Factors Influencing the Adoption of Financial and Non-Financial Information Cloud Backup methodology in Term of age and Gender: Evidence from the United States

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Abstract

The purpose of this quantitative study is to evaluate the factors that may have an influence on consumers' decision to adopt cloud backup procedures. A quantitative research design was used. The dependent variable was whether or not the participant uses a cloud backup process and the independent variables were age and gender. An online survey was used for data collection. The results were that age and gender are not related to cloud adoption rate. Also, it was concluded that although cloud computing in general and using cloud computing for backing up valuable files offers many advantages to consumers, they have not been completely integrated into consumers' daily computing activities. In addition, some of the advantages described in this paper included cost effectiveness due to a lack of physical space requirements for users, reduction in utility costs such as electricity and temperature regulation, reduction in required equipment (such as external hard drives), off-site data availability (i.e., accessibility and mobility), a high level of automation, and scalability

Keywords: Cloud backup, Cloud computing, Cloud infrastructure as a service, Cloud platform as a service, Cloud software as a service, Cloud storage, Community cloud computing as a utility, Financial and non-financial.

1. Introduction

The growth and popularity of internet changed the way data is being backed up. In the early 80s and 90s, tapes backup were common for data backup, then floppy disks came into play between the hands of consumers. However, we are talking about small amount of storage were available on those devices, only thousands of bytes were referred as Kilobytes. Also at that time, the availability and the speed of internet wasn't the way it is now a days. All the computer's tasks are done on the computer device itself comparing to today, almost all computing are done online.

Having small storage capacity and slow internet speed made it not possible for cloud backup technology to exist. In fact, few people will back up their data, others have their data on papers and stored in folders located in file cabinets. Surprisingly, few people even in the early 2000s will back up their data. Consumers don't backup up their data because it requires time, it cost a lot to buy the backup hardware, or they forget to do it much often. Consumers always complain about data loss, data availability, and data theft when it comes to back up their data on their hard drives or other backup devices.

Hard drive technologies and capacity have increasingly developed and improved from the way it was in the past. Storages capacities are no longer in the Kilobytes, Megabytes, or even Gigabytes schemes, in fact it's in the hundreds of Terabytes. Year by year the storage capacity is increasing and available to consumers to purchase. Internet speed also is a lot faster from the way it was in the past reaching 30 megabyte per second comparing it to few kilobytes per seconds in most households. Combining those two technological advancements in the hard drive capacity and internet speed, cloud backup was born.

Cloud backup gives the consumers the opportunity to back up their data seamlessly. Normally, consumers' will need to setup and configure their cloud backup service only once. Then, the cloud backup provider will automatically backup the consumers' computer or mobile device using software that they download on the device. The biggest advantage that this is can be done while the consumer is still using the device that is being backed up or not. With cloud backup method storing data has become easy and effective. Consumers don't have to remember when to backup or how to backup.

Another cloud backup advantage is that it makes the data available to be accessed from anywhere in the world as long as there is an internet connection. Also, the cloud backup providers have more knowledge in regard to data security than average consumer does. As a result, having your data stored on the cloud may be less vulnerable to hackers than having it stored on your own. A recent study by Trend Micro has shown that almost 39% of U.S consumers do not back up their computers. That shows an increase of numbers of consumers who backup their data. This study defined and evaluated the reasons that motivated consumers to adopt to cloud backup as well as their concerns of the adoption.

2. Research Questions

Based on the purpose of this study, two research questions were developed with one question for each of the four demographic variables to be examined.

RQ1. To what extent, if any, is age related to consumers' decision to adopt to cloud backup?
RQ2. To what extent, if any, do male and female consumers differ with respect to the decision to adopt to cloud backup?

3. Definition of Terms

Cloud backup

Cloud backup is a computing service that enables the users to backup their computer to a remote location seemingly and restore the data anytime they desire (Rouse, 2010).

Cloud computing

Cloud computing is a style of computing where scalable and elastic IT-related capabilities are provided as a service to external customers using Internet technologies (Cearley, 2010). In other words, cloud computing is a process of renting computers, storage, network capacity, and other IT resources on an hourly basis and is based on the client's consumption.

Cloud infrastructure as a service

Cloud infrastructure as a service is a cloud computing model that consumers will have access to a full capability of an IT infrastructure such as processing, storage, networks, and other essential computing resources that are provided from a third party (Mell & Grance, 2009).

Cloud platform as a service

Cloud platform as a service is a cloud computing model that gives consumers the opportunity to develop their own software by utilizing programming languages, environments, and tools that are located on the cloud IT infrastructure and supported by the cloud provider (Mell & Grance, 2009).

Cloud software as a service

Cloud software as a service is a cloud computing model that consumers has access to use the software running on the cloud platforms that are utilizing the cloud infrastructures (Mell & Grance, 2009).

Cloud storage

Cloud storage is a computing service of storing data securely in a remote location which can then be accessed through the Internet (Robert, 2012).

Community cloud

Community cloud is a cloud computing delivery model where the computing is delivered to several organizations that share the same concerns or to specific community.

Computing as a utility

Computer as a utility is a cloud computing delivery method where the user will receive a monthly billing statement for the service they utilize by the cloud service provider (Carr, 2008).

Delta blocking

Delta blocking is a method used to divide and save files into blocks to reduce time and increase backup efficiency (Clapperton, 2000).

Hybrid cloud

Hybrid cloud is a cloud computing delivery model where the computing services are combines between any two or more cloud models such as (private, public, and community) that enable data portability (Mell & Grance, 2009).

