A. (2013) A Survey on Optimizing QoS during Service Level Agreement in Cloud. *Published in International Journal of Emerging Technology and Advanced Engineering* ,3(3).

Clarke, N. and Furnell, S. (2020) *Human Aspects of Information Security and Assurance. 14<sup>th</sup> IFIP WG 11.12 International Symposium, HAISA 2020 Mytilene, Lesbos, Greece, July 8-10, 2020 Proceedings*. Switzerland: Springer Nature.

Cleary, M., Horsfall, J. and Hayter, M. (2014) Data collection and sampling in qualitative research: does size matter?. *Journal of advanced nursing*, 70(3), pp.473-475.

Collis, J. and Hussey, R. (2009) *Business research*. Basingstoke^ eNH NH: Palgrave Macmillan.

Converse, J.M. (2017) *Survey research in the United States: Roots and emergence 1890-1960*. Abington: Routledge.

Cook, C. (2012) Email interviewing: generating data with a vulnerable population. *Journal of Advanced Nursing*, 68(6), pp.1330-1339.

Costigan, S.S. and Perry, J. (2016) Protecting Google. Is an Attack Against Google, an Attack Against the US?. In *Cyberspaces and Global Affairs* (pp. 109-118).

Creswell, J. W. and Clark, V. L. P. (2007) *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage Publications.

Creswell, J. W., Clark, V. L., Gutmann, M. L. and Hanson, W. E. (2003) Advanced mixed methods research designs. *Handbook of mixed methods in social and behavioral research*, pp.209-240.

Cronin, C. (2014) Using case study research as a rigorous form of inquiry. *Nurse Res*, 21(5), pp.19-27.

Cronin, C. (2014) Using case study research as a rigorous form of inquiry. *Nurse Res*, 21(5), pp.19-27.

Dai, D., Zheng, W. and Fan, T. (2017) Evaluation of personal cloud storage products in China. *Industrial Management & Data Systems*, 117(1), pp.131-148.

De Hert, P. and Papakonstantinou, V. (2016) The new General Data Protection Regulation: Still a sound system for the protection of individuals?. *Computer Law & Security Review*, 32(2), pp.179-194.

Denzin, N. K. and Lincoln, Y. S. (2008) *Collecting and interpreting qualitative materials*. Sage.

Denzin, N.K. and Lincoln, Y.S. (2017) *The SAGE Handbook of Qualitative Research*. London: SAGE.

Dhillon, Gurpreet (2007). *Principles of Information Systems Security: text and cases*. NY: John Wiley & Sons

Dillon, T., Alhamad, M. and Chang, E. (2010) Conceptual SLA framework for cloud computing. In *Digital Ecosystems and Technologies (DEST), 2010 4th IEEE International Conference on IEEE*, pp. 606-610.

Drago, I., Mellia, M., Munaf' o, M. M., Sperotto, A., Sadre, R. and Pras. A. (2012) Inside Dropbox: Understanding Personal Cloud Storage Services. In *Proceedings of the 12th ACM Internet Measurement Conference*, IMC'12, pp.481–494.

Drago, I., Bocchi, E., Mellia, M., Slatman, H. and Pras, A. (2013) Benchmarking personal cloud storage. In *Proceedings of the 2013 conference on Internet measurement conferenceACM*, pp. 205-212.

Drago, I., Bocchi, E., Mellia, M., Slatman, H. and Pras, A. (2013) Benchmarking personal cloud storage. In *Proceedings of the 2013 conference on Internet measurement conferenceACM*, pp. 205-212.

Duff, P. (2018) *Case Study Research in Applied Linguistics*. Abingdon: Routledge.

Ellinger, A. E. and Shin, H. (2013) The effect of implicit service guarantees on business performance. *Journal of Services Marketing*, 27(6), pp.431-442.

Emeakaroha, V.C., Brandic, I., Maurer, M. and Breskovic, I. (2011) SLA Aware Application Deployment and Resource Allocation in Clouds. *Published in the Proc. 35th IEEE Annual Computer Software and Applications Conference Workshops (COMPSACW)*, pp. 298-303.

Erl, T., Puttini, R. and Mahmood, Z. (2013) *Cloud Computing: Concepts, Technology, & Architecture*. Pearson Education.

Etikan, I., Musa, S.A. and Alkassim, R.S. (2016) Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), pp.1-4.

Etro, F. (2015) The economics of cloud computing. In *Cloud Technology: Concepts, Methodologies, Tools, and Applications* (pp. 2135-2148).

Fan, M., Kumar, S. and Whinston, A. B. (2009) Short-term and long-term competition between providers of shrink-wrap software and software as a service. *European Journal of Operational Research*, 196(2), pp.661–671.

Ferrer, A. J., Hernández, F., Tordsson, J., Elmroth, E., Ali-Eldin, A., Zsigri, C. and Sheridan, C. (2012) OPTIMIS: A holistic approach to cloud service provisioning. *Future Generation Computer Systems*, 28(1), pp.66-77.

Fiedler, M., Hossfeld, T. and Tran-Gia, P. (2010) A generic quantitative relationship between quality of experience and quality of service. *Network, IEEE*, 24(2), pp.36-41.

Forrester Research (2011) *The personal cloud: Transforming personal computing, mobile, and web markets*. [Online]. Available at :<http://www.forrester.com/rb/Research/personal> cloud transforming personal computing\%2C mobile\%2C and/q/id/57403/t/2 (Accessed on Dec 16\8, 2014).

Fulton, B.R. (2018) Organizations and survey research: Implementing response enhancing strategies and conducting nonresponse analyses. *Sociological Methods & Research*, 47(2), pp.240-276.

Fusch, P.I. and Ness, L.R. (2015) Are we there yet? Data saturation in qualitative research. *The qualitative report*, 20(9), pp.1408-1416.

Gai, K., Qiu, M., Zhao, H., Tao, L. and Zong, Z. (2016) Dynamic energy-aware cloudlet-based mobile cloud computing model for green computing. *Journal of Network and Computer Applications*, 59, pp.46-54.

Gale, N.K., Heath, G., Cameron, E., Rashid, S. and Redwood, S. (2013) Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC medical research methodology*, 13(1), p.117.

Galen, G. and Eric, K. (2008) *What cloud computing really means*. [Online], Available at: <http://www.infoworld.com/article/08/04/07/15FE-cloudcomputing-reality1.html> (Accessed on Dec 18, 2014).

Gao, J., Pattabhiraman, P., Bai, X. and Tsai, W. T. (2011) SaaS performance and scalability evaluation in clouds. In *Service Oriented System Engineering (SOSE), 2011 IEEE 6th International Symposium on IEEE*, pp. 61-71.

García, A., Blanquer, I. Espert, and Hernández García, V. (2014) SLA driven dynamic cloud resource management. *Future Generation Computer Systems*, 31, pp. 1-11.

Garg, S. K., Versteeg, S. and Buyya, R. (2013) A framework for ranking of cloud computing services. *Future Generation Computer Systems*, 29(4), pp.1012-1023.

Garrison, G., Wakefield, R.L. and Kim, S. (2015) The effects of IT capabilities and delivery model on cloud computing success and firm performance for cloud supported processes and operations. *International Journal of Information Management*, 35(4), pp.377-393.

Gartner (2012a) *Gartner*. [Online], Available at: <http://www.gartner.com/newsroom/id/1947315> (Accessed on Dec 17, 2014).

Gates, T.M. and Cysique, L.A. (2016) The chronicity of HIV infection should drive the research strategy of neuroHIV treatment studies: A critical review. *CNS drugs*, 30(1), pp.53-69.

Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013) Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational research methods*, 16(1), pp.15-31.

Glaser, K. (2014) *Inductive or Deductive? The Impact of Method of Instruction on the Acquisition of Pragmatic Competence in EFL*. Newcastle: Cambridge Scholars.

Glennerster, R., Miguel, E. and Rothenberg, A.D., (2013) Collective action in diverse Sierra Leone communities. *The Economic Journal*, 123(568), pp.285-316.

GoGrid (2012) *Cloud hosting, cloud servers, hybrid hosting, cloud infrastructure*. [Online], Available at:<http://www.gogrid.com/> (Accessed on Jan 26, 2015).

Goo, J., Kishore, R., Nam, K., Rao, H. R. and Song, Y. (2007) An investigation of factors that influence the duration of IT outsourcing relationships. *Decision Support Systems*, 42(4), pp.2107–2125.

Gracia-Tinedo, R., Artigas, M. S., Moreno-Martinez, A., Cotes, C. and Lopez, P. G. (2013). Actively Measuring Personal Cloud Storage. In *Cloud Computing (CLOUD), 2013 IEEE Sixth International Conference on IEEE*, pp. 301-308.

Graham, M. and Dutton, W.H. (2019) *Society and the Internet: How Networks of Information and Communication are Changing our Lives*. Oxford: Oxford University Press.

Gray, D.E. (2013) *Doing research in the real world*. London: Sage.

Grobauer, B., Walloschek, T. and Stocker, E. (2011) Understanding cloud computing vulnerabilities. *Security & privacy, IEEE*, 9(2), pp.50-57.

Gutierrez, A., Boukrami, E. and Lumsden, R. (2015) Technological, organisational and environmental factors influencing managers' decision to adopt cloud computing in the UK. *Journal of Enterprise Information Management*, 28(6), pp.788-807.

Hajizadeh, R. and Jafari Navimipour, N. (2017) A method for trust evaluation in the cloud environments using a behavior graph and services grouping. *Kybernetes*, 46(7), pp.1245-1261.



Hamdaq, M. and Tahvildari, L. (2012) Cloud Computing Uncovered: A Research Landscape. In H. Ali & M. Atif (Eds.), *Advances in Computers* , 86, pp. 41–85.

Hameed, A., Khoshkbarforousha, A., Ranjan, R., Jayaraman, P.P., Kolodziej, J., Balaji, P., Zeadally, S., Malluhi, Q.M., Tziritas, N., Vishnu, A. and Khan, S.U. (2016) A survey and taxonomy on energy efficient resource allocation techniques for cloud computing systems. *Computing*, 98(7), pp.751-774.

Hamzeh, K., Jelena and Vojislav (2012) Performance Analysis of Cloud Computing Centers Using M/G/m/m+r Queuing Systems. *Published in the IEEE Transactions on parallel and Distributed systems*, 23(5).

Hashem, I.A.T., Yaqoob, I., Anuar, N.B., Mokhtar, S., Gani, A. and Khan, S.U. (2015) The rise of “big data” on cloud computing: Review and open research issues. *Information systems*, 47, pp.98-115.

He, L., Madathil, S.C., Oberoi, A., Servis, G. and Khasawneh, M.T. (2019) A systematic review of research design and modeling techniques in inpatient bed management. *Computers & Industrial Engineering*, 127, pp.451-466.

He, S., Guo, L. and Guo, Y. (2011) Real time elastic cloud management for limited resources. In: *Cloud Computing (CLOUD), 2011 IEEE International Conference on*, pp. 622 -629.

Heart, T. (2010) Who is out there? Exploring the effects of trust and perceived risk on SaaS adoption intentions. *Database for Advances in Information Systems*, 41(3), pp.49–68.

Heart, T. (2010) Who is out there? Exploring the effects of trust and perceived risk on SaaS adoption intentions. *Database for Advances in Information Systems*, 41(3), pp.49–68.

Heckathorn, D.D.(2011) Comment: Snowball versus respondent-driven sampling. *Sociological methodology*, 41(1), pp.355-366.

Hobfeld, T., et al. (2012) Challenges of QoE management for cloud applications. *Communications Magazine, IEEE*, 50(4), pp. 28-36.

Holmström, J., Ketokivi, M. and Hameri, A.P. (2009) Bridging practice and theory: a design science approach. *Decision Sciences*, 40(1), pp.65-87.

Hoofnagle, C.J., Sloat, B. and Borgesius, F.Z. (2019) The European Union general data protection regulation: What it is and what it means. *Information & Communications Technology Law*. 28(9), pp. 65-98.

Houidi, I., Mechtri, M., Louati, W. and Zeghlache, D. (2011) Cloud service delivery across multiple cloud platforms. In *Services Computing (SCC), 2011 IEEE International Conference on IEEE*, pp. 741-742.

Hu, W., Yang, T. and Matthews, J. N. (2010) The good, the bad and the ugly of consumer cloud storage. *ACM SIGOPS Operating Systems Review*, 44(3), pp.110–115.

Hulland, J., Baumgartner, H. and Smith, K.M. (2018) Marketing survey research best practices: evidence and recommendations from a review of JAMS articles. *Journal of the Academy of Marketing Science*, 46(1), pp.92-108.

Hutchinson, M. and Dorsett, P. (2012) What does the literature say about resilience in refugee people? Implications for practice. *Journal of Social Inclusion*, 3(2), pp.55-78.

Iacono, W.G., Heath, A.C., Hewitt, J.K., Neale, M.C., Banich, M.T., Luciana, M.M., Madden, P.A., Barch, D.M. and Bjork, J.M. (2018) The utility of twins in developmental cognitive neuroscience research: How twins strengthen the ABCD research design. *Developmental cognitive neuroscience*, 32, pp.30-42.

Idowu, O.E. (2016) Criticisms, constraints and constructions of case study research strategy. *Asian Journal of Business and Management*, 4(5), pp. 123-132.

Ifinedo, P. (2012) "Understanding information systems security policy compliance: An integration of the theory of planned behavior and the protection motivation theory", *Computers and Security*, 31(1), 83-95.

Ioannidis, J.P., Greenland, S., Hlatky, M.A., Khoury, M.J., Macleod, M.R., Moher, D., Schulz, K.F. and Tibshirani, R. (2014) Increasing value and reducing waste in research design, conduct, and analysis. *The Lancet*, 383(9912), pp.166-175.

Ion, I., Sachdeva, N., Kumaraguru, P. and Čapkun, S. (2011) Home is safer than the cloud!: privacy concerns for consumer cloud storage. In *Proceedings of the Seventh Symposium on Usable Privacy and Security ACM*, p. 13.

Islam, S., et al. (2012) How a consumer can measure elasticity for cloudplatforms. In *Proceedings of the third joint WOSP/SIPEW international conference on Performance Engineering ACM*.

Islam, S., Lee, K., Fekete, A. and Liu, A. (2012) How a consumer can measure elasticity for cloud platforms. In *Proceedings of the 3rd ACM/SPEC International Conference on Performance Engineering ACM*, pp. 85-96.

Jamshed, S. (2014) Qualitative research method-interviewing and observation. *Journal of basic and clinical pharmacy*, 5(4), p.87.

Jonassen, D. and Land, S. eds. (2012) *Theoretical foundations of learning environments*. Abingdon: Routledge.

Jula, A., Sundararajan, E. and Othman, Z. (2014) Cloud computing service composition: A systematic literature review. *Expert Systems with Applications*, 41(8), pp.3809-3824.

Jun, S.A. and Fletcher, J. (2014) Methodology of studying intonation: From data collection to data analysis. *Prosodic Typology II: The Phonology of Intonation and Phrasing*, 3, pp.493-519.

Kadir, M.F., Sayeed, M.S.B., Shams, T. and Mia, M.M.K. (2012) Ethnobotanical survey of medicinal plants used by Bangladeshi traditional health practitioners in the management of diabetes mellitus. *Journal of Ethnopharmacology*, 144(3), pp.605-611.

Kajava, J. et al (2010) *Information security standards and global business: Proceedings of International Conference on Industrial Technology (ICIT 2010)*, December 15-17, Mumbai, India. p. 2091- 2095.

Kankanhalli, A., Teo, H.-H., Tan, B. C. Y. and Wei, K.-K. (2003) An integrative study of information systems security effectiveness. *International Journal of Information Management*, 23(2), pp.139.

Kansra, P. and Jha, A.K. (2016) Measuring service quality in Indian hospitals: an analysis of SERVQUAL model. *International Journal of Services and Operations Management*, 24(1), pp.1-17.

Katsaros, G., Gallizo, G., Kübert, R., Wang, T., Fitó, J. O. and Henriksson, D. (2011) A Multi-level Architecture for Collecting and Managing Monitoring Information in Cloud Environments. In *CLOSER 2011: International Conference on Cloud Computing and Services Science (CLOSER)*, Noordwijkerhout, The Netherlands, pp. 232-239.

Khajeh-Hosseini, A., Greenwood, D. and Sommerville, I. (2010a) *Cloud Migration: A Case Study of Migrating an Enterprise IT System to IaaS*. Submitted to IEEE CLOUD.

King, N. and Horrocks, C. (2010) Interviews in qualitative research. London: Sage.

Kratochwill, T.R. (2015) Single-case research design and analysis: An overview. In *Single-Case Research Design and Analysis (Psychology Revivals)* pp. 13-26

Kresimir, P. and Zeljko, H. (2010) Cloud computing security issues and challenges. In *PROC Third International Conference on Advances in Human-oriented and Personalized Mechanisms, Technologies, and Services*, pp. 344-349.

Kumar, A. (2012) World of Cloud Computing & Security. *International Journal of Cloud Computing and Services Science (IJ-CLOSER)*, 1(2), pp.53-58.

Kumar, V. and Reinartz, W. (2018) *Customer relationship management: Concept, strategy, and tools*. London: Springer.

Kune, R., Konugurthi, P.K., Agarwal, A., Chillarige, R.R. and Buyya, R. (2016) The anatomy of big data computing. *Software: Practice and Experience*, 46(1), pp.79-105.

Labonte, M.T. (2011) From patronage to peacebuilding? Elite capture and governance from below in Sierra Leone. *African Affairs*, 111(442), pp.90-115.

Lamb, M.E., Hershkowitz, I., Orbach, Y. and Esplin, P.W., (2011) *Tell me what happened: Structured investigative interviews of child victims and witnesses*. Hoboken: John Wiley & Sons.

Lasher, D. R., Ives, B. and Jarvenpaa, S. L. (1991) USAA-IBM partnerships in information technology: Managing the image project. *MIS Quarterly*, 15(4), pp.551–565

Leavy, P. (2017) *Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches*. New York: Guilford Publications.

Lee, I. (2019) Pricing schemes and profit-maximizing pricing for cloud services. *Journal of Revenue and Pricing Management*, pp.1-11.

Lee, M. (2012). “Securing the Human to protect the system: human factors in Cyber security” *IEEE*.

Levy, P.S. and Lemeshow, S. (2013) *Sampling of populations: methods and applications*. New Jersey: John Wiley & Sons.

Lewis, S. (2015) Qualitative inquiry and research design: Choosing among five approaches. *Health promotion practice*, 16(4), pp.473-475.

Li Pan (2011) *Towards a framework for automated service negotiation in Cloud computing*. Published in the Proceedings of IEEE CCIS.

Li, H., Yu, L. and He, W. (2019) The impact of GDPR on global technology development. *Journal of Global Information Technology Management*, 22(1), pp. 1-6.

Li, Z., Wilson, C., Jiang, Z., Liu, Y., Zhao, B. Y., Jin, C. and Dai, Y. (2013) Efficient batched synchronization in dropbox-like cloud storage services. In *Middleware 2013 Springer Berlin Heidelberg*, pp. 307-327.

Liao, J., Qi, Q., Wang, J., Wang, J. and Cao. Y. (2016) A Dual Mode Self-Adaption Handoff for Multimedia Services in Mobile Cloud Computing Environment. *Multimedia Tools and Applications*, 75(8), pp.4697–4722. doi:10.1007/s11042-015-2498-4.

Liu, C. T., Du, T. C. and Tsai, H. H. (2009) A study of the service quality of general portals. *Information & Management*, 46(1), pp.52–56.

Liu, X., Rubino, E. and Prybutok, V.R. (2018) A Cloud Storage Service Quality Trust Model. *Software Quality Professional*, 20(3).

Liu, X., Yang, Y., Yuan, D., Zhang, G., Li, W. and Cao, D. (2011) A generic QoS framework for cloud workflow systems. In *Dependable, Autonomic and Secure Computing (DASC), 2011 IEEE Ninth International Conference on IEEE*, pp. 713-720.

Lockett, H., Johnson, M., Evans, S. and Bastl, M. (2011) Product Service Systems and supply network relationships: an exploratory case study. *Journal of Manufacturing Technology Management*, 22(3), pp.293-313.

Lublinsky, B. (2009) *Cleaning the air on Cloud Computing*.Online], Available at:<http://www.infoq.com/news/2009/04/air> (Accessed on Jan 16, 2016).

Lucas, S.R. (2014) Beyond the existence proof: ontological conditions, epistemological implications, and in-depth interview research. *Quality & Quantity*, 48(1), pp.387-408.

Ludwig, H., Keller, A., Dan, A., King, R. and Franck, R. (2003) *Web service level agreement (WSLA) language specification*. London: IBM Corporation.

Lund, J. (2021) *What is GDPR and how does it impact your business?* Available at: <https://www.superoffice.com/blog/gdpr/> Accessed (14 March 2021).

Lyons, K., Messinger, P. R., Niu, R. H. and Stroulia, E. (2012) A tale of two pricing systems for services. *Information Systems and E-Business Management*, 10(1), pp.19-42.

Ma, Q., Pearson, J. M. and Tadisina, S. (2005) An exploratory study into factors of service quality for application service providers. *Information & Management*, 42(8), pp.1067–1080.

Maconachie, R., Dixon, A.B. and Wood, A. (2009) Decentralization and local institutional arrangements for wetland management in Ethiopia and Sierra Leone. *Applied Geography*, 29(2), pp.269-279.

Maluka, S.O., Hurtig, A.K., Sebastián, M.S., Shayo, E., Byskov, J. and Kamuzora, P. (2011) Decentralization and health care prioritization process in Tanzania: from national rhetoric to local reality. *The International journal of health planning and management*, 26(2), pp.e102-e120.

Manuel, P. (2015) A trust model of cloud computing based on Quality of Service. *Annals of Operations Research*, 233(1), pp.281-292.

Marean, C.W., Anderson, R.J., Bar-Matthews, M., Braun, K., Cawthra, H.C., Cowling, R.M., Engelbrecht, F., Esler, K.J., Fisher, E., Franklin, J. and Hill, K. (2015) A new research strategy for integrating studies of paleoclimate, paleoenvironment, and paleoanthropology. *Evolutionary Anthropology: Issues, News, and Reviews*, 24(2), pp.62-72.

Mauldin, R.L. (2020) *Foundations of Social Work Research*. UT Arlington: Mass Open Press.

Maxwell, G. (2014) The ontological status of theoretical entities. In *The Nature of Scientific Theory*. Abingdon: Routledge.

Maxwell, J.A. (2012) *Qualitative research design: An interactive approach* (Vol. 41). London: Sage publications.

Mazumdar, S. and Pranzo, M. (2017) Power efficient server consolidation for cloud data center. *Future Generation Computer Systems*, 70, pp.4-16.

Mei, J., Li, K., Ouyang, A. and Li, K. (2015) A profit maximization scheme with guaranteed quality of service in cloud computing. *IEEE Transactions on Computers*, 64(11), pp.3064-3078.

Mell and Grance (2011) *The NIST Definition of Cloud Computing*. [Online], Available at: <http://csrc.nist.gov/publications/nistpubs/800-145/SP800-145.pdf> (Accessed on Dec 16, 2014).

Mell, P. and Grance, T. (2009) The NIST definition of cloud computing. *National Institute of Standards and Technology*, 53(6), pp.50.

Moghaddam, F.F., Rohani, M.B., Ahmadi, M., Khodadadi, T. and Madadipouya, K. (2015) Cloud computing: Vision, architecture and Characteristics. In *Control and System Graduate Research Colloquium (ICSGRC), 2015 IEEE 6<sup>th</sup>* (pp. 1-6). IEEE.

Mohammed, F., Ibrahim, O. and Ithnin, N. (2016) Factors influencing cloud computing adoption for e-government implementation in developing countries: Instrument development. *Journal of Systems and Information Technology*, 18(3), pp.297-327.

Morrow Jr, J.R., Martin, S.B. and Jackson, A.W. (2010) Reliability and validity of the FITNESSGRAM®: Quality of teacher-collected health-related fitness surveillance data. *Research Quarterly for Exercise and Sport*, 81(sup3), pp.S24-S30.

Morsy, M. A., Grundy, J. and Müller, I. (2010) An Analysis of the Cloud Computing Security Problem. In: *PROC APSEC 2010 Cloud Workshop*.

Na, S. H., Park, J. Y. and Huh, E. N. (2010) Personal cloud computing security framework. In *Services Computing Conference (APSCC), 2010 IEEE Asia-Pacific IEEE*, pp. 671-675.

Nelson, G. A. and Cohn, S. (2015) Data collection methods for evaluating museum programs and exhibitions. *Journal of Museum Education*, 40(1), pp.27-36.

Ntouskas, T., Papanikas, D., & Polemi, N. (2012). A collaborative system offering security management services for SMEs/mEs. In: *Global Security, Safety and Sustainability & e-Democracy*. Springer: Berlin Heidelberg.



Nutbrown, C. (2011) Naked by the pool? Blurring the image? Ethical issues in the portrayal of young children in arts-based educational research. *Qualitative Inquiry*, 17(1), pp.3-14.

Ooijen, I.V. and Vrabec, H.U. (2019) Does the GDPR enhance consumer's control over personal data? An analysis from a behavioural perspective. *Journal of Consumer Policy*, 42, pp. 91- 107.

Ou, Y. C., de Vries, L., Wiesel, T. and Verhoef, P. C. (2014) The role of consumer confidence in creating customer loyalty. *Journal of Service Research*, 17(3), pp.339-354.

Palinkas, L.A., Horwitz, S.M., Green, C.A., Wisdom, J.P., Duan, N. and Hoagwood, K. (2015) Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, 42(5), pp.533-544.

Parr, J.R., De Jonge, M.V., Wallace, S., Pickles, A., Rutter, M.L., Le Couteur, A.S., van Engeland, H., Wittemeyer, K., McConachie, H., Roge, B. and Mantoulan, C. (2015) New interview and observation measures of the Broader Autism Phenotype: Description of strategy and reliability findings for the interview measures. *Autism Research*, 8(5), pp.522-533.

Piraghaj, S.F., Dastjerdi, A.V., Calheiros, R.N. and Buyya, R. (2017) A survey and taxonomy of energy efficient resource management techniques in platform as a service cloud. In *Handbook of Research on End-to-End Cloud Computing Architecture Design*, pp. 410-454.

Ponelis, S.R. (2015) Using interpretive qualitative case studies for exploratory research in doctoral studies: A case of Information Systems research in small and medium enterprises. *International Journal of Doctoral Studies*, 10(1), pp.535-550.

Poucher, Z.A., Tamminen, K.A., Caron, J.G. and Sweet, S.N. (2020) Thinking through and designing qualitative research studies: A focused mapping review of 30 years 'of qualitative research in sport psychology. *International Review of Sport and Exercise Psychology*, 13(1), pp. 163-186.

Presthus, W. and Sørsum, H. (2019) Consumer perspectives on information privacy following the implementation of the GDPR. *International Journal of Information Systems and Project Management*. 7(3), pp. 19-34.

Probst, C. W., Sasse, M. A., Pieters, W., Dimkov, T., Luysterborg, E. and Arnaud, M. (2012) Privacy penetration testing: How to establish trust in your cloud provider. In *European Data Protection: In Good Health?* pp. 251-265.

Puthal, D., Sahoo, B.P.S., Mishra, S. and Swain, S. (2015) Cloud computing features, issues, and challenges: a big picture. In *2015 International Conference on Computational Intelligence and Networks*, pp. 116-123.

Pyramid (2014) *The Personal Cloud: A Strategic Imperative for Operators*. [Online], Available at: [http://www.pyramidresearch.com/store/Report\\_Personal\\_Cloud.htm](http://www.pyramidresearch.com/store/Report_Personal_Cloud.htm)b (Accessed on Dec 16\8, 2014).

Qamar, S., Lal, N. and Singh, M. (2010) Internet Ware Cloud Computing: Challenge. (*IJCSIS*) *International Journal of Computer Science and Information Security*, 3.

Qi, Q., Liao, J., Wang, J., Wang, J., Li, Q. and Cao, Y. (2016) Integrated Multi-Service Handoff Mechanism with QoS Support Strategy in Mobile Cloud Computing. *Wireless Personal Communications*, 87(2), pp.593–614. doi:10.1007/s11277-016-3210-3.

Rahi, S. (2017) Research design and methods: A systematic review of research paradigms, sampling issues and instruments development. *International Journal of Economics & Management Sciences*, 6(2), 1-5.

Rankin, K.P., Salazar, A., Gorno-Tempini, M.L., Sollberger, M., Wilson, S.M., Pavlic, D., Stanley, C.M., Glenn, S., Weiner, M.W. and Miller, B.L. (2009) Detecting sarcasm from paralinguistic cues: anatomic and cognitive correlates in neurodegenerative disease. *Neuroimage*, 47(4), pp.2005-2015.

Rao, R.V. and Selvamani, K. (2015) Data security challenges and its solutions in cloud computing. *Procedia Computer Science*, 48, pp.204-209.

Razaque, A., Rizvi, S.S., Khan, M.J., Hani, Q.B., Dichter, J.P. and Parizi, R.M., (2017) Secure and quality-of-service-supported service-oriented architecture for mobile cloud handoff process. *Computers & Security*, 66, pp.169-184.

Rebollo, O., Mellado, D., Fernández-Medina, E. and Mouratidis, H. (2015) Empirical evaluation of a cloud computing information security governance framework. *Information and Software Technology*, 58, pp.44-57.