Intelligent file selection

Intelligent file selection does not backup nonessential files such as clipart and cookies that are stored on the computer to increase network efficiency (Kane & Hopkins, 1993).

Local backup

Local backup is a self-service computer backup method that is done locally via mass storages or small storages system such as backup servers, computers, tapes, flash drive, CD, DVD, cell phones, and external hard drive (Clapperton, 2000).

Private cloud

Private cloudis a cloud computing delivery method where the computing is delivered privately for an organization. The cloud IT infrastructure might be controlled by the organization itself or by a third party (Mell & Grance, 2009).

Public cloud

Public cloud is a cloud computing delivery model where the computing services are delivered to the general public and it's specifically owned by a third party cloud computing provider (Mell & Grance, 2009).

Quantitative research

Quantitative research is research that analyzes numerical data.

Service level agreement

A service level agreement is a digital subscription contract between the cloud backup provider and the consumers.

Technology acceptance model

The TAM is a model of the acceptance behavior for a type of technology (Straub & Burton-Jones, 2007).

User

A user is an organization or individual that uses cloud computing resources as a customer of a cloud computing provider.

4. Literature Review

4.1 Cloud Computing Background and History

Cloud backup is a subset of cloud computing that is an internet based computing. As a result, this section will drive us back in time to the history of early data storage, legacy computing, the World Wide Web, internet, cloud computing, and then how cloud backup started. Data storage started as early as 1725 by using punch cards created by Basile Bouchon. Punch cards are perforated paper loops used to store patterns which could be used on cloth (Robert, 2012). In 1846, Alexander Bain improved the punch cards technology and created what he called as punch tapes that can hold significantly more data than the punch cards.

In 1898, Valdemar Poulsen invented the magnetic wire recording. Based on Polsen's invention, magnetic tape sound recording was invented by Fritz Pfleumer in 1928 in Germany and this technology enabled users to store larger data. In 1939, the complex number calculator (CNC) was created by Bell Telephone Laboratories, designed by researcher George Stibitz. In 1940, Stibitz demonstrated his new invention at an American Mathematical Society conference at Dartmouth College in Hanover, New Hampshire.

Amazingly, Stibitz was able to perform some calculations on the CNC remotely from New York City, using teletype connected via special telephone lines (Kessler, 2005). This is considered to be the first remote access computing, which was performed in 1940.

In 1941, the Z3 computer was built by Konrad Zuse, a German engineer. The Z3 was an early computer which depended on the relay technology that was available at that time. The Z3 used floating point binary arithmetic and had a 22-bit word length. The original Z3 was destroyed during World War II, and then it was reconstructed by its creator in the 60s. During that time, another computer was completed in 1942 at Iowa State Collage in Iowa by Professor John Vincent Atanasoff and graduate student Cliff Berry that was called the Atanasoff-Berry Computer (ABC).

In 1944, Professor Howard Aiken invented the Mark-1 which is a relay-based calculator that was a size of a room. The Mark-1 was funded by International Business Machines (IBM) that had a 50-foot camshaft that synchronized the machine's thousands of component parts (Kessler, 2005). In early 1946, a faster computer was born: the ENIAC computer. This computer was built by John Mauchly and Presper Eckert and improved computing by 1000 times on the speed of its predecessors. In 1946, with the emergence of computers, RCA developed a new type of data storage called selectrontubes that can hold up to 4096 bits of information, which was a tremendous advancement at that time.

In 1950, the earliest form of magnetic storage was built and sold to the U.S Navy. The magnetic storage was included in a computer called ERA 1101, the first commercially produced computer. The ERA 1101's storage held 1 million bits (1 MB) on its magnetic drum. The ERA 1101 was created by Engineering Research Associates of Minneapolis and revolutionized storage technology for years to come. Drums registered information as magnetic pulses in tracks around a metal cylinder. Read/write heads both recorded and recovered the data. Drums eventually stored as many as 4,000 words and retrieved any one of them in as little as five-thousandths of a second (Kessler, 2005).

In 1952, IBM has revolutionized storage technology by creating the first high speed magnetic tape for electronic digital computers called IBM 726. The IBM 726 can store 2 million digits per tape by using the vacuum technology method, which allows a circulating loop between two points to the drive can stop and start in less than a second. In 1956, data storage became larger due to the creation of IBM RAMAC 350 disks. The IBM 350 disk file consists of 50 magnetically coated metal platters with 5 million bytes of data. The platters, stacked one on top of the other, rotated with a common drive shaft (Denning & Metcalfe, 1997).

In 1960, the first commercial modem was created by AT&T in order to convert digital data to analog data for transmission across its long distance telephone network. This represented the first computer network in the world. In 1964, the first online transaction processing was made in IBM SABRE reservation system setup for American Airlines that linked 2000 airport terminals in 65 cities. In the 1960s, the idea of cloud computing was created by Joseph Carl Robnett Licklider, one the America's leading computer scientists. Licklider is one of the first scientists to plant the seed of the Internet in the 1960s and articulated the vision that became the Advance Research Project Agency Network (ARPANET).

At a time when computers filled entire rooms and were programmed by punch cards and paper tapes, Licklider envisioned seemingly far-fetched computer development that have become today's reality including desktop computers, graphical user interfaces, digital libraries, and intelligence agents (Lambert, 2005). Licklider's vision has become true and many of us today rely extremely on the computer machines. Licklider funded the creation of ARPANET in the late 1960s which offered universities the ability to access files from a remote device (Robert, 2012a). Also in the late 19060s, John McCarthy, a computer scientist who coined the term *artificial intelligence*, believed that at some point we will have a worldwide computer network. He is also the first to come up with the idea of the network being delivered as a public utility.