Reichheld, F. F. and Scheffer, P. (2000) E-loyalty. *Harvard Business Review*, 78(4), pp.105–113.

Remenyi, D. (1998). *Doing Research in Business and Management: An Introduction to Process and Method*. London: Sage.

Ren, L., Zhang, L., Wang, L., Tao, F. and Chai, X. (2017) Cloud manufacturing: key characteristics and applications. *International Journal of Computer Integrated Manufacturing*, 30(6), pp.501-515.

ReSearCher, N. (2017) Use of theoretical and conceptual frameworks in qualitative research. *Nurse researcher*, 21(6), pp.34-38.

Richins, D., Ahmed, T., Clapp, R. and Reddi, V.J. (2018) Amdahl's Law in Big Data Analytics: Alive and Kicking in TPCx-BB (BigBench). In *2018 IEEE International Symposium on High Performance Computer Architecture (HPCA)* (pp. 630-642).

Rifai, H., S. (2011) Mohammed, and A. Mellouk. A brief synthesis of QoS-QoE methodologies. In *Programming and Systems (ISPS), 2011 10th International Symposium on IEEE*.

Rittinghouse, J.W. and Ransome, J.F. (2017) *Cloud computing: implementation, management, and security*. Florida: CRC press.

Riva, O., Yin, Q., Juric, D., Ucan, E. and Roscoe, T. (2011) Policy expressivity in the Anzere personal cloud. In *Proceedings of the 2nd ACM Symposium on Cloud Computing ACM*, pp. 14.

Robson, C. (2002) *Real world research: A resource for social scientists and practitioner researchers*, 2nd ed . Oxford, UK: Blackwell.

Rodrigues, T.G., Suto, K., Nishiyama, H. and Kato, N. (2017) Hybrid method for minimizing service delay in edge cloud computing through VM migration and transmission power control. *IEEE Transactions on Computers*, 66(5), pp.810-819.

Rosanas, J. M. and Velilla, M. (2003) Loyalty and trust as the ethical bases organizations. *Journal of Business Ethics*, 44(1), pp.49–59.

Rosenthal, A., Mork, P., Li, M. H., Stanford, J., Koester, D. and Reynolds, P. (2010) Cloud computing: a new business paradigm for biomedical information sharing. *Journal of biomedical informatics*, 43(2), pp.342-353.

Rowley, J. (2012) Conducting research interviews. *Management Research Review*, 35(3/4), pp.260-271.

Rubin, H.J. and Rubin, I.S. (2011) Qualitative interviewing: The art of hearing data. London: Sage.

Ryan, F., Coughlan, M. and Cronin, P. (2009) Interviewing in qualitative research: The one-to-one interview. *International Journal of Therapy and Rehabilitation*, 16(6), pp.309-314.

Ryan, G. (2018) Introduction to positivism, interpretivism and critical theory. *Nurse Researcher*, 25(4), pp.41-49.

Sabi, H.M., Uzoka, F.M.E., Langmia, K. and Njeh, F.N. (2016) Conceptualizing a model for adoption of cloud computing in education. *International Journal of Information Management*, 36(2), pp.183-191.

Saccani, N., Perona, M. and Bacchetti, A. (2017) The total cost of ownership of durable consumer goods: A conceptual model and an empirical application. *International Journal of Production Economics*, 183, pp.1-13.

Saleh, N.B., Aich, N., Plazas-Tuttle, J., Lead, J.R. and Lowry, G.V. (2015) Research strategy to determine when novel nanohybrids pose unique environmental risks. *Environmental Science: Nano*, 2(1), pp.11-18.

Samimi, P., Teimouri, Y. and Mukhtar, M. (2016) A combinatorial double auction resource allocation model in cloud computing. *Information Sciences*, 357, pp.201-216.

Saravanan, M.K. and Kantham, M.L. (2013) *An enhanced QoS Architecture based Framework for Ranking of Cloud Services*.

Saunders, M., Lewis, P., and Thornhill, A., (2009) *Research Methods for Business Students* (5<sup>th</sup> Edition), New Jersey: Prentice Hall.

Scheaffer, R.L., Mendenhall III, W., Ott, R.L. and Gerow, K.G.(2011) *Elementary survey sampling*. London: Cengage Learning.

Schubert, L., Jeffery, K. and Neidecker-Lutz, B. (2010) *The Future for Cloud Computing: Opportunities for European Cloud Computing Beyond 2010*. London: Technical Report.

Schutt, R.K. (2019) *Investigating the Social World: The Process and Practice of Research*. London: SAGE Publication.

Schutt, R.K. (2020) *Processes and Practices of Research*. Singapore: SAGE Publications. Delhi: IGI Global.

Sekaran, U. and Bougie, R. (2016) *Research methods for business: A skill building approach*. New Jersey: John Wiley & Sons.

Sen, J. (2015) Security and privacy issues in cloud computing. In *Cloud Technology: Concepts, Methodologies, Tools, and Applications*, pp. 1585-1630.

Shaikh, R. and Sasikumar, M. (2015) Trust model for measuring security strength of cloud computing service. *Procedia Computer Science*, 45, pp.380-389.

Shanker, U. and Pandey, S. (2020) Handling Priority Inversion in Time-Constrained Distributed Databases.

Shawky, D.M. and Ali, A.F. (2012) Defining a measure of cloud computing elasticity. In *Systems and Computer Science (ICSCS), 2012 1<sup>st</sup> International Conference on IEEE*.

Shawyer, A., Milne, B. and Bull, R., (2009) Investigative interviewing in the UK. *International developments in investigative interviewing*, pp.24-38.

Sherratt, F. and Leicht, R. (2020) Unpacking ontological perspectives in CEM research: Everything is biased. *Journal of Construction Engineering and Management*. 146(2), pp. 143-155.

Shi, W. and Dustdar, S. (2016) The promise of edge computing. *Computer*, 49(5), pp.78-81.

Shuja, J., Gani, A., Shamshirband, S., Ahmad, R.W. and Bilal, K. (2016) Sustainable cloud data centers: a survey of enabling techniques and technologies. *Renewable and Sustainable Energy Reviews*, 62, pp.195-214.

Shyam, G.K. and Manvi, S.S. (2015) Modelling resource virtualisation concept in cloud computing environment using finite state machines. *International Journal of Cloud Computing*, 4(3), pp.258-278.

Shyam, S.M. and Prasad, G.V. (2017) Framework for IoT applications in the Cloud, is it needed? A study. In *2017 International Conference on Computing Methodologies and Communication (ICCMC)*, pp. 1046-1048.

Sider, T. (2009) Ontological realism. *Metametaphysics*, pp.384-423.

Silverman, D. (2010) *Interpreting qualitative data* .Ch 6 , London: Sage

Singh, K.D. (2015) Creating your own qualitative research approach: Selecting, integrating and operationalizing philosophy, methodology and methods. *Vision*, 19(2), pp.132-146.

Singh, S. and Chana, I. (2016) QoS-aware autonomic resource management in cloud computing: a systematic review. *ACM Computing Surveys (CSUR)*, 48(3), p.42.

Singh, S. and Chana, I. (2015) Q-aware: Quality of service based cloud resource provisioning. *Computers & Electrical Engineering*, 47, pp.138-160.

- Singh, S. and Chana, I. (2016) A survey on resource scheduling in cloud computing: Issues and challenges. *Journal of grid computing*, 14(2), pp.217-264.
- Smith, B. and Ceusters, W. (2010) Ontological realism: A methodology for coordinated evolution of scientific ontologies. *Applied ontology*, 5(3-4), pp.139-188.
- Sperling, K., Hvelplund, F. and Mathiesen, B.V. (2011) Centralisation and decentralisation in strategic municipal energy planning in Denmark. *Energy Policy*, 39(3), pp.1338-1351.
- Srinivasan, J., Wei, W., Ma, X. and Yu, T. (2011) EMFS: Email-based personal cloud storage. In *Networking, Architecture and Storage (NAS), 2011 6th IEEE International Conference on IEEE*, pp. 248-257.
- Stergiou, C. and Psannis, K.E. (2017) Recent advances delivered by Mobile Cloud Computing and Internet of Things for Big Data applications: a survey. *International Journal of Network Management*, 27(3), p.e1930.
- Straub, D. W. and Nance, W. D. (1990) Discovering and disciplining computer abuse in organizations: A field study. *Management Information Systems Quarterly*, 14(1), pp.45-62.
- Straub, D. W. and Welke, R. J. (1998) Coping with systems risk: Security planning models for management decision making. *Management Information Systems Quarterly*, 22(4), pp.441.
- Strauss, A.L. and Corbin, J.M. (1990) *Basic of qualitative research: Grounded theory procedures and techniques*. Newbury Park (CA): Sage.
- Suhag, A. (2020) *GDPR in cloud context: How it impacts cloud industry*. Available at: <https://www.cloudmanagementinsider.com/gdpr-explained-for-cloud-industry/> (Accessed: 20 February 2021).
- Sullivan, D. (2019) *Official Google Cloud Certified Professional Cloud Architect Study Guide*. Canada: John Wiley & Sons.
- Sutton, J. and Austin, Z. (2015) Qualitative research: Data collection, analysis, and management. *The Canadian Journal of Hospital Pharmacy*, 68(3), p.226.

Tankard, C. (2016) What the GDPR means for businesses. *Network Security*, 2016(6), pp.5-8.

Tankard, C. (2017) Encryption as the cornerstone of big data security. *Network Security*, 2017(3), pp.5-7.

Teddlie, C. and Tashakkori, A. (2009) *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioural sciences*. London: Sage.

Tetnowski, J. (2015) Qualitative case study research design. *Perspectives on Fluency and Fluency Disorders*, 25(1), pp.39-45.

The Economist (2011) *Cybersecurity: hacked off* in print 14<sup>th</sup> July 2011

The Times (2011) *Hacking of data firm Epsilon exposes customers of 50 firms* in print 5<sup>th</sup> April 2011

Therkelsen, A. (2015) Rethinking Place Brand Communication: From Product-Oriented Monologue to Consumer-Engaging Dialogue. In: *Rethinking Place Branding* , Springer International Publishing, pp. 159-173.

Thomas, D.R. (2017) Feedback from research participants: are member checks useful in qualitative research?. *Qualitative Research in Psychology*, 14(1), pp.23-41.

Thomas, E. and Magilvy, J.K. (2011) Qualitative rigor or research validity in qualitative research. *Journal for specialists in pediatric nursing*, 16(2), pp.151-155.

Thomas, S., Baby, S.S., Raju, S.R., Thomas, T.R., D'Souza, G., Pavitha, A.P. and Fernandes, P.J. (2017) A Descriptive Study to assess the Level of Job Satisfaction of Nurse Educators in a Selected College of Nursing in Mangalore. *International Journal of Nursing Education and Research*, 5(4), pp.359-363.

Tian, Y., Song, B. and Huh, E. N. (2011) Towards the development of personal cloud computing for mobile thin-clients. In *Information Science and Applications (ICISA), 2011 International Conference on IEEE*, pp. 1-5.



Tuli, F. (2010) The basis of distinction between qualitative and quantitative research in social science: Reflection on ontological, epistemological and methodological perspectives. *Ethiopian Journal of Education and Sciences*, 6(1).

Turner, S.F., Cardinal, L.B. and Burton, R.M. (2017) Research design for mixed methods: A triangulation-based framework and roadmap. *Organizational Research Methods*, 20(2), pp.243-267.

Vanlwaarden, J., VanderWiele, T., Ball, L. and Millen, R. (2003) Applying SERVQUAL to web sites: An exploratory study. *International Journal of Quality & Reliability Management*, 20(8), pp. 919- 935.

Vascellaro, J. E. (2012) *Google discloses privacy glitch*. Belgium: WJS Blogs.

Voss, C. (2010) *Case research in operations management*. In *Researching operations management*. Abingdon: Routledge.

Vrij, A., Hope, L. and Fisher, R.P. (2014) Eliciting reliable information in investigative interviews. *Policy Insights from the Behavioral and Brain Sciences*, 1(1), pp.129-136.

Wachter, S., Mittelstadt, B. and Floridi, L. (2017) Why a right to explanation of automated decision-making does not exist in the general data protection regulation. *International Data Privacy Law*, 7(2), pp.76-99.

Wagner, T. M. and Hess, T. (2013) *What Drives Users to Pay for Freemium Services? Examining People's Willingness to Pay for Music Services*. AIS Electronic Library.

Wakita, T., Ueshima, N. and Noguchi, H. (2012) Psychological distance between categories in the Likert scale: Comparing different numbers of options. *Educational and Psychological Measurement*, 72(4), pp.533-546.

Walls, A.R., Okumus, F., Wang, Y.R. and Kwun, D.J.W. (2011) An epistemological view of consumer experiences. *International Journal of Hospitality Management*, 30(1), pp.10-21.

Wang, C., Wang, Q., Ren, K. and Lou, W. (2010) Privacy-preserving public auditing for data storage security in cloud computing. In *INFOCOM, 2010 Proceedings IEEE*, pp. 1-9.

Wang, D. (2013) Influences of cloud computing on e-commerce businesses and industry. *Journal of Software Engineering and Applications*, 6(06), p.313.

Wang, Q., Wang, C., Ren, K., Lou, W. and Li, J. (2011) Enabling public auditability and data dynamics for storage security in cloud computing. *Parallel and Distributed Systems, IEEE Transactions on*, 22(5), pp.847-859.

Wang, Y., Chen, S. and Pedram, M. (2013) Service level agreement-based joint application environment assignment and resource allocation in cloud computing systems. In *Green Technologies Conference IEEE*, pp. 167-174.

Wang, Y., Wen, J., Wang, X. and Zhou, W. (2017) Cloud service evaluation model based on trust and privacy-aware. *Optik-International Journal for Light and Electron Optics*, 134, pp.269-279.

Whitman, M. E. (2004) In defense of the realm: Understanding the threats to information security. *International Journal of Information Management*, 24(1), pp.43.

Wu, K., Vassileva, J. and Zhao, Y. (2017) Understanding users' intention to switch personal cloud storage services: Evidence from the Chinese market. *Computers in Human Behavior*, 68, pp.300-314.

Wu, L., Garg, S. K. and Buyya, R. (2012) SLA-based admission control for a Software-as-a-Service provider in Cloud computing environments. *Journal of Computer and System Sciences*, 78(5), pp.1280-1299.

Wu, Z., Liu, X., Ni, Z., Yuan, D. and Yang, Y. (2013) A market-oriented hierarchical scheduling strategy in cloud workflow systems. *The Journal of Supercomputing*, 63(1), pp.256-293.

Xiao Liu, Yun Yang, Dong Yuan, Gaofeng Zhang, Wenhao Li and Dahai Cao (2011) A Generic QoS Framework for Cloud Workflow Systems. Published in *Ninth IEEE International Conference on Dependable, Autonomic and Secure Computing*.

Xiong, K. and Perros, H. (2012) Service Performance and Analysis in Cloud Computing. *Published in the Annual SRRI Global Conference*, pp. 11-20,

Xu, X. 2012. From cloud computing to cloud manufacturing. *Robotics and computer-integrated manufacturing*, 28(1), pp.75-86.

Xu, Y., Huang, X. and Liu, J.K. (2016) *Efficient Handover Authentication with User Anonymity and Untraceability for Mobile Cloud Computing. Future Generation Computer Systems*, 62 (September), pp.190–95. doi:10.1016/j.future.2015.09.028.

Yakimenko, O. A., et al. (2009) Mobile system for precise aero delivery with global reach network capability. In *Control and Automation, ICCA 2009, IEEE International Conference*, pp. 1394–1398.

Yan, Q., Yu, F.R., Gong, Q. and Li, J. (2016) Software-defined networking (SDN) and distributed denial of service (DDoS) attacks in cloud computing environments: A survey, some research issues, and challenges. *IEEE Communications Surveys & Tutorials*, 18(1), pp.602-622.

Yang, C., Yu, M., Hu, F., Jiang, Y. and Li, Y. (2017) Utilizing cloud computing to address big geospatial data challenges. *Computers, environment and urban systems*, 61, pp.120-128.

Yang, L., Han, Z., Huang, Z. and Ma, J. (2018) A remotely keyed file encryption scheme under mobile cloud computing. *Journal of Network and Computer Applications*, 106, pp.90-99.

Yi, S., Qin, Z. and Li, Q. (2015) Security and privacy issues of fog computing: A survey. In *International conference on wireless algorithms, systems, and applications*, pp. 685-695.

Yilmaz, K. (2013) Comparison of quantitative and qualitative research traditions: Epistemological, theoretical, and methodological differences. *European Journal of Education*, 48(2), pp.311-325.

Yin, S.Y., Huang, K.K., Shieh, J.I., Liu, Y.H. and Wu, H.H. (2016) Telehealth services evaluation: a combination of SERVQUAL model and importance-performance analysis. *Quality & Quantity*, 50(2), pp.751-766.

Zargar, S.T., Joshi, J. and Tipper, D. (2013) A survey of defense mechanisms against distributed denial of service (DDoS) flooding attacks. *IEEE communications surveys & tutorials*, 15(4), pp.2046-2069.

Zeithaml, V., Parasuraman, A. and Malhotra, A (2002) Service quality delivery through web sites: A critical review of extant knowledge. *Journal of the Academy of Marketing Science*, 30(4), pp.362–375.

Zeithaml, V.A., Parasuraman, A. and Berry, L.L (1990) *Delivering quality service; Balancing customer perceptions and expectations*. New York: The Free Press.

Zhang, Q., Cheng, L. and Boutaba, R. (2010) Cloud computing: state-of-the-art and research challenges. *Journal of internet services and applications*, 1(1), pp.7-18.

Zhang, Y., Zheng, Z., Wu, X., Lyu, M. R. and Wang, J (2013) QoS ranking prediction for cloud services. *Parallel and Distributed Systems, IEEE Transactions on*, 24(6), pp.1213-1222.

Zheng, X., Martin, P., Brohman, K. and Xu, L.D (2013) CLOUDQUAL: A Quality Model for Cloud Services. *IEEE Transactions on Industrial Informatics*, 99.

Zheng, X (2014) *Qos representation, negotiation and assurance in cloud services*. Ph.D dissertation, School of Computing, Queen's University, Kingston, Ontario, Canada.

Zheng, Z, Xinmiao Wu, Yilei Zhang, Michael, R., Lyu and Jianmin Wang (2013) QoS Ranking Prediction for Cloud Services. *Published in IEEE Transactions on Parallel and Distributed Systems*, 24(6).

Zhu, F., Li, H. and Lu, J. (2012) A service level agreement framework of cloud computing based on the cloud bank model. In *Computer Science and Automation Engineering (CSAE), 2012 IEEE International Conference on* IEEE, pp. 255-259.

Žukauskas, P., Vveinhardt, J. and Andriukaitienė, R. (2018) *Philosophy and Paradigm of Scientific Research*. London: IntechOpen.

## **Appendices**

### **Appendix I: Survey**

#### **PART A: DEMOGRAPHICS**

1) Please indicate how long your company has been in existence

0 – 1 year

1 – 3 years

3 – 5 years

5 – 10 years

11+ years

2) Please indicate the size of your company by approximate turnover

£0 - £100,000

£100,001 - £250,000

£250,001 - £500,000

£500,001 - £1,000,000

£1,000,001+

3) Please indicate the number of employees in your company

1 – 10 employees

11 – 25 employees

26 – 50 employees

51 – 100 employees

101+ employees

4) Please indicate the main industry sector your business operates in

1) Agriculture / Horticulture

2) Finance / Accountancy

3) IT / IS

4) Legal

5) Logistics / Supply Chain

6) Manufacturing

7) Personal Services (eg beauty / personal wellbeing)

8) Pharmaceuticals

9) Professional Services (eg business consultancy)

10) Retail

5) Please indicate whether you are using cloud services and has some means of identifying and/or protecting information assets

Yes

No

## PART B: PERCEPTIONS OF CLOUD COMPUTING AND INFORMATION SECURITY

6) This section of the questionnaire is looking to gather opinions on your level of understanding of the concept of cloud computing and information security. There are no right or wrong answers. Please indicate how much you agree or disagree with the following statements:-

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have a clear understanding of the term “cloud computing” and could explain it to a friend or colleague					Y
I have a clear understanding of the concept “information security” and could explain it to a friend or colleague				Y	
I would describe myself as having a high level of awareness as regards cloud computing and information security and its importance				Y	
I make sure that I am aware of the latest developments in cloud computing and information security and that I pass these on to my colleagues				Y	
I am aware of cloud storage technology and could explain them in suitable terms to a				Y	

friend or colleague.					
----------------------	--	--	--	--	--

## PART C: APPLICATIONS OF CLOUD COMPUTING SECURITY

- 7) This section of the questionnaire is designed to allow us to understand the level of cloud computing security which has been adopted and which techniques and approaches are used predominately. Please indicate how much you agree or disagree with the following statements:-

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I would describe myself as having a robust attitude to cloud service and their security (I have full software protection, I constantly monitor the location of my information and I regularly review procedures when situations change)			Y		
I would describe myself as having a moderate attitude to cloud computing and my data security (for example I have anti-viral software and regularly check online activity)					Y
I would describe myself as having a weak attitude to cloud computing and information security (I have little or no internet security, and would probably not notice immediately if I lost information).	Y				



I have process controls on my system to protect my data in cloud (such as encrypting data, regularly changing passwords, and backing up all information on a regular basis)			Y		
I recognise the value of my information on cloud and encourage others to do the same by raising awareness and fostering a culture of information security.					Y

#### **PART D: CHALLENGES WITH CLOUD COMPUTING AND SECURITY.**

8) This section of the questionnaire is intended to capture your opinions of the known difficulties and challenges with use of cloud service and implementing security procedures and processes. Please indicate how much you agree or disagree with the following statements:-

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I finds it extremely costly and resource intensive to continually monitor and protect my personal information in cloud computing.			Y		
Although there are obvious benefits to cloud computing and its security but it is too costly to implement and			Y		

maintain personally					
Compatibility issues with existing cloud service providers and security protocols I already have in use			Y		
The on-going cost of cloud computing standards training and security procedures is very high.			Y		

### Functional Parameters

- 9) This section of the questionnaire is designed to allow us to understand your attitude towards the functional parameters of personal cloud service that you use. Please indicate how much you agree or disagree with the following statements:-

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I think that the personal cloud storage service that I use is very user-friendly					Y
I am satisfied with the 24*7 accessibility of personal cloud storage service				Y	
I think that the personal cloud storage service that I use is very reliable			Y		
I happy with the ability of the personal cloud storage service to accommodate my needs			Y		

I think that the personal cloud storage service is always prompt in solving my queries and concerns			Y		
---	--	--	---	--	--

### Non-Functional Parameters

10) This section of the questionnaire is designed to allow us to understand your attitude towards the non-functional parameters of personal cloud service that you use. Please indicate how much you agree or disagree with the following statements:-

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I am highly likely to recommend the personal cloud storage service that I use to my friends			Y		
I feel emotionally attached to the personal cloud storage service that I use		Y			
I am very motivated when using personal cloud storage service			Y		
I am more likely to use a personal cloud storage service if the service is used by my friends and peers		Y			
I am less likely to switch from my personal cloud storage service as it is very difficult to transfer data between personal cloud services			Y		
I usually follow social norms and trends while choosing		Y			

personal cloud storage service					
--------------------------------	--	--	--	--	--

### Organisational parameters of privacy and security

11) This section of the questionnaire is designed to allow us to understand the level of privacy and security offered by the personal cloud service that you use.

Please indicate how much you agree or disagree with the following statements:-

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I think that the personal cloud service that I use is effective at deterring issues that affect user security and privacy			Y		
I think that the personal cloud service that I use is effective at finding remedies for issues related to user security and privacy			Y		
I think that the personal cloud service that I use is effective at preventing issues that affect user security and privacy			Y		
I think that the personal cloud service that I use is effective at detecting issues that affect user security and privacy				Y	

### Customer parameters of privacy and security

12) This section of the questionnaire is designed to allow us to understand your understanding as a customer regarding the level of privacy and security offered

by the personal cloud service that you use. Please indicate how much you agree or disagree with the following statements:-

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I have read and understood privacy agreement of the personal cloud storage service that I use		Y			
I am willing to store my information in the personal cloud storage service as I believe that the service offers adequate security and privacy to my data			Y		
I believe that the personal cloud storage service that I use is complying with existing regulations regarding security and privacy of user data			Y		
It is important to me that my personal cloud storage service updates its security and privacy standards to meet the GDPR regulations			Y		
My trust with the personal cloud storage service has worn off after using it for a long time		Y			

### Customer trust and satisfaction

13) Please rate your overall trust with your personal cloud storage service on a scale of 1-5 where 1=Very low and 5= Very high?

- 1
- 2
- 3
- 4
- 5

14) Please rate your overall satisfaction with your personal cloud storage service on a scale of 1-5 where 1=Very low and 5= Very high?

- 1
- 2
- 3
- 4
- 5

#### **Customer Retention loyalty and advocacy loyalty**

15) How likely are you to switch to another provider? (0 – Not at all likely to 5 – Extremely likely)

- 1
- 2
- 3
- 4
- 5

16) How likely are you to recommend the personal cloud storage service that you currently use to your friends/colleagues? (0 – Not at all likely to 5 – Extremely likely)

- 1
- 2
- 3

- 4
- 5

## **PART E: QUALITATIVE QUESTIONS**

1. How do you define quality of service in the context of commercial cloud service operations?
2. Do you use any specific method for evaluating the quality of your cloud service? What criteria or metrics do you employ for monitoring and support of the cloud service?
3. At an individual customer level, what are some quality expectations that consumers have and how does your organisation go about meeting these expectations? How do you think these differ from the context of commercial cloud platforms?
4. Do you feel that these criteria/metrics are sufficient to guarantee user satisfaction through QoS?
5. How do you think this influences continued customer commitment to the use of your platform?
6. If I were to differentiate the QoS in terms of functional (e.g. elasticity, speed) and non-functional (e.g. brand loyalty), what do you think has greater impact?
7. How much do you think security is part of the service provided? What security measures do you take to support your cloud?
8. What are some challenges which you face in meeting these needs in the context of personal cloud storage?
9. How often do you audit your services?
10. Are there any future plans to enhance your service provision in terms of QOS and security?
11. Do you think that the trust of customers towards cloud storage services change over time? Is it true that there is decay in customer trust after using the service for a long time?
12. What in your opinion are the main factors contributing to customer switching behaviour in personal cloud storage services?
13. Do you expect any changes in customer perception of quality of personal cloud storage services in the aftermath of GDPR (General Data Protection Regulation) enacted by the EU?
14. How does a critical mass and social norm influence customer satisfaction in personal cloud storage services?



***Thank you for your participation – your opinions are extremely valuable to this research. Please be assured that all responses are intended for academic purposes only and will remain entirely confidential.***

### **Cloud Quality of Service APP.**

It will do comparison between selected cloud service providers and give us option to choose best for our requirement e.g. To measure response times ,Security, cost, storage, speed, reliability, availability, less downtime and level of service etc. for Personal or Commercial use.

### **Application Structure:**

1-INSTALL CLOUD SERVICE QUALITY APP:

2-WHEN I WILL RUN APP. ON THE MOBILE OR ON THE SYSTEM IT WILL ASK ME TO SELECT SERVICE PROVIDERS AND MY REQUIREMENTS TO GET BEST OPTION.

DROPBOX , ONEDRIVE, AMAZON , BT, VMWARE , MEMSET ,UKFAST

3-THEN IT WILL ASK ME TO SELECT THE SERVICE I WANT TO USE CLOUD FOR....

I-PERSONAL USE

- FOR TO RENT SOFTWARE

- COST
- STORAGE
- VIRTUALIZATION
- PLATFORM
- SPEED
- AVAILABILITY
- RELIABILITY
- INFRASTRUCTURE
- STORAGE ETC.

## II-COMMERCIAL USE

- FOR TO RENT SOFTWARE
- COST
- STORAGE
- VIRTUALIZATION
- PLATFORM
- SPEED
- AVAILABILITY
- RELIABILITY
- INFRASTRUCTURE

- STORAGE ETC.

After selection of our requirements the APP will do comparison between selected providers on the bases of speed, data loss, availability, security etc. and go back in to last six month quality of service performance check and on the bases of the last six month(or as we set the duration manually) observations will suggest the best one.

The emphasis would be on the intelligence of the app, the intelligence and accuracy of the recommender agent(s) and the efficiency of the algorithm employed.

## **Appendix II - Transcript**

### **I Final**

#### **6. How do you define quality of service in the context of cloud services? What do you think is the differentiator when you evaluate commercial cloud service operations?**

Quality of service in any software service context will obviously refer to providing the service in a way such that the customer needs are met. So, in the context of cloud services, I would think that this would involve the same strategy—i.e. providing a service that meets the needs of the customer. So when we come to an individual user product, like personal cloud storage, it would be different from that of a large scale customer. For example, any organisation, even say an SME which uses a cloud service, may look at time to fix the issue or the access to the service as more important. But for an individual y need—becomes more important. If you ask me, Dropbox can perhaps be like the customer, I think their ability to meet and provide scalability—i.e. providing what the pioneer which revolutionised the personal cloud storage space. We created a unique platform and I think our ability to provide better services and more scalability when compared to other services is perhaps the greatest thing that differentiates us from other customers.