In 1970, a very important year in the networking world, the U.S Department of Defense established four networking nodes at four different universities on the ARPANET to serves as a computer to computer communication. In 1971, the first email was sent by Ray Tomlinson from Bolt. Tomlinson is famous for using the "@" sign in the email, whom sent the first email by using the military network ARPANET.

In 1971, Kenbak-1 was born, the first personnel computer that was introduced by John V. Blankenbaker. The Kenbak-1 was made from small and medium scale integrated circuits. The Kenbak relied on switches for input and lights for output from its 256-byte memory.

Around the same time an eight inch floppy were invented by David Nobel at IBM. The floppy disk spread quickly due to its mobility, that is, the ability to take data from one system to another. However, 3 years later KenbakCorporation closed their doors after selling only 40 PCs.

In 1974, the Alto was built by Xerox. The Alto was the first workstation with a built in mouse for input, it also had the capabilities to store files on Windows operating system. The Alto looked a lot like today's personnel computer; in fact it was the leading technology to new form factor of computing that led to our today's computers. In 1977, the Commodore PET, the first fully assembled personnel computer, was built and sold commercially. It came with either four or eight kilobytes of memory, two built in cassette drives, and an attached keyboard. After the introduction of Commodore PET, the Apple Corporation became the leader in computer innovation and created its Apple II computer. Apple II was different than any other computers and its predecessors because it had a printed circuit motherboard, switching power supply, keyboard, case assembly, manual, game paddles, A/C power cord, and cassette tape with a computer game called Breakout. Apple II had the best color graphic of its time that was connected to a color screen. After only few months Radio Shack introduced the first desktop computer, the TRS-80 and with sales of over 10,000 units.

In 1978, manufactures started introducing the 5.25"floppy disk, which was originally created by Shugart Association in 1976 for personnel computers purposes. In 1980, Seagate Technology created the first hard drive for microcomputers that we are familiar with today. In 1981, IBM introduced its first PC; it ran on 4.77 MHz using the first CPU, Intel 8088 microprocessor and used the first Microsoft operating system (Microsoft MS-DOS). In the same year, the first portable computer was invented by Adam Osborne, the Osborne I.

In 1983, Lisa was introduced by Apple, which was the first personnel computer with graphic user interface. The Lisa ran on Motorola 68000 microprocessor, one megabyte of RAM, dual 5.25"floppy disk drives, and five megabyte hard drive. Also, it's a very important year to remember, when APANET splits into the ARPANET and MILNET, which it became civilian instead of military use. In the same year, Compaq introduced the first PC clone that uses the exact same software as the IBM and compatible with IBM. Compaq recorded first-year sales from the Clone of $111 million, the most ever by an American business in a single year (Wright, Smith, Jesser, &Stupeck, 1999).

In 1985, the National Science Foundation (NSF) was formed and began with linking five super computer centers. Later the government assigned duties from ARPANET to NSFNET, which later allowed commercial use of the internet in 1991. ARPANET helped the expansion of the Internet by awarding a contract to AT&T and MCI to provide access points around the United States to a network with a bandwidth of 1.5 megabits per second. In 1987, IBM introduced the PS/2 machines, which made the 3.25"floppy disks drive and video graphics array standard for IBM computers. The PS/2 was the first IBM computer to include the 80386 Intel chip and a new IBM operating system the O/S 2, which allowed users to use the mouse for the first time.

In 1988, the first computer worm was produced by Robert Morris and seriously damaged the ARPANET. The worm was programmed to copy itself until the memory of the computer could not handle the data which caused the memory to disable. The In 19990, Tim Berners-Lee, an English computer scientist has created the first page on the World Wide Web, which brought Licklider's and McCarthy's idea to life. Berners-Lee drew the network diagram for the World Wide Web and surprisingly he drew a cloud to represent the Internet, and the Internet was been shown graphically as a cloud from that point onward.

In 1992, the network was upgraded to T-3 lines, which transfers information at 45 megabits per seconds. In 1993, the Mosaic web browser was released to the people that allowed them to use the Internet the way we use it today. Mosaic was developed at the National Center for Supercomputing Applications (NCSA) at the University of Illinois Urbana-Champaign beginning in late 1992. NCSA released the browser in 1993, and officially discontinued development and support on January 7, 1997 (Andreessen, 1993). In 1994, blogs and search engines were created which made the web easier to navigate and allowed users to create their own websites. In 1995, the ARPANET was renamed the Internet. During the 1990s, cloud computing was just in the air, untouched, and there wasnot a conceptual name for the technology. At the same time, zip disk were created to store data which were similar to floppy disks but with much greater storage capacity. In 1997, Ramnath Chellappa, an information system professor was the first to discuss and provided the term of cloud computing and published the first cloud computing research study (Chang, Abu-Amara, &Sanford, 2010).

In 1999, one of the first companies to offer a cloud computing service to deliver enterprise application via a website to companies is saleforce.com. Saleforce.com opened the doors for other software companies to provide the use of their software over the Internet.

In 2002, the next big cloud computing technological development was created by Amazon and was called Amazon Web Services. This development delivered a suite of cloud-based services including computation, storage, and even human intelligence through Amazon Mechanical Turk (Mohammed, 2009). In 2006, Amazon launched another cloud computing product called *The Amazon Elastic Compute Cloud* (Amazon EC2). Amazon EC2 is a web service that provides resizable compute capacity in the cloud and allows organizations and individuals to rent servers on which to run their own computer applications (Amazon, 2006).