#### **7. Do you use any specific method for evaluating the quality of your cloud service? What criteria or metrics do you employ for monitoring and support of the cloud service?**

In terms of evaluating customer requirements for move to the cloud, we have a structured approach to gathering the information we require to migrate services to the cloud. In addition, we can provide options for improving the efficiency of services following migration to the cloud by using alternative services: options frequently include migration of email to Office 365 or Google Apps for Business

and migration of desktop services to Amazon Workspaces. So, for us, quality provision can be thought of as the extension of services that are made available.

We operate an SLA for customers with hosted services. These are specific to the customer's needs but always include 24/7 monitoring of services, full helpdesk support and regular account reviews. The SLA is transparent to you as a customer and you will have an account manager to give you swift contact should any service incidents arise. So yes, the SLA is the key. We monitor the provision of service by using the SLA as the key criterion and making sure that all the terms which are part of the SLA are met when needed.

**8. At an individual customer level, what are some quality expectations that consumers have and how does your organisation go about meeting these expectations? How do you think these differ from the context of commercial cloud platforms?**

As I said earlier, definitely consumer quality requirements are quite different as I think the requirements can vary immensely. Think about it: it's the basic difference between a B2B and a B2C market. I think what primarily varies is the greater engagement that is needed with the customer. Making sure we give good quality is what makes or breaks us. I think Drop box has managed to grow every day because we provide this personalisation, this differentiation. I have worked with corporate clients, and typically their QoS focuses more on latency, elasticity, costs, scalability—things like that. In the case of the personal cloud, since we have the 'freemium' model, cost is not a key element. It's more like the value that we bring to the customer, the trust in us... So, yeah, I'd say there is a big difference! We need to be aware of this difference.

**9. Do you feel that these criteria/metrics are sufficient to guarantee user satisfaction through QoS?**

Yes, I do. We do a comprehensive review to make sure that our criteria and metrics meet the needs of the customer. When customers call making complaints, we follow up. We do a survey to find out what went wrong and what was done to make it better. The metrics are bespoke to the customer, so we always have the satisfaction of the customer at their centre.

**10. How do you think this influences continued customer commitment to the use of your platform?**

I think we do give better scalability with our freemium model. While I agree that there are others who do the same, we partner with other service providers. For example, we managed to create a huge user base in India while partnering with Samsung and providing a 1 GB online storage space. The good part of this was that we made people know we were there, you know... that is what differentiates us from most others...

**11. If I were to differentiate the QoS in terms of functional (e.g. elasticity, speed) and non-functional (e.g. brand loyalty), what do you think has greater impact?**

Both. I can't choose one over the other. But functional elements like speed and scalability are definitely important. I can't pretend they are not. The same is true with our value as a brand. I don't think we have reached loyalty yet, but the value of the brand is definitely important... for sure! So, I would say, as a marketing manager of such an organisation, I would focus on both elements as it can contribute to a significant increase in overall performance

**12. How much do you think security is part of the service provided? What security measures do you take to support your cloud?**

Identity management and access. This is the biggest challenge a personal cloud user may face. This has led to potential challenges in other cases, so we are very committed to meeting this requirement. Another element that I would suggest is ensuring privacy and confidentiality by avoiding data breaches. I think this is a key area where organisation or commercial cloud computing strongly differs from the personal cloud storage space. When you think about it, many corporates take their own steps to avoid compromising their credentials and make sure that this takes place through multi-factor authentication and encryption. So in the case of personal storage, this is clearly not possible. So yes, data breach and identity management would be my top choice. We take efforts to make sure that there is no breach here.

**13. What are some challenges which you face in meeting these needs in the context of cloud storage?**

The first is cost, as many users prefer to use the freemium model. The second I would say, in the context of security, is the inability to get the users to be fully aware of the challenges of the cloud. I mean, we have a comprehensive SLA, yes, but how many read it? Do they know what they should do to keep themselves safe? I am not so sure.

Yes, there as well, cost would be a factor. We try to give 24/7 support, but with users from around the world, this can be difficult. I think all of this comes down to trust and the customer perception that we can give them what they really want. So, this is the most important element that needs to be addressed.

**14. How often do you audit your services?**

We audit our services and the provision of services from third parties on an annual basis and more frequently for newer and smaller suppliers.

**15. Are there any future plans to enhance your service provision in terms of QOS and security?**

We are developing new services through our internal R&D function. These include the c3 cloud platform we use to operate, manage and report service provision, and also more sophisticated tools to automate cloud provision. In security terms, we are revising our audit processes at the moment and pursuing ISO-27001 certification based on our existing processes.

**11. Do you think that the trust of customers towards cloud storage services change over time? Is it true that there is decay in customer trust after using the service for a long time?**

In my opinion, yes there is a chance. However, in my opinion, trust is the important factor for building a successful cooperative partnership with clients. For enhancing the trust among Consumers Cloud vendors must be very transparent regarding their underlying infrastructure, policies, and maintenance or support procedures. That is if the Cloud vendors follow the procedure mentioned above then there will be only less chance for not trusting the cloud vendors.

**12. What in your opinion are the main factors contributing to customer switching behaviour in cloud storage services?**

Yes, The organisations will prefer to change from one cloud storage services to the other vendors offering personal cloud storage service if there is any security issue in their cloud services.

**13. Do you expect any changes in customer perception of quality of cloud storage services in the aftermath of GDPR (General Data Protection Regulation) enacted by the EU?**



Yes, the customers who are using cloud storage services will expect changes after the implementation of GDPR enacted by the EU. That is the customers will expect more concerning the principle “Privacy by Default” as it enhances the security in the services offered by the organisation in default. Thus the organisations are now obliged to take into account data privacy during the design stages of the entire projects along with the lifecycle of the relevant data process.

#### **14. How does a critical mass and social norm influence customer satisfaction in cloud storage services?**

I think that the critical mass influences in every purchasing decisions as well as in the customer satisfaction irrespective to the product or service. So I can say that the critical mass is playing a significant effect on the customer satisfaction in relation to the personal cloud storage services as well. In fact, when the customers or the mass have a positive outlook towards the cloud storage system, it will attract the rest of the individuals who intend to buy the same service. In such cases the clear reflection can be observed on the level of customer satisfaction. Similarly, if the mass is having a negative attitude towards the service, then the customer satisfaction will also be in relation to that. And I think the influence of the social norm is also not much different from that of the critical mass.

## **II Final**

### **1. How do you define quality of service in the context of cloud services? What do you think is the differentiator when you evaluate commercial cloud service operations?**

Quality of service is firstly a technical term, so I would say most customers in a cloud context may refer to it as simply as service quality. QoS in our company can be something as simple as meeting the quality needs of the customer. The challenge here is defining what quality means to the customer. Yeah, I would say quality to me and my team is to make sure that we provide uninterrupted service with all the things that we promised the customer. When you compare the cloud storage to perhaps a more complex one, I would say requirements vary. A single user gives importance to the speed at which they can access (i.e. upload or download), the ability to store more (i.e. scalability), but you see, a commercial client may worry about privacy, about latency and loss as other elements. So yes, there is a definite difference between the two. The differentiator in the context of a cloud service platform is difficult to assess, but I would say, perhaps, meeting what the customer asks of us and making sure we meet these needs—yes, they are the true challenges that need to be met.

### **2. Do you use any specific method for evaluating the quality of your cloud service? What criteria or metrics do you employ for monitoring and support of cloud service?**

No, we do not use a specific method for evaluation of cloud services. It involves research and testing with an in-house proof of concept system. Limitations can be due to the security.

There are few things I will keep in mind before evaluating any cloud services.

1. The load that we have today, and also thinking about the future—how the work load may change with the growth and demand.

2. However, if we want to design a cloud service, a public, private or a hybrid cloud model, we have to invest in understanding what we want to achieve and design a model around that.
3. Cloud is a term that has multiple meanings. For example, you can have a cloud infrastructure where you are utilising the computer (CPU, memory, storage and network) from a private or public provider.
4. Cloud can be just software as a service. Software can be the application that is deployed to abstract the computer for the end user, where he can just focus on providing the software and focus on the SAS.
5. What service will be appropriate for cloud service?

Most of the cloud platforms are virtual environments, so a monitoring tool which is aware of the virtual environment will be good. We cannot depend on traditional monitoring tools which are designed for physical servers. Some of the tools I have evaluated are Opsview, SolarWinds, vRealize Operations Manager (vROPS), open source Check\_MK, Nagios, etc. I would be more inclined towards vROPS, as it's a product from VMware and is designed from the bottom, keeping the virtual infrastructure in mind.

**3. At an individual customer level, what are some quality expectations that consumers have and how does your organisation go about meeting these expectations? How do you think these differ from the context of commercial cloud platforms?**

Well, the personal cloud is where customers store a lot of important things, ranging from important documents to personal elements like photographs. So the customer does require the ability to be immediately able to reach what they want when they want and to be assured that what they want can be seen or accessed without any compromise in privacy. The quality expectations of a customer in my opinion are largely immediate access, ease of access and the ease of use of the interface. So usability is definitely an element which needs to be discussed. On the other hand, I'd say that a commercial platform which gives cloud has not extended beyond basic storage right: we have the IaaS, PaaS and others, so they

look for reliability, speed and other functional elements like availability and elasticity. We have been able to meet what the personal cloud customer wants by making sure that we follow what is there in our SLA. I think this is key to understanding our service provision capabilities.

**4. Do you feel that these criteria/metrics are sufficient to guarantee user satisfaction through QoS?**

End users are never satisfied. They always want more performance, more storage, and more networks. I would suggest that before talking about QoS we have to benchmark the physical environment; then, once we virtualised, we have to benchmark it again so that we have a standard to look back on when we have any problems related to performance, etc. Sometimes users complain that after virtualising an application that was on a physical server, it has become slower than ever. They think as it's running on a virtual machine which is running on a shared infrastructure, it is slow.

If we have done benchmarking of an application and the server before and virtualisation—i.e. moving to the cloud—then we can compare the values on the day the user has complained and understand if the application or server is really having poor performance.

**5. How do you think this influences continued customer commitment to the use of your platform?**

Are you talking about the QoS metrics and the customer satisfaction and commitment? Well, this is not rocket science. As with any other service, when they are happy with us, they come back to us.

**6. If I were to differentiate the QoS in terms of functional (e.g. elasticity, speed) and non-functional (e.g. brand loyalty), what do you think has greater impact?**

I'd go with functionality. I mean, the software industry has always run on functionality. If I can prove that my platform can improve overall access, overall capabilities and overall scalability, then I would definitely be able to ensure that the customer needs are always met. This will in turn increase my brand recognition maybe. Now, think about Google—what made it different from other search platforms? Its ability to be precise and provide the most relevant results. Their secret source? Their algorithm. Now the brand name is synonymous with the use of the web. So I'd always go with functionality as the answer.

**7. How much do you think security is part of the service provided? What security measures do you take to support your cloud?**

For security and privacy of the cloud, we have to manage the:

1. Identity management/access management
2. Physical security of the infrastructure (in private or public cloud)
3. Making sure the service is available
4. Application security again comes down to identity management (1)

**8. What are some challenges which you face in meeting these needs in the context of cloud storage?**

The number of users is simply too many. Meeting every end user's needs and making sure that the QoS reflects the combined aggregate needs of various users is an uphill task. I am genuinely worried that we won't be able to make it.

**9. How often do you audit your services?**

Every quarter.

**10. Are there any future plans to enhance your service provision in terms of QoS and security?**

Management of an infrastructure always requires enhancement of the service. This can bring more performance and improve the QoS working alongside to improve the security too.

**11. Do you think that the trust of customers towards cloud storage services change over time? Is it true that there is decay in customer trust after using the service for a long time?**

No, the trust of customers towards cloud storage services will not change over time if the communication between the client and the cloud vendor are maintained efficiently. In our organisation, we are maintaining the transparency between the client clearly regarding our infrastructure, maintenance procedures and policies adopted by our organisation for enhancing security. In this highly competitive marketplace, some of the cloud vendors will not disclose such matters to the clients, and this will reduce the trust among the vendors, but in our organisation, we are more transparent to clients.

**12. What in your opinion are the main factors contributing to customer switching behaviour in cloud storage services?**

Among the mobile users and internet, the popularity has been attained by cloud storage services. For switching behaviours from one service to the other are only limited in cloud storage services. In my opinion, the main four factors that induce the customers for switching the services from one cloud vendor to the other are mainly due to the four elements, and they are the risk, social norm, switching cost and trust.

**13. Do you expect any changes in customer perception of quality of cloud storage services in the aftermath of GDPR (General Data Protection Regulation) enacted by the EU?**

After the successful implementation of GDPR enacted by the EU in May 2018 the consumers using the personal cloud storage services has expected the changes concerning the security of the individual's data stored in the cloud storage. After the implementation of GDPR, the organisations that are offering cloud services must utilise proper organisational and technical security measures to protect the stored information in cloud services against the unauthorised processing and accidental disclosure, loss, access, alteration or destruction. Therefore for protecting personal data, this GDPR helps the individuals more.

**14. How does a critical mass and social norm influence customer satisfaction in cloud storage services?**

The technological progress attained in the recent years has brought up many products and services into the public. The personal cloud storage service is one of such technological advancement happened in this world. Now considering your question the influence of the critical mass and the social norm on the personal cloud storage service, I would like to say that both are affecting the customer satisfaction. As a cloud computing professional, I can say that the mass or the public is having a mixed approach or attitude towards the service. Most of the individuals consider it to be the one of the easiest ways of storing the personal files which is large and important. I can strongly say that the hassle-free accessing to the service from any part of this world from any compatible device is what makes them attracted to the service. In such customers, we can see a high satisfaction level. It is, in fact, their satisfaction which reflects on other users or the public to purchase the service and to use it. However, there are some users who point out the difficulty in transferring the files from one service provider to another service provider. Such thoughts contribute to the negative social norm towards the personal cloud storage services and further impact on the customer satisfaction.

**III Final**

**1. How do you define quality of service in the context of cloud services?  
What do you think is the differentiator when you evaluate commercial  
cloud service operations?**

Today, everything is shifting to the cloud. So there is a lot of discussion on what can and what should be moved. For a I user, this is another thing that they think of. Privacy. So for me, the difference between a personal cloud and a commercial cloud platform is what the user wants. Commercial clients always have their own systems and requirements in place. So their definition or expectation of quality differs from an individual user's wants. An individual user may think twice about putting something on the web unless they know that it would be safe. So, for a cloud user I would say scalability options, availability and ease of use, responsiveness are key factors. They also worry about latency issues, as well as the lack of immediate support (i.e. reliability). It's difficult to identify exactly one issue as a differentiator, but I would say consistent support is a key element which influences the process.

**2. Do you use any specific method for evaluating the quality of your cloud service? What criteria or metrics do you employ for monitoring and support of cloud service?**

It's very hard to evaluate the cloud service as it depends on the requirement of the organisation, like performance, cost and reliability of service. But most of the organisations are moving towards the cloud because it's more resilient, fast and easy to manage. It depends on the organisation as well as the requirement of the company. But most of the vendors offer monitoring tools to monitor the systems and applications.