Amazon EC2 charges consumers based on their computing consumptions. For example, when a consumer utilizes more computing resources the charges increase, and when consumer utilizes less size, the charge will be adjusted. In 2009, another big technological event occurred as WEB 2.0 was introduced. Google and Microsoft started to offer a browser-based enterprise and individual applications, such services as Google Apps. According to Dan Germain, a Chief Technology Officer at Cobweb Solutions, "The most important contribution to cloud computing has been the emergence of 'killer apps' from leading technology giants such as Microsoft and Google. When these companies deliver services in a way that is reliable and easy to consume, the knock-on effect to the industry as a whole is a wider general acceptance of online services"

At the beginning of the 21st century, the race for technological advancements was amplified. Many technological concepts are changing rapidly. The dependency on the Internet has become a life essential to many human beings. The Internet speed and capacity of storage has also increased. Within a few years, organizations and consumers started switching from hardware platforms to cloud services due to the ease of use and a reduction in cost. Since then, many startup companies had adopted cloud computing to provide different computing services to its consumers. One of the most famous cloud computing services offered to consumers today is cloud backup and storage.

4.2 Cloud Computing

According to Cearley (2010), "Cloud computing is a style of computing where scalable and elastic IT-related capabilities are provided as a service to external customers using Internet technologies." In other words, cloud computing is a process of renting computers, storage, network capacity, and other IT resources on an hourly basis and is based on the client's consumption. As such this flexible service can be always accessible to clients and their customers via the Internet.

The National Institute of Standard and Technology (NIST) has been assigned responsibility for federal cloud computing. The NIST is an organization that sets rules and guidelines to manage the cloud computing technology effort and also provides an authoritative definition for the technology (Ferreiro, 2010).The NIST defines cloud computing as "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."Cloud computing refers to computing being done over the Internet by using a third-party computing resources (Knorr &Gruman, 2009).

4.3 Cloud Computing Characteristics

The NIST also identified five characteristics for cloud computing. First is on-demand self-service in which a consumer can unilaterally draw computing capabilities such as server time and network storage as needed automatically without requiring human interaction with each service's provider (Truitt, 2009). Having this feature in place helps organizations and individuals access their accounts easily and quickly in order to get their computing needs met more efficiently. Second, broad network access in which the capabilities are presented over the network and accessed through ordinary means that support use by various thin or thick client platforms such as mobile phones, laptops, and PDAs (Mell&Grance, 2009).

Third is the resource pooling which includes the provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand (Smith, 2009). Providers' equipmentis shared among consumers depending on consumers' usage.

There is a sense of location independence in that the customer generally has no control or knowledge over the exact location of the provided resources but may be able to specify location at a higher level of abstraction (e.g., country, state, or datacenter). Examples of resources include storage, processing, memory, network bandwidth, and virtual machines (Mell & Grance, 2009).

Fourth is the rapid elasticity that is the ability to expand the service capacity that is being offered by the cloud service provider depending on the consumers' usage. In most cases, consumers feel that service being offered is endless and can be purchased in any quantity at any time depending on their needs. In the event of using less capacity, the service will adjust automatically so the consumer will pay only for their usage (Bauer and Adams, 2012). Fifth, resources are governed and measurement by the service provider and in some cases the user (Smith, 2009). The cloud service is automatically governed, controlled, and optimized by some type of metering technology that allows the provider and user to monitor the service that is being consumed such as (user account, bandwidth, processing, and storage) (Mell & Grance, 2009)

4.4Cloud Computing Models

Cloud computing has three different service models. The first is termed *cloud infrastructure as a service*. In this model, consumers will have access to a full capability of an IT infrastructure such as processing, storage, networks, and other essential computing resources that are provided by a third party. Consumers are authorized to install and uninstall applications and operating systems that fit the need of the organization. Consumers do not have a physical control of the underlying IT infrastructures, but have a control of all the resources that are provided from within the infrastructure such as storage, applications, operating system, and limited control of some network component such as firewalls and privacy settings (Mell & Grance, 2009).

The second service model is termed *cloud platform as a service*. This cloud model gives consumers the opportunity to develop their own software by utilizing programming languages, programming environment, and programming tools that are located on the cloud IT infrastructure and supported by the cloud provider. However, the consumers do not have access to manage and control the cloud infrastructure or any network components but only have control of the application being deployed and application hosting configuration (Mell & Grance, 2009). The third model is termed *software as a service*. With this specific model, consumers have access to use the software running on the cloud platforms that are utilizing the cloud infrastructures. Consumers access and utilize the software using a web browser. Consumers do not manage or have any control capability relative to the cloud platform or cloud infrastructure including network, storage, servers, or operating systems. Consumers might have limited control to the software provided at the user level but not beyond that point. The best example of this type of model that is widely accepted today is the cloud backup (Mell&Grance, 2009). Figure 1 shows a schematic of the separation of responsibilities within the cloud computing model

Separation of Responsibilities

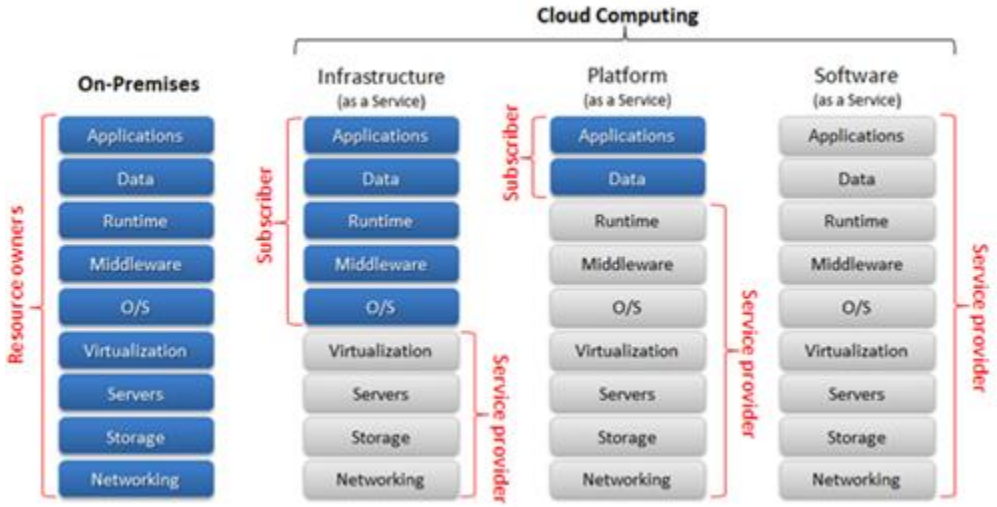

Figure 1. Cloud computing model and the separation of responsibilities. Adapted from "Cloud computing primer for IT pros," by Y. Chou, 2010, Retrieved from http://blogs.technet.com/b/yungchou/archive/2010/11/15/cloud-computing-primer-for-it-pros.aspx

4.5 Cloud Computing Deployment Model

Cloud computing is deployed in four different deployment models. The first deployment model is a *private cloud*. The computing is delivered privately for an organization. The cloud IT infrastructure might be controlled by the organization itself or by a third party. The IT infrastructure might be physically located onsite or off site (Mell & Grance, 2009). The second deployment model is termed a *community cloud*. In a community cloud, the computing is delivered to several organizations that share certain characteristics that dictate similar cloud computing needs. The cloud infrastructure is shared and might be located onsite or offsite, and might be controlled by different organization community or a third party (Mell & Grance, 2009).

The third deployment is called a *public cloud*. In this type of deployment, the computing services are delivered to the general public and the cloud is owned by a third party cloud computing provider (Mell & Grance, 2009). The fourth deployment model is called a *hybrid cloud*. The computing services are combines between any two or more cloud models such as (private, public, and community) that enable data portability(Mell & Grance, 2009). Figure 2 shows a schematic of the various cloud computing deployment models.

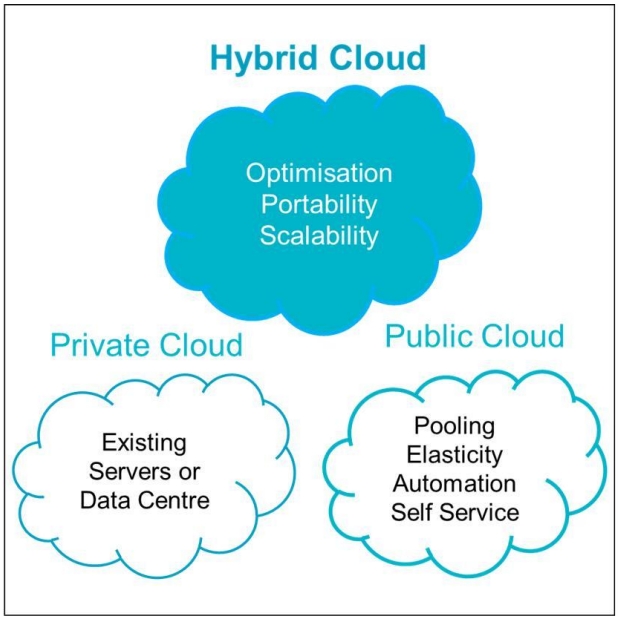

Figure 2.Cloud computing deployment model.

4.6Computing as a Utility

Nicholas Carr (2008) raised several important cloud computing issues in his book Thebig switch, in which he describes the move to a cloud computing framework as similar to the shift to using electrical power in the 1800s. In the mid-1800s, factories had to build their own generators in order to use the power of electricity and to remain competitive. At the beginning of the 20th century, the electrification era had begun, and electric current generated in distant power plants by big utilities was delivered to factories over a network of wires. With remarkable speed and low cost, the new utilities took over the supply of industrial and residential power. As a result, privately-owned generators became obsolete (Carr, 2008). By supplying electricity to many buyers from central generating stations, the utilities achieved an economy of scale in power production that no individual factory could match. It became a competitive necessity for manufacturers to hook their plants up to the new electric grid in order to tap into the cheaper source of power (Carr, 2008).

Electrical light altered the rhythms of life; furthermore, its assembly lines redefined industry and work; and electric appliances brought the industrial revolution into the home. Cheap and plentiful electricity shaped the world today. It is a world that did not exist a mere hundred years ago, and yet the transformation that has played out over just a few generations has been so great, so complete, that it has become almost impossible for us to imagine what life was like before electricity began to flow through the sockets in our walls (Carr, 2008). Carr (2008) suggested that computing is becoming more like a utility in such similar fashion. As a user you will plug in your computer or hand held device to the new computing utility grid and be immediately connected.

There will be no need for companies to purchase their own servers and no need for individuals to purchase hard drives or USB memory since they will be saving their data and operating through the clouds. Cloud computing is available to everyone, anywhere, and at any giving time with an amazingly affordable cost. Private computer systems will increasingly be built and operated by services provided over the Internet through centralized data processing plants. Computing is turning into a utility just as electricity did (Carr, 2008).