**3. Do you feel that these criteria/metrics are sufficient to guarantee user satisfaction through QoS?**



I believe it's very hard to satisfy the user, but providing a good service along with the up time and meeting the requirements and SLA would make a user satisfied.

Now when you have a corporate client, you have a bespoke order where we naturally customise. But in the case of personal computing and cloud storage, this is largely based on a COTS approach. In such cases, we have to take the average of what every individual would like. This makes it next to impossible to address the potential challenges of all customers.

**4. How do you think this influences continued customer commitment to the use of your platform?**

I think integrating positive QoS with other elements like migration through other elements. An example is the OneDrive integration with Office 365. This has helped the customer not only choose us but remain committed to using our platform and continuing to use our platform when needed.

**5. If I were to differentiate the QoS in terms of functional (e.g. elasticity, speed) and non-functional (e.g. brand loyalty), what do you think has greater impact?**

I think its 50–50. This is mostly a reflection of the current day challenge of piracy and the challenge of leaks over anything else. So a lot of people trust brands or companies which assure that they can provide value.

Functionality for sure. Latency and accessibility are key elements which influence overall performance and management. So if there is good latency and access, it is definitely possible that it would contribute to better performance.

**6. How much do you think security is part of the service provided? What security measures do you take to support your cloud?**

The biggest challenge currently facing the market is security, especially for the cloud hosted infrastructure, as most of the communication can be happening over the public IPs.

The best possible way is to block all the non-required ports and restrict communication over the specific IPs. And keep the system updated all the time.

Also, allow very limited access to the users on the server. Also, users can use SSL to connect to the servers and traffic can be encrypted for communication.

**7. What are some challenges which you face in meeting these needs in the context of cloud storage?**

Multiple users, and the inability to meet all user needs. We have discussed this before.

**8. How often do you audit your services?**

As per the schedule audit mandate. Based on the organisation's requirements, we have to perform the audit services which include the security aspects of systems by overseeing the service to maintain the business continuity and upgrade the infrastructure as per the company requirements.

**9. Are there any future plans to enhance your service provision in terms of QOS and security?**

Many vendors in the market are enhancing their product to support the cloud hosted infrastructure. But the only down side is security, which need to be improved over the communication on the cloud. Also, most organisations are moving towards cloud and in a process of building their own private cloud to offer the server an infrastructure as a service or software as a service.

**11. Do you think that the trust of customers towards cloud storage services change over time? Is it true that there is decay in customer trust after using the service for a long time?**

It depends on the cloud provider's quality of service offered to the clients on comparing with the own IT department. For enhancing the trust among the

customers in our organisation, we provide the customers with the option to handle their encryption keys while storing their data in the cloud. Therefore by providing this security among the data stored in the cloud can be enhanced thus the trust among the customers towards cloud storage services will not be reduced.

**12. What in your opinion are the main factors contributing to customer switching behaviour in cloud storage services?**

Among the mobile users and internet, the popularity has been attained by cloud storage services. For switching behaviours from one service to the other are only limited in cloud storage services. In my opinion, the main four factors that induce the customers for switching the services from one cloud vendor to the other are mainly due to the four elements, and they are the risk, social norm, switching cost and trust.

**13. Do you expect any changes in customer perception of quality of cloud storage services in the aftermath of GDPR (General Data Protection Regulation) enacted by the EU?**

In my opinion, yes to an extent the consumers expected changes in the perception of quality of personal cloud storage services in the aftermath of GDPR enacted by the EU. As the GDPR is a set of data protection laws that help the all over individuals in the country and it is mainly used for data protection of the individuals. Moreover, this law also helps the individual to concern their data stored in the cloud and how the data is being used and also the individuals can raise the complaints if the information is misused, so it highly benefitted the individuals in the UK.

**14. How does a critical mass and social norm influence customer satisfaction in personal cloud storage services?**

Well, being social animal humans beings are highly influenced by the social norms and the culture of the society. The influence of the social norms, the culture and the critical mass effect as you asked is creating a substantial impact on the customer satisfaction of the personal cloud storage services. We can observe that many of the products or the services which the individuals are purchasing are part of the social

influence. People even regret to buy the products or the services by considering the negative attitude of the public towards that specific product or service. In such case, it can be observed that the critical mass effect and the social norm are both positively and negatively influencing the customer satisfaction.

## **IV Final**

### **1. How do you define quality of service in the context of cloud services? What do you think is the differentiator when you evaluate commercial cloud service operations?**

Personal cloud storage is growing, so with it, I'd say the definition of a QoS will continue to change. We define QoS using different elements, but if I were to put it in one word, then meeting customer expectations would be the definition I use. Many users look for services from our platform because the use of external storage devices has become redundant, so they look for something that can provide access anywhere. In that context, QoS is something that can be defined by reliability of service provided as well as the speed of response when something goes wrong. I also think that customers are getting tired of the number of devices they need to store, so scalability definitely is a key component that needs to be assessed. But for a commercial customer, I think they look at issues like jitter, latency, packet loss and other elements as well.

### **2. Do you use any specific method for evaluating the quality of your cloud service? What criteria or metrics do you employ for monitoring and support of cloud service?**

We provide highly secure public, private and hybrid cloud solutions, hosted in Canada, the USA and the UK Tier 3 data centres.

### **3. At an individual customer level, what are some quality expectations that consumers have and how does your organisation go about meeting these expectations? How do you think these differ from the context of commercial cloud platforms?**

I think today many users of personal cloud storage are moving past the free model. Right, they think, why waste money on external hard disks for storage? So, they are willing to move to a premium model from the current free model. These customers normally expect responsiveness in the service (i.e. ability to respond to

the queries of the customers) as well as the ability to increase or scale access. Though scalability in the context of a personal cloud platform is relatively less, it is important to acknowledge that the scalability is an important expectation. So, yes, that is the difference in my book.

**1. Do you feel that these criteria/metrics are sufficient to guarantee user satisfaction through QoS?**

Yes, I would say so. I genuinely believe that we can meet the needs of the customer if we focus on our platform criteria.

**2. How do you think this influences continued customer commitment to the use of your platform?**

I would say the ease of sync and usability are the key elements which have brought about this option, no question at all. Also, it is important to understand the links between security and quality. When we achieve both, we improve customer trust in the platform and their satisfaction with the platform. This automatically leads to an increase in customer commitment to the platform.

**3. If I were to differentiate the QoS in terms of functional (e.g. elasticity, speed) and non-functional (e.g. brand loyalty), what do you think has greater impact?**

I would give more importance to non-functional attributes. The reason for this is that most people give importance to brand recognition rather than understand what a particular product or service is delivering. When it comes to online cloud based services, Microsoft's OneDrive is the one that most people with any lack of knowledge of cloud services will choose, simply because the service has Microsoft's backing. A vast majority of cloud based users are people who are just beginning to get their first experience in this area. Therefore, they are more likely to trust a big global well-known brand cloud service (perceived value) than choose a cloud service for its many functional parameters.

**4. How much do you think security is part of the service provided? What security measures do you take to support your cloud?**

Our cloud platforms are highly secure and you will understand this information is strictly confidential.

**5. What are some challenges which you face in meeting these needs in the context of personal cloud storage?**

Too many quality metrics which keep evolving every day and keep changing every day. This makes it impossible to meet targets.

**6. How often do you audit your services?**

Regularly, using both internal and external organisations.

**7. Are there any future plans to enhance your service provision in terms of QOS and security?**

Yes, there are. However, as you will understand, this information is strictly confidential.

**11. Do you think that the trust of customers towards cloud storage services change over time? Is it true that there is decay in customer trust after using the service for a long time?**

In my opinion, the trust among the consumers using the cloud storage services may change if the organisations offering cloud services did not maintain the appropriate communication regarding the security they provide on the cloud storage and regular updates on the policies adopted the organisation should also be conveyed among the consumers.

**12. What in your opinion are the main factors contributing to customer switching behaviour in cloud storage services?**

In my opinion, the main factor that highly induces the customers to switch from one personal cloud service to the other is a Perceived risk of incumbent service. However, the customers will not prefer switching from one service to other as it is the

enormous time-consuming process for the customers for transferring data from one storage device to the other storage device

**13. Do you expect any changes in customer perception of quality of cloud storage services in the aftermath of GDPR (General Data Protection Regulation) enacted by the EU?**

In my viewpoint, yes there are specific changes in customer perception of quality of personal cloud storage services in the aftermath of GDPR negatively enacted by the EU. As customers know after the implementation of GDPR the personal data will not be stored longer as it is only used for the predefined purpose. Therefore after the implementation of GDPR, there are certain retention periods and the data that are unused in clouds will be expired after specific time period so this has profoundly affected the consumers in the certain way who are using the cloud service for the data storage.

**14. How does a critical mass and social norm influence customer satisfaction in cloud storage services?**

In my opinion, both the terms the critical mass and the social norm are connected to each other. I consider that it is the critical mass effect which later contributes to the social norm. Even though the personal cloud is a highly dependable service in the present days, people are not really intending to buy the service. The reason for this is the misconceptions of the public towards the privacy of the files stored in the cloud service. I do personally know some people who are highly opposing the usage of the personal cloud computing system. The individuals who are opposing or criticising the usage of the personal cloud storage services is pointing out the lack of privacy in the service. They fear that their files will be misused by other parties or by the service provider itself. This attitude can be observed not only in a few people but on a large scale. This is what contributes towards the critical mass effect and the social norm and thereby influence the purchasing behaviour and the satisfaction of the customers. I would like to say that the people who are criticising the personal cloud storage service should questions the usage of the email service as well because even emails are kind of personal cloud computing.



## **V Final**

- 1. How do you define quality of service in the context of cloud services? What do you think is the differentiator when you evaluate commercial cloud service operations?**

Ensuring that customer needs are met by providing priority to their needs based on various elements ranging from data flows, different applications, user needs and guaranteeing a specific level of performance, etc. I'd say all of these refer to quality of service. What differentiates a personal cloud platform from that of a commercial cloud platform is the difference in focus areas. For a commercial cloud, it can be application or service based and so, in case we have a SaaS or an IaaS, we focus on throughput, delay, jitter and loss rate. On the other hand, in the case of a personal cloud computing platform, I'd think the focus is more on end user needs like resolution, quality, reliability of service, scalability and other such elements. I think our differentiator is not necessarily through the service quality platform but through other features. Having said that, I also acknowledge that we are able to provide high level service quality through a clear SLA.

- 2. Do you use any specific method for evaluating the quality of your cloud service? What criteria or metrics do you employ for monitoring and support of cloud service?**

Quality of service is monitored through a previously established set of parameters. For confidentiality reasons I can't share this with you, but obviously, we try to meet the basic needs—i.e. support to the customer, using a transparent SLA, providing options for the customer to upgrade from the freemium model for better performance.

I think we develop based on the type of selection. This would involve the use of the free or the premium version. We first develop a proof of concept and then move forward. So, based on user needs, it is expected to change and this will help monitor performance.

**3. At an individual customer level, what are some quality expectations that consumers have and how does your organisation go about meeting these expectations? How do you think these differ from the context of commercial cloud platforms?**

Customers expect immediate access, immediate response and, most importantly, the ability to migrate across different platforms. I think in the context of Google, being able to upload an MS Excel file or Word and then work on it offline and online is important. But the key difference between, say, a commercial customer expectation and a personal storage consumer expectation is that personal storage is more simple and the needs are clear. The customer expectations are met by constantly asking the customer what they want. We do surveys; we do internal team meetings to figure out what an average customer would need; we have done focus groups to understand and to be able to differentiate the customer from a corporation. We have also been thinking about remote services. The ability to emulate the service experience for potential users is important. So we try to do remote testing in our organisation.

For instance, we try to generate traffic through existing technology and stress the test networks using the traffic. This is effective for us, but obviously time consuming. The bigger companies always look for more, so their expectations can be complex. I think in the context of companies which go for commercial services, centralisation of services and speed is important.

**4. Do you feel that these criteria/metrics are sufficient to guarantee user satisfaction through QoS?**

For the majority of the customers, yes. Sometimes it's not possible to meet the needs of every single customer. I think our complaints record shows that most of the problems customers face are technical, which get resolved immediately. The overall feedback is good.

**5. How do you think this influences continued customer commitment to the use of your platform?**

The ability of to provide different services really. To the end customer, the costs of services have become much cheaper and more accessible. So, if we can give them multiple services ranging from providing a software service, a networking service, an application service as well as an access service, then we can perhaps standardise the infrastructure service quality. This can improve commitment.

**6. If I were to differentiate the QoS in terms of functional (e.g. elasticity, speed) and non-functional (e.g. brand loyalty), what do you think has greater impact?**

Definitely non-functional parameters. I believe that the cloud services market is not yet mature and therefore, when a particular product or service is introduced to the world, the non-functional parameters gain an edge when it comes to impact on QoS. However, I would also add that cloud based services are quickly gaining popularity and it will not be too long before individuals start giving more weightage to functional parameters.

**7. How much do you think security is part of the service provided? What security measures do you take to support your cloud?**

Multifactor authentication systems such as one-time passwords, phone-based authentication and smartcards protect cloud services because they make it harder for attackers to log in with stolen passwords. The Anthem breach, which exposed more than 80 million customer records, was the result of stolen user credentials. Anthem had failed to deploy multifactor authentication, so once the attackers obtained the credentials, it was game over. Many developers make the mistake of embedding credentials and cryptographic keys in the source code and leaving them in public-facing repositories such as GitHub. They also need to be rotated periodically to make it harder for attackers to use keys they've obtained without authorisation. Organisations planning to federate identity with a cloud provider need to understand the security measures the provider uses to protect the identity platform. Centralising identity into a single repository has its risks. Organisations

need to weigh the trade-off of the convenience of centralising identity against the risk of having that repository become an extremely high value target for attackers.

**8. How often do you audit your services?**

Regularly.

**9. Are there any future plans to enhance your service provision in terms of QOS and security?**

We are trying to improve our sync capabilities to improve performance.

**11. Do you think that the trust of customers towards cloud storage services change over time? Is it true that there is decay in customer trust after using the service for a long time?**

In my opinion, it will not change. That is the customers who are using the cloud services for a longer time will not decay their trust in the organisation offering cloud service if the organisations maintain their data with high security for a long time and if the data of the particular organisation are misused and if the information gets lost then the trust will get decayed.

**12. What in your opinion are the main factors contributing to customer switching behaviour in cloud storage services?**

In my point of view, the factor that compels the customers to transfer from one cloud service to the other cloud vendors is due to the elements such as favourable social norms, transfer trust and the Perceived critical mass towards the new services. These are the main factors that promote the customers to shift from one cloud service provider to the other.

**13. Do you expect any changes in customer perception of quality of cloud storage services in the aftermath of GDPR (General Data Protection Regulation) enacted by the EU?**

Yes, I expect changes in customer perception of quality of personal cloud storage services in the aftermath of GDPR enacted by the EU. As after the implementation of GDPR, the new obligations on businesses has been implemented that is in the UK

who are using cloud services must ensure the customers that the cloud service they are using must not cause the applications and system the organisation design for storing the data should not expose the customers to any risk. Therefore by this, the customers are more satisfied with using the Cloud storage services.

**14. How does a critical mass and social norm influence customer satisfaction in cloud storage services?**

In my personal opinion, social norms or the critical mass are not creating an impact on the customer satisfaction of the personal cloud storage services. Being a cloud computing professional I have not encountered any such incidents or opinions. The personal cloud storage service is highly used by the individuals in the present days. In fact, the usage of the personal cloud storage services is increasing day by day. In such a case I don't believe that the critical mass or the social norm even though it is negative is creating a substantial impact or influence on the purchasing behaviour or the satisfaction of the customers.

## **VI Final**

- 1. How do you define quality of service in the context of cloud services? What do you think is the differentiator when you evaluate commercial cloud service operations?**

I think QoS is the ability of the service provider to be able to meet a set of contracted clauses and quality requirements. This is given through the SLA. So the QoS in the context of a personal cloud storage platform is something that can meet the SLA needs. I think it is the SLA that is different in the context of a personal user and a commercial user. I think that is the primary differentiator that can be seen.

- 2. Do you use any specific method for evaluating the quality of your cloud service? What criteria or metrics do you employ for monitoring and support of cloud service?**

SLA agreements are the key to our QoS measurement and metrics setting. We make sure that our agreement covers all our quality assurances. However, we do understand that resource capabilities and scalability options for the customers can bring potential challenges and that these challenges need to be met. So, we also focus on impairment risks that take place and are found to influence the operation. This research contends that applications need to be consistently monitored for infrastructure resource delivery due to potential challenges associated with VM failure within the platform. This can influence the customer and can ultimately degrade service quality. Therefore, the measurement of these applications is needed.

In terms of monitoring the support services, I'd say we have a direct platform through which the customer can give feedback. I will admit that, given the global reach, assurance is an issue, but we take pride in the fact that every query is attended to within 24 hours.

**3. At an individual customer level, what are some quality expectations that consumers have and how does your organisation go about meeting these expectations? How do you think these differ from the context of commercial cloud platforms?**

Customer expectation is an on-time service based on quality assurances we made in the SLA. It is as simple as that and we would like to maintain these needs. To truly achieve these needs, we believe that constant monitoring of the SLA agreements as discussed before is enough. I think customers expect immediate synchronisation across various systems. But I'd say it's a challenge, as the number of customers in a personal cloud platform is just too many; there is just so much variation in what they need.

**4. Do you feel that these criteria/metrics are sufficient to guarantee user satisfaction through QoS?**

Absolutely. This is a guarantee. As we strongly focus on building the overall platform strength by focusing on various QoS requirements, it will influence their satisfaction. The key is consistent follow up. This can help us improve our overall performance. I also believe that monitoring QoS through data analytics has helped improve overall performance. For example, we track the number of service complaints we receive, try and figure out how we can overcome potential challenges and problems. We also see where the challenge comes and try to reduce the number of complaints. Monitoring and support are based on our SLA agreement. We give complete support and we make sure that there is quality assurance where needed.

**5. How do you think this influences continued customer commitment to the use of your platform?**

I think the true ability of these services is the ability to create impairments and partnerships. For example, the personal cloud platform not only provides a storage space but also offers some application access. Now, these rely strongly on critical components which are provided directly as partnerships. For now, we don't work with those outside our organisation and this is followed by our competitors as well. So if we continue to create positive partnerships and meet

independent needs, I think we will continue to create a positive relationship with the customer. I believe that capabilities like Database-as-a-Service (DBaaS) and Load-Balancing-as-a-Service (LBaaS) allow cloud service providers to ‘buy’ a mature technology component service rather than ‘building’ private and application-specific instances. However, these offerings are vulnerable to service reliability, latency, quality and unavailability impairments as well.

**6. If I were to differentiate the QoS in terms of functional (e.g. elasticity, speed) and non-functional (e.g. brand loyalty), what do you think has greater impact?**

Both functional and non-functional parameters have a role to play. The exact ratio of which parameter holds more value depends on each type of individual, since everyone has unique requirements, likes and needs. In my opinion, in terms of overall scale, functional parameters have more importance when compared to non-functional parameters. I also believe that the more time cloud based service providers are given to improve their product and customers learn about such services, more people will start giving more importance to functional parameters.

**7. How much do you think security is part of the service provided? What security measures do you take to support your cloud?**

Practically every cloud service and application now offers APIs. IT teams use interfaces and APIs to manage and interact with cloud services, including those that offer cloud provisioning, management, orchestration and monitoring.

The security and availability of cloud services—from authentication and access control to encryption and activity monitoring—depend on the security of the API. Risk increases with third parties that rely on APIs and build on these interfaces, as organisations may need to expose more services and credentials, the CSA warned. Weak interfaces and APIs expose organisations to security issues related to confidentiality, integrity, availability and accountability.

**8. How often do you audit your services?**

Quarterly.



**9. Are there any future plans to enhance your service provision in terms of QOS and security?**

I am not involved in the development.

**11. Do you think that the trust of customers towards cloud storage services change over time? Is it true that there is decay in customer trust after using the service for a long time?**

Yes, there is a chance from the customer's side to mistrust the organisation's cloud services offered to the customers if there is a lack of transparency and communication between clients and Cloud service vendors.

**12. What in your opinion are the main factors contributing to customer switching behaviour in cloud storage services?**

In my opinion, personal cloud service adoption of users may get affected by the user's perception, and experience on services offered by the cloud vendors and technical characteristics of cloud computing may have both positive or negative influence.

**13. Do you expect any changes in customer perception of quality of cloud storage services in the aftermath of GDPR (General Data Protection Regulation) enacted by the EU?**

Yes, the customer expectation has wholly changed concerning the quality of personal cloud storage services in the aftermath of GDPR that is implemented by the EU. After the implementation of GDPR, the privacy of the data stored has been strengthened more in two ways. The primary purpose is that the organisation responsibility is to protect the user data has increased, and secondly, the consumers can know how their data has been used, accumulated and stored and also whenever it is requested by the customers to delete it can be deleted, and this highly benefits the customers after the implementation of GDPR.

#### **14. How does a critical mass and social norm influence customer satisfaction in personal cloud storage services?**

First of let me tell you that the social norm or the critical mass is not that much influencing on the customer satisfaction of the personal cloud storage services. I am not saying that it is not at all influencing. Yes, it is influencing, but only on a certain level. The personal cloud storage service has become an integral part of the modern storage systems. However, certain criticisms are visible regarding the safety of the files stored in the personal cloud storage systems. The criticisms are found to be generating the social norm that the personal cloud storage services are not safe. Even though the criticisms and anxiety regarding the safety of the personal cloud storage services exist, it is not able to create a notable effect on the satisfaction level of the customers. Majority of the users possesses a positive attitude towards the personal cloud storage services and are found to be highly satisfied also.

## **VII Final**

### **1. How do you define quality of service in the context of cloud services? What do you think is the differentiator when you evaluate commercial cloud service operations?**

Quality for a personal cloud storage user is definitely something that is based on the immediate needs of the customer. So, in this context, I would say providing a service when needed—i.e. on-demand service—is the most important thing. I'd say this should also be as automated as possible—for example, network storage and reduced time of upload without the requirement of human interaction is a key element. Automatic upload to the cloud in the OneDrive is definitely a key element that forms part of the QoS platform.

In contrast, I think if asked to comment on a commercial cloud, the focus is more on resource use. So I think in organisations, resource pooling can be a key QoS. You may not agree with this, but the provider's computing resource use can be considered. So they may look for physical and virtual resource platforms. This is definitely something that needs to be considered. I also think that the commercial cloud has the bigger requirement of being rapidly elasticity-providing in its approach. I think elasticity and rapid scalability is are key elements which are more important in a commercial context. Many individuals look for space, and say, a 10 GB cap is more than enough for many users around the world.

### **2. Do you use any specific method for evaluating the quality of your cloud service? What criteria or metrics do you employ for monitoring and support of cloud service?**

I'd say for a long time even the software industry used customer satisfaction as the key element which influences quality metrics. So when we develop a quality metric, we focus on this element as the key indicator. However, we also base our measurement on other elements. These include factors like defect measurement or areas where there is drop in service provision. We also like to categorise the potential metrics based on preventing the error (e.g. metrics to see how the drop in service or, for example, the lack of immediate response to a query is carried out).

The quality of monitoring a given service is largely based on the ability to meet individual needs and based on how we integrate the personal cloud into other services like the use of software. I think traditionally a lot of metrics associated with structured software quality based their assumptions on the number of decisions in the control flow. These metrics only suggest the possibility of the problem. Today, the challenge in metrics monitoring is to see how the error or lapse in quality could have been prevented. That is the key.

**3. At an individual customer level, what are some quality expectations that consumers have and how does your organisation go about meeting these expectations? How do you think these differ from the context of commercial cloud platforms?**

Customer expectation is immediate access and efforts need to be taken to ensure that there is immediate access. A primary risk that we face is the infrastructure latency. I think customers, especially end customers like those who use personal cloud storage, are not aware of the service latency concept and therefore often have the biggest expectations in this context. For instance, if the service is in a non-virtualised context, then the response time for, say, a fast and a slow query is not greatly different. But imagine if the same is done using a virtualised infrastructure. In fact, the use of Google Drive based on use of Google Office has been a key challenge as we have had some complaints of service latency. This can lead to a significant loss in the patience of the customer, which can in turn lead to their dissatisfaction and inability to satisfy their expectations.

**4. Do you feel that these criteria/metrics are sufficient to guarantee user satisfaction through QoS?**

Yes. I think we can meet the needs of the customer. How effectively can this need be met? Only through tracking of the performance. We also keep a detailed log of ongoing and future ways in which QoS criteria can be defined. We normally categorise them broadly based on, say, functionality (e.g. latency or scalability) and non-functional or customer or user end challenge (e.g. ease of use). We make sure that all these criteria are clearly defined and that is circulated across the organisation.

**5. How do you think this influences continued customer commitment to the use of your platform?**

I think constant monitoring and revisiting the platform needs has led to better performance. We will continue to create a positive environment where users will find it effective to use the platform as long as the SLA is tight. To create this, we need service level objectives for all cloud platforms and constant revisiting of these objectives. The approach can be managed such that we can enhance fault isolation and can ensure that the fault is identified when needed to improve service quality needs. Therefore, as long as existing parameters continue to provide clear service boundaries and requirements, it would be easy to pinpoint the problems within the platform. This will make it easier to determine the problem and fix it. Architect applications aim to minimise the impact of cloud infrastructure impairments on end customers. In addition, test applications with likely infrastructure impairments ensure that customers consistently receive acceptable service quality.

**6. If I were to differentiate the QoS in terms of functional (e.g. elasticity, speed) and non-functional (e.g. brand loyalty), what do you think has greater impact?**

I would rate functional parameters as having a greater impact on QoS. This is simply because, over time, customers will start learning more about the various types of cloud services available and will become more proficient in using them. This will give them a better understanding of the products' functional parameters. I believe that if the functional parameters are good, then over time the name of the product will automatically become famous and brand recognition will improve automatically. Therefore, I believe that giving more importance to functional parameters will over time improve non-functional parameters.

**7. How much do you think security is part of the service provided? What security measures do you take to support your cloud?**

System vulnerabilities, or exploitable bugs in programs, are not new, but they've become a bigger problem with the advent of multitenancy in cloud computing. Organisations share memory, databases and other resources in close proximity to

one another, creating new attack surfaces. Fortunately, attacks on system vulnerabilities can be mitigated with basic IT processes. Another element that needs to be highlighted is phishing. Fraud and software exploitation are still successful, and cloud services add a new dimension to the threat because attackers can eavesdrop on activities, manipulate transactions and modify data. Attackers may also be able to use the cloud application to launch other attacks.

I also think insider threat and the associated challenge is an issue. The insider threat has many faces: a current or former employee, a system administrator, a contractor or a business partner. The malicious agenda ranges from data theft to revenge. In a cloud scenario, a hell-bent insider can destroy whole infrastructures or manipulate data. Systems that depend solely on the cloud service provider for security, such as encryption, are at greatest risk.

**8. How often do you audit your services?**

Monthly.

**9. Are there any future plans to enhance your service provision in terms of QOS and security?**

I am not involved in this.

**11. Do you think that the trust of customers towards cloud storage services change over time? Is it true that there is decay in customer trust after using the service for a long time?**

In my viewpoint, there is no chance to decay the trust between the customers towards the organisation who are using the cloud services for the longer time. For example, in our company, there are a lot of clients who are using the cloud services for several years, and we have provided the clients with their encryption key to secure their data in the cloud, so they are much satisfied with our service and no any mistrust created.

**12. What in your opinion are the main factors contributing to customer switching behaviour in cloud storage services?**

In my opinion, No, as switching behaviour in personal cloud storage services is the most time-consuming process that is to shift the data from one cloud services to the other take more time so the individuals will not prefer to switch from one service to the other.

**13. Do you expect any changes in customer perception of quality of cloud storage services in the aftermath of GDPR (General Data Protection Regulation) enacted by the EU?**

Yes, there are a lot of changes in customer perception after the implementation of GDPR enacted by the EU in the quality of personal cloud storage services. As the customers know after the implementation of GDPR in cloud services, there are various changes involved in terms of security that is it strengthens privacy, data control and visibility, data sovereignty and also enhances the confidentiality by security and design.

**14. How does a critical mass and social norm influence customer satisfaction in cloud storage services?**

Well, in my opinion, there is nothing such as the social norm or the critical mass effect on the customer satisfaction of the personal cloud storage services. I know that the social norms are a significant factor in influencing the purchasing behaviour of the customers. Similar to the social norm the critical mass effect can control the purchasing behaviour of the individuals. Even though both the critical mass and the social norm is capable of influencing the purchasing behaviour of the individuals with the products and services, in the case of personal cloud storage services there is no such influence. It is in fact because that personal cloud storage service is different from other types of services and those who willing to purchase it and their satisfaction will not be influenced by the social norms, unlike other products or services.

## VIII Final

### **16. How do you define quality of service in the context of cloud services? What do you think is the differentiator when you evaluate commercial cloud service operations?**

So, quality is what we assure our customers of and is part of our SLA. But QoS can be too technical and not something the direct customer would be able to understand. What they look for is reliable service, without down time, all time access and response when they have a challenge. This is something we need to be fully aware of and accept the same. Another service quality attribute that I would immediately think of is the ability to provide access to a broad network of services. These can include various elements ranging from standardised mechanisms promoting use by heterogeneous sources like mobile phones, laptops, work stations, etc. So this is another aspect that an individual user may look for—i.e. they may use a tablet, a mobile phone or a personal laptop. So sync in different devices is something they may focus on.