5. Research Design

A quantitative research design was used in this study. According to Creswell (2009), quantitative research designs are most appropriate when (a) the constructs of interested are readily quantifiable and (b) specific hypotheses are tested. Both of these characteristics applied to this study because the variables of interest, use of cloud backup, age, and gender, were readily measurable, and there were specific hypotheses related to the effects of any, gender on the use of cloud backup. In studies in which the constructs of interest are not readily quantifiable and when specific hypotheses are not to be tested, Creswell (2009) indicated that qualitative research methods may be more appropriate than quantitative methods, but this is not the case in this study. For these reasons a quantitative research method was selected for this study.

There are a variety of quantitative research designs including experiments, quasi-experimental studies, ex post facto studies, and descriptive studies (Creswell, 2009). Among the variety of quantitative research designs, the research design selected as most appropriate for this study was an ex post facto study. In true experiments, the researcher randomly assigns participants to groups, manipulates the independent variable, and observes the effects of the manipulation on the dependent variable (Creswell, 2009). Quasi-experimental studies are similar to experimental studies except that there is no random assignment to groups, but there is still manipulation of the independent variable and a desire to observe the effects of the manipulation on the dependent variable.

Ex post facto studies, on the other hand, do not involve any manipulation of the independent variable (Creswell, 2009). Specifically, the characteristics of ex post facto studies are (a) no manipulation of the independent variable(s), (b) no random assignment of individuals to groups, and (c) a desire to determine if the independent variables are related to the dependent variable (Creswell, 2009). All of these characteristics apply to the current study. There is no manipulation of the independent variables because they are all pre-existing conditions (i.e., age, gender, income, and education). There is no random assignment to groups because participants cannot be randomly assigned to age groups, gender groups, and so forth. But, there is still a desire to examine the effects of these independent variables on the dependent variable, making an ex post facto research design most appropriate for this study.

The dependent variable in this study was whether or not the participant uses a cloud backup process. Whether or not the participant uses a cloud backup process was a dichotomous variable. The independent variables were the demographic characteristics of age (number of years old), gender (male or female). The independent variable (gender)was categorical while the other (age) was continuous. Chi-square tests were used to determine if the categorical independent variables are related to whether or not the participant uses a cloud backup process (for the second research question). Independent samples *t* tests were performed for the two continuous variables to determine if participants who use a cloud backup process differed from those who do not in terms of age (for the first research question).

5.1Population and Sampling Procedures

The population of interest in this study consisted of computer users in the United States. The sample consisted of a subset of this population. In order to obtain the sample for this study, a third-party marketing research firm was responsible for recruitment. The marketing research firm assembled a list of potential participants for this study, the sampling pool, and provided this list to the researcher. The researcher then used the Survey Monkey service to contact and recruit the participants for this study. The final sample consisted of those individuals from the sampling pool who consented to participate.

A statistical power analysis was performed using the G*Power computer program in order to determine the sample size required for this study. In the power analyses, two-tailed tests, desired power of .80, an alpha level of .05, and medium effect sizes were specified. As noted, the two types of statistical tests to be performed in this study are chi-square tests and independent samples *t* tests. For the chi-square tests, both of which had 1 degree of freedom, a medium effect size of $w = .30$ was specified and G*Power indicated that 88 participants would be required to achieve power of .80.

For the independent samples *t* tests, a medium effect size of *d* = .50 was specified and G*Power indicated that 128 participants were required. Therefore, the minimum required sample size for this study was set at 128 to ensure power of .80 for all statistical tests.

5.2 Sample Demographic and Background Characteristics

Table 1 shows descriptive statistics for the participants'; demographic and background characteristics. The majority of the participants (55.9%) were male, and most (56.6%) were married. The most common ethnic groups were White/Caucasian (66.9%) followed by Arab/Middle Eastern (10.3), African American (8.1%), Asian-American (7.4%), and Hispanic (6.6%).

Table 1: Descriptive Statistics for Participants' Demographic and Background Characteristics (N = 136)

Variable	Frequency	Percentage
Gender		
Male	76	55.9
Female	60	44.1
Marital status		
Single	47	34.6
Married	77	56.6
Separated	1	.7
Widowed	1	.7
Divorced	6	4.4
Living with partner	4	2.9
Ethnicity		
African-American	11	8.1
White/Caucasian	91	66.9
Asian-American	10	7.4
Hispanic	9	6.6
Arab/Middle Eastern	14	10.3
Multiple races	1	.7
	M	*SD*
Age	35.43	10.39

5.3Use of Computer Backup Procedures

Descriptive statistics for the survey items related to the use of computer backup procedures are shown in Table 2. Most participants (61.8%) stated that they use cloud backup. When asked for the quickest method to save a file being worked on so that it could be accessed later, the most common response was a USB Drive/Flash Drive/Jump Drive/Memory Stick (49.3%) followed by the internal hard drive on the computer (30.9%), emailing the file to oneself (30.1%), or cloud backup (28.7%). The participants stated that the made an average of 22.28 backups per year (*SD* = 87.64) and had an average of 5.32 years of experience with computer backup (*SD* = 5.34).

Table 2: Descriptive Statistics for Use of Computer Backup Procedures (N = 136)

Variable	Frequency	Percentage
Use of cloud backup		
No	52	38.2
Yes	84	61.8
Quickest method to save a file being worked on so that it can be accessed later		
USB Drive/Flash Drive/Jump Drive/Memory Stick	67	49.3
CD/DVD/Blue Ray	9	6.6
External Hard Drive	22	16.2
Your Computer/Internal Hard Drive	42	30.9
Email the file to yourself	41	30.1
Smart Phone	18	13.2
Cloud Backup/Online Backup	39	28.7
	M	*SD*
Backups per year	22.28	87.64
Years of experience with computer backup	5.32	5.34

Table 3 shows descriptive statistics for types of data and size of files backed up locally or in the cloud. Three types of data were more frequently backed up in the cloud: music (with 41.9% in the cloud and 34.6% locally), photos (with 65.4% in the cloud and 57.4% locally), and videos (with 36.0% in the cloud and 22.8% locally). Four types of data were most frequently backed up locally including computer software (with 20.6% locally and 14.0% in the cloud), work-related and school-related files (with 45.6% locally and 42.6% in the cloud), financial data (with 39.7% locally and 36.0% in the cloud), and personal information data (with 46.3% locally and 41.9% in the cloud).