Differentiator? Well, I'd say 24/7 support. Our reliability is the most important element.

### **1. Do you use any specific method for evaluating the quality of your cloud service? What criteria or metrics do you employ for monitoring and support of cloud service?**

In a commercial context, it is important to acknowledge that there is an absolute guarantee which needs to be immediately enforced. Commercial clients pay more so they obviously look for an immediate response. Faster response time, less jitter, less latency is obviously a difference. I'd argue that the basic elements for both remain the same.

We monitor performance using different tools like Ops View and Solar wind. I've also been recommended that open source elements would work, but we have not used it at all.



**2. At an individual customer level, what are some quality expectations that consumers have and how does your organisation go about meeting these expectations? How do you think these differ from the context of commercial cloud platforms?**

There are multiple elements which can be highlighted as the expectation of the customer and we have discussed many of these before. The biggest one, if you like, is the assurance and trust that the customer has in my platform. If I have that, I will keep the customer. Customer retention costs in the personal cloud storage platform are high. This is because, when compared to the corporate customer, the number of customers is very high so their requirements and expectations keep varying. It's not necessarily costs, but it a lot of different elements.

**3. Do you feel that these criteria/metrics are sufficient to guarantee user satisfaction through QoS?**

As I've been saying all along, the first and foremost element that a consumer thinks will help him/her in the context of a software service is the ability to maintain quality in terms of access to a particular service, ensuring that this access leads to reliable and continuous elements and, finally, ensuring that there is retention of the service and the ability to complain when such retention is not achieved. So a customer who is part of a personal cloud platform does not care about other elements like cost or infrastructure. If we give them this service, they will continue to be happy with the platform and will continue to use the platform as expected and needed.

**4. How do you think this influences continued customer commitment to the use of your platform?**

When the customer needs are met and they are satisfied, they will remain committed. However, it is also very important to note that a balance between security and service quality needs to be established. I believe that if we are able to avoid impairments and security breaches while ensuring that if they do happen we mitigate them very fast, we can definitely create customer commitment. Think about it—in any service, what is important is ensuring that there is visibility of metrics and accountability at different levels. We need to think of the cloud as an

eco-system where constant feedback from the client is gained to ensure that the independent customer needs are always met. This is the best way to create customer engagement and customer commitment to the platform.

**5. If I were to differentiate the QoS in terms of functional (e.g. elasticity, speed) and non-functional (e.g. brand loyalty), what do you think has greater impact?**

Well, in my experience, it is not always easy to develop a platform which brings about an improvement in quality if we don't focus on both, so yes, both equally important.

**6. How much do you think security is part of the service provided? What security measures do you take to support your cloud?**

Data challenges are in my opinion the greatest, even more than other challenges. Compliance policies often stipulate how long organisations must retain audit records and other documents. Losing such data may have serious regulatory consequences. The new EU data protection rules also treat data destruction and corruption of personal data as data breaches requiring appropriate notification. Know the rules to avoid getting in trouble. Also, think about it: it is all well shared and not very clear at all. If an integral component gets compromised—say, a hypervisor, a shared platform component, or an application—it exposes the entire environment to potential compromise and breach. We do many things like defence-in-depth strategy, including multifactor authentication of all hosts, host-based and network-based intrusion detection systems and others.

**7. How often do you audit your services?**

Monthly.

**8. Are there any future plans to enhance your service provision in terms of QOS and security?**

Confidentiality issues.

**11. Do you think that the trust of customers towards cloud storage services change over time? Is it true that there is decay in customer trust after using the service for a long time?**

If the organisation offering cloud services does not maintain any transparency between their clients, then the trust among the organisation will get reduced over time, and this will profoundly affect the brand's reputation.

**12. What in your opinion are the main factors contributing to customer switching behaviour in personal cloud storage services?**

In my viewpoint, various factors permit the users to shift their service from one cloud service to the other and one main factor that profoundly influences the consumers are security factors that affect the data stored in the cloud storage.

**13. Do you expect any changes in customer perception of quality of cloud storage services in the aftermath of GDPR (General Data Protection Regulation) enacted by the EU?**

Yes, there are a lot of changes in customer perception of quality of personal cloud storage services in the aftermath of GDPR enacted by the EU. As after implementing the GDPR the security of the data stored in the cloud will be enhanced. That is after the implementation of GDPR all organisations are decided must implement 'Privacy-by-design' as the main principle for every system and application mainly for protecting the personal information of the customers who are using cloud services.

**14. How does a critical mass and social norm influence customer satisfaction in cloud storage services?**

The critical mass effect is something which is very significant when it comes to the satisfaction level or the purchasing behaviour of the individuals. I believe that the social norm or even the critical mass effect is very powerful and are capable of both promoting and destroying the reputation and image of a brand, their product or service. In my opinion, both the social norm and the critical mass carry an element of control which constrains our behaviour. It is what tells us what to do, how to do or what not to do. These constrain or the control is visible when it comes to the use of

personal cloud storage services. I have seen people criticising the personal cloud storage services believing that their files are not safe in the system. They even promote their misconception and restricts others from using it. This misconception is what pulling down the customers from using the service and significantly reducing their satisfaction level.

### Appendix 3: Regression analysis results

*Effect of Customer Factors (CF) and Organisational factors (OF) on customer trust towards the personal cloud storage service*

#### REGRESSION

/VARIABLES= @11.1Deter @11.2Remedy @11.3Prevention @11.4Detection  
@12.1UndPriAgr @12.2WillingtoStr @12.3ExiLaws @12.4GDPR @12.5Timedecay  
/DEPENDENT= @13.CusTrust  
/METHOD=ENTER  
/STATISTICS=COEFF R ANOVA BCOV.

#### Model Summary (13.CusTrust)

R	R Square	Adjusted R Square	Std. Error of the Estimate
.97	.94	.93	.31

#### ANOVA (13.CusTrust)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	268.82	9	29.87	315.74	.000
Residual	17.97	190	.09		
Total	286.80	199			

#### Coefficients (13.CusTrust)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.72	.08	.00	8.87	.000
11.1Deter	-.09	.04	-.09	-2.48	.014
11.2Remedy	-.32	.12	-.36	-2.61	.010
11.3Prevention	-.04	.05	-.04	-.94	.350
11.4Detection	.46	.14	.47	3.26	.001
12.1UndPriAgr	.12	.07	.15	1.83	.069
12.2WillingtoStr	.18	.14	.19	1.33	.187
12.3ExiLaws	.47	.13	.54	3.48	.001
12.4GDPR	-.11	.08	-.12	-1.44	.150
12.5Timedecay	.20	.09	.24	2.23	.027

Coefficient Correlations (13.CusTrust)

Model		11.1Deter	11.2Remedy	11.3Prevention
	Covariances	11.2Remedy 11.3Prevention 11.4Detection 12.1UndPriAgr 12.2WillingtoStr 12.3ExiLaws 12.4GDPR 12.5Timedecay	.00 .00 .00 .00 .00 .00 .00 .00	.00 .02 .00 -.01 .00 .00 -.01 .00
Model		11.4Detection	12.1UndPriAgr	12.2WillingtoStr
	Covariances	.00 .00 .00 .00 .00 .00 .00 .00	.00 -.01 .00 .02 .00 -.02 .01 .00	.00 .00 .00 .00 .00 .00 .00 .00
Model		12.3ExiLaws	12.4GDPR	12.5Timedecay
	Covariances	.00 .00 .00 -.02 .00 .02 .00	.00 -.01 .00 .01 .00 .00 .02	.00 .00 .00 .00 .00 .00 .00

Model		12.3ExiLaws	12.4GDPR	12.5Timedecay
		.00	.00	.01

# Effect of functional and non-functional parameters on user satisfaction

## REGRESSION

```

/VARIABLES= @9.1Funct1 @9.2Funct2 @9.3Funct3 @9.4Funct4 @9.5Funct5
@10.1NoFunct1 @10.2NoFunct2 @10.3NoFunct3 @10.4NoFunct4 @10.5NoFunct5
@10.6NoFunct6
/DEPENDENT= @14.CusSatis
/METHOD=ENTER
/STATISTICS=COEFF R ANOVA BCOV.

```

## Model Summary (14.CusSatis)

<i>R</i>	<i>R Square</i>	<i>Adjusted R Square</i>	<i>Std. Error of the Estimate</i>
.97	.94	.93	.30

## ANOVA (14.CusSatis)

	<i>Sum of Squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
<i>Regression</i>	252.83	11	22.98	257.94	.000
<i>Residual</i>	16.75	188	.09		
<i>Total</i>	269.58	199			

## Coefficients (14.CusSatis)

	<i>Unstandardized Coefficients</i>		<i>Standardized Coefficients</i>
	<i>B</i>	<i>Std. Error</i>	<i>Beta</i>
<i>(Constant)</i>	3.15	NaN	.00
9.1Funct1	.00	NaN	.00
9.2Funct2	-.10	.06	-.11
9.3Funct3	.19	.06	.24
9.4Funct4	-4301765091394659.50	NaN	-4570809032037422.00
9.5Funct5	.00	.00	.00
10.1NoFunct1	4301765091394659.50	NaN	4570809032037422.00
10.2NoFunct2	.21	NaN	.25
10.3NoFunct3	.00	.00	.00
10.4NoFunct4	.40	.08	.50
10.5NoFunct5	.00	.00	.00
10.6NoFunct6	-.34	.07	-.38

	<i>t</i>	<i>Sig.</i>
<i>(Constant)</i>	NaN	NaN
9.1Funct1	NaN	NaN

9.2Funct2	-1.56	.120
9.3Funct3	3.33	.001
9.4Funct4	NaN	NaN
9.5Funct5	NaN	NaN
10.1NoFunct1	NaN	NaN
10.2NoFunct2	NaN	NaN
10.3NoFunct3	NaN	NaN
10.4NoFunct4	5.35	.000
10.5NoFunct5	NaN	NaN
10.6NoFunct6	-5.05	.000

Coefficient Correlations (14.CusSatis)

Model		9.1Funct1	9.2Funct2
	<i>Covariances</i>	9.2Funct2	-1567591439540.36
		9.3Funct3	.00
		9.4Funct4	.01
		9.5Funct5	-46698221818407.49
		10.1NoFunct1	.00
		10.2NoFunct2	46698221818407.49
		10.3NoFunct3	1567591439540.37
		10.4NoFunct4	.00
		10.5NoFunct5	-.01
		10.6NoFunct6	.00



**Effect of Security and privacy perceptions and QoS perception of a user on the loyalty of a user towards the personal cloud storage service**

**REGRESSION**

```

/VARIABLES= @9.1Funct1 @9.2Funct2 @9.3Funct3 @9.4Funct4 @9.5Funct5
@10.1NoFunct1 @10.2NoFunct2 @10.3NoFunct3 @10.4NoFunct4 @10.5NoFunct5
@10.6NoFunct6 @11.1Deter @11.2Remedy @11.3Prevention @11.4Detection
@12.1UndPriAgr @12.2WillingtoStr @12.3ExiLaws @12.4GDPR @12.5Timedecay
/DEPENDENT= @15.RetLoy
/METHOD=ENTER
/STATISTICS=COEFF R ANOVA BCOV.

```

**Model Summary (15.RetLoy)**

R	R Square	Adjusted R Square	Std. Error of the Estimate
.97	.94	.93	.31

**ANOVA (15.RetLoy)**

	Sum of Squares	df	Mean Square	F	Sig.
Regression	259.76	20	12.99	132.11	.000
Residual	17.60	179	.10		
Total	277.36	199			

**Coefficients (15.RetLoy)**

	Unstandardized Coefficients		Standardized Coefficients
	B	Std. Error	Beta
(Constant)	2.13	5702515.20	.00
9.1Funct1	-1.60	NaN	-1.85
9.2Funct2	.19	.09	.20
9.3Funct3	.13	.07	.17
9.4Funct4	-49808297734328.67	NaN	-52176377069692.74
9.5Funct5	.34	.12	.42
10.1NoFunct1	49808297734328.67	NaN	52176377069692.74
10.2NoFunct2	1.07	NaN	1.23
10.3NoFunct3	.00	.00	.00
10.4NoFunct4	.35	.11	.42
10.5NoFunct5	.00	.00	.00
10.6NoFunct6	.12	.10	.13
11.1Deter	-.08	.04	-.08
11.2Remedy	.00	.00	.00
11.3Prevention	-.17	.06	-.18
11.4Detection	.00	.00	.00
12.1UndPriAgr	-.31	.09	-.37
12.2WillingtoStr	.08	.03	.09
12.3ExiLaws	.51	.16	.61
12.4GDPR	-.14	.10	-.15
12.5Timedecay	.00	.10	.00

	<i>t</i>	<i>Sig.</i>
<i>(Constant)</i>	.00	1.000
9.1Funct1	NaN	NaN
9.2Funct2	2.01	.046
9.3Funct3	1.85	.067
9.4Funct4	NaN	NaN
9.5Funct5	2.92	.004
10.1NoFunct1	NaN	NaN
10.2NoFunct2	NaN	NaN
10.3NoFunct3	NaN	NaN
10.4NoFunct4	3.18	.002
10.5NoFunct5	3.25	.001
10.6NoFunct6	1.20	.234
11.1Deter	-1.81	.071
11.2Remedy	NaN	NaN
11.3Prevention	-2.65	.009
11.4Detection	3.25	.001
12.1UndPriAgr	-3.25	.001
12.2WillingtoStr	2.96	.004
12.3ExiLaws	3.14	.002
12.4GDPR	-1.30	.197
12.5Timedecay	.00	.998

Coefficient Correlations (15.RetLoy)

<i>Model</i>		9.1Funct1	9.2Funct2
<i>Covariances</i>	9.2Funct2		-1729495657434.45
	9.3Funct3		.00
	9.4Funct4		.01
	9.5Funct5		-20458975829374.51
	10.1NoFunct1		.01
	10.2NoFunct2		20458975829374.51
	10.3NoFunct3		1729495657434.49
	10.4NoFunct4		.00
	10.5NoFunct5		-.02
	10.6NoFunct6		.00
	11.1Deter		.00
	11.2Remedy		.00
	11.3Prevention		.00
	11.4Detection		.00
	12.1UndPriAgr		.00
	12.2WillingtoStr		.01
	12.3ExiLaws		.00
	12.4GDPR		-.04
	12.5Timedecay		-.01



<i>Model</i>		10.1NoFunct1
	<i>Covariances</i>	.01
		.00
		.00
		6230254364438.64
		.01
		-6230254364438.64
		.00
		.00
		.00
		.00
		.00
		.00
		.00
		.00
		.00
		.00
		-.01
		.00
		-.01
		.00