Table 3: Descriptive Statistics for Types of Data and Size of Files Backed Up Locally or in the Cloud (N = 136)

	Backed Up Locally		Backed Up in the Cloud	
Variable	Frequency	Percentage	Frequency	Percentage
Types of Data				
Music	47	34.6	57	41.9
Photos	78	57.4	89	65.4
Videos	31	22.8	49	36.0
Computer Software	28	20.6	19	14.0
Work Related/School Related	62	45.6	58	42.6
Financial Data	54	39.7	49	36.0
Personal Information Data	63	46.3	57	41.9
None	10	7.4	6	4.4
Size of Files				
Less than 10 MB	17	12.5	10	7.4
10 MB - 100 MB	25	18.4	17	12.5
100 MB – 500 MB	11	8.1	10	7.4
500 MB – 1 GB	11	8.1	10	7.4
1 GB – 50 GB	28	20.6	47	34.6
More than 50 GB	29	21.3	27	19.9
Missing	15	11.0	15	11.0

5.4 Perceptions of Cloud Security, Reliability, and Value

Table 4 shows the mean responses to the items related to perceptions of cloud security, reliability, and value. The statements for which agreement was strongest were "I feel that cloud backup is reliable" (M = 3.90, SD = .91), "I feel that cloud backup method is secure" (M = 3.84, SD = 1.07), "Cloud backup provided a good value for the cost" (M = 3.84, SD = .93), and "I would feel comfortable recommending cloud backup to anyone" (M = 3.83, SD = 1.10). Participants were neutral regarding the statement "I am/would be concerned with the security of the technology used by the cloud backup method" (M = 3.03, SD = 1.26) and agreed moderately (with means between 3.50 and 3.69 on a scale from 1 to 5) for the statements "I feel that cloud backup method is more secured than traditional backup method" (M = 3.50, SD = 1.20), "Cloud backup is more reliable than traditional backup" (M = 3.60, SD = 1.08), "Cloud backup method was not secure few years ago" (M = 3.63, SD = .93), and "I consider cloud backup as a cost effective method more than the traditional method" (M = 3.69, SD = 1.03).

6. Research Question 1

The first research question of this study was: To what extent, if any, is age related to cloud adoption rate? The null hypothesis for this research question was:

H_{1o}: Age is not related to cloud adoption rate.

Table 5 shows the mean age for those who had and had not adopted the cloud backup system. The average age of those who had not adopted the cloud was 33.38 (SD = 8.04) whereas the average age of those who had adopted the cloud was 36.72 (SD = 11.50). However, this difference was not statistically significant, $t(132) = -1.83$, $p = .070$. Therefore, the null hypothesis was not rejected and it was concluded that age was not related to cloud adoption rate.

Table 4: Descriptive Statistics for Perceptions of Cloud Backup in Terms of Security, Reliability, and Value (N = 136)

Statement	*M*	*SD*
1. I feel that cloud backup method is secure.	3.84	1.07
2. I am/would be concerned with the security of the technology used by the cloud backup method.	3.03	1.26
3. I feel that cloud backup method is more secured than traditional backup method.	3.50	1.20
4. Cloud backup method was not secure few years ago.	3.63	.93
5. I feel that cloud backup is reliable.	3.90	.91
6. Cloud backup is more reliable than traditional backup.	3.60	1.08
7. Cloud backup provide a good value for the cost.	3.84	.93
8. I consider cloud backup as a cost effective method more than the traditional method	3.69	1.03
9. I would feel comfortable recommending cloud backup to anyone	3.83	1.10

Note. Items were rated on a five-point Likert scale from 1 = *strongly disagree* to 5 = *strongly agree* so higher means indicate higher levels of agreement.

Table 5: Descriptive Statistics for Age as a Function of Adoption of Cloud Backup (N = 136)

Group	*M*	*SD*
Have not adopted cloud	33.38	8.04
Have adopted cloud	36.72	11.50

7.Research Question 2

The second research question was: To what extent, if any, do male and female consumers differ with respect to cloud adoption rate? The corresponding null hypothesis was:

H_{2o}: Male and female consumers do not differ with respect to cloud adoption rate.

Table 6 shows the cross tabulation of gender and adoption of cloud backup. A total of 67.1% of males had adopted cloud compared to 55.0% of females. However, the results from the chi-square test was not statistically significant, $\chi^2(1) = 2.08$, $p = .149$. This indicated that the null hypothesis was not rejected and it was concluded that male and female consumers did not differ with respect to cloud adoption rate.

Table 6: Cross tabulation of Gender and Adoption of Cloud Backup (N = 136)

	Had not adopted cloud		Had adopted cloud	
Group	Frequency	Percentage	Frequency	Percentage
Male	25	32.9	51	67.1
Female	27	45.0	33	55.0

8. Findings

Two research questions were answered in this study. The first research question of this study was: To what extent, if any, is age related to cloud adoption rate? The null hypothesis associated with this research question was not rejected and it was concluded that age was not related to cloud adoption rate. The second research question was: To what extent, if any, do male and female consumers differ with respect to cloud adoption rate? The null hypothesis was not rejected indicating that male and female consumers did not differ with respect to cloud adoption rate.

9. Conclusions and Recommendations

Three primary conclusions were drawn. First, it was concluded that although cloud computing in general and using cloud computing for backing up valuable files offers many advantages to consumers, they have not been completely integrated into consumers' daily computing activities. This conclusion was reached through an analysis of the perceived advantages and disadvantages of cloud computing (Bauer & Adams, 2012; Mell & Grance, 2009; Smith, 2009; Truitt, 2009). Second, it was concluded that there are a variety of different service models for cloud computing (Mell & Grance, 2009) including cloud infrastructure as a service (in which consumers have access to a full capability of an IT infrastructure such as processing, storage, networks, and other essential computing resources that are provided by a third party), cloud platform as a service (in which consumers have the opportunity to develop their own software by utilizing programming languages, programming environment, and programming tools that are located on the cloud IT infrastructure and supported by the cloud provider), and software as a service (in which consumers have access to use the software running on the cloud platforms that are utilizing the cloud infrastructures).

Third, some of the advantages described in this paper included cost effectiveness due to a lack of physical space requirements for users, reduction in utility costs such as electricity and temperature regulation, reduction in required equipment (such as external hard drives), off-site data availability (i.e., accessibility and mobility), a high level of automation, and scalability (Armbrust, 2009; Miller, 2009; Sedayao, 2008; Smith, 2009).

Despite these advantages, there are also perceived disadvantages that represent barriers to adoption including potentially poor system performance (e.g., slow bandwidth speeds), lack of data availability through network connectivity failures (due to a variety of causes), lack of protocol standardization, potential security problems, and legal questions regarding which governmental organizations would have legal access to the data (Binning, 2009; Miller, 2009; Sedayao, 2008). The balance between the advantages and disadvantages of cloud backup relative to traditional backup are weighed by consumers before making their decision (Clapperton, 2000), and therefore the perceptions of consumers relating to these facets of cloud backup warranted further study resulting in the current research. Innovation theory (Lundblad, 2003; Rogers, 1962) provided the theoretical framework for understanding how consumers would weigh the decision regarding switching to cloud backup.

In addition, none of the four demographic variables (age and gender) were related to the adoption of cloud backup procedures. Past researchers had not specifically examined these four independent variables and so no direct comparisons are possible. In the context of the theoretical frameworks for this study (i.e., innovation theory from Rogers [1962] and Lundblad [2013] and the technology acceptance model of Davis [1986]), the adoption of cloud for backup will depend on consumers perceptions of the innovation including the perceptions of the advantages of the new technology and the ease with which it can be adopted. These factors may depend on the demographic and background characteristics of the users but no evidence supporting these potential differences were found in the current study. Another key finding from the currents study was that most of the participants used cloud backup at least to some extent (62%). Given that cloud computing and backup has only been available since 1999 to consumers (Chang et al., 2010), the 62% figure represents substantial market penetration in just over a decade.
The supplemental results from this study also provided some linkage with past research. In the current study, the participants indicated that the most common use for cloud backup was for music, photos, and videos. These are file types for which consumers would require frequent access. This is consistent with past researchers who have concluded that one of the key advantages of cloud backup is data availability (Sedayao, 2008). With cloud backup, consumers are able to access their data from anywhere they desire on any type of display media they use (Smith, 2009) which is consistent with the use of cloud backup for music, photos, and videos.

Participants in the current study agreed that cloud backup provides good value for the cost, and this is also consistent with the conclusions from other researchers who have concluded that cloud backup technology is cost effective (Armbrust, 2009).

In the current study, the participants concluded that USB devices and memory sticks were the fastest methods of backup and this can be true because cloud backup performance depends on the bandwidth speed (Miller, 2009). In general, accessing a file on a local area network within the home or at work is faster than accessing the file over the wide area network (Miller, 2009). This potential advantage of local backup may disappear as Internet bandwidth speeds increase (Miller, 2009).

Participants in this study demonstrated a belief that cloud backup was secure. Although there are questions about the security of all types of backup, some past researchers have questioned the security of cloud backup due to storage in different countries and other concerns (Binning, 2009), but these do not appear to be shared by consumers who view cloud backup as secure (as seen in the current study.

10. Implications for Practice

The Internet has simplified the use of information technology around the world. The Internet has become a necessity in each household and has opened many doors to other technologies to come such as cloud backup. With the increase of Internet use, data has become tremendous such as pictures, videos, music, personal data, and work related data. It is very important for people to keep their data in one way or another. The most common practice to keep their data is through backing up to an external hard drive. However, the external hard drive still reside in the same house of the user, which might be at risk if anything happened to that person's house. Now, with the cloud backup technology consumers are worry-free. No matter what happened around the consumer the data is not only resided in their location but multiple locations in the clouds. Perhaps, their data might be somewhere in a different country.

The implication of this study is to help cloud backup provider to better understand consumers' needs and wants. Also, to provide consumers' with the best service provided. To study consumers' concerns in regard to cloud backup. Based on the result of this study, demographic factors such as; age, gender, income level, and education level doesn't influence consumers to adopt to cloud backup. As a result, cloud backup providers will have a better chance to mass market to all consumers in the United States without limiting their criteria to a certain demographic.

This statistical study indicates that approximately 62% of participants use cloud backup. This result is beneficial to cloud service providers, because it has a clear indication that there is an increase in the cloud backup adoption rate. The result looks very promising for cloud backup providers. Marketing campaigns should be altered around this fact in terms of there is still 40% of the market that does not currently use backup. Cloud backup providers should educate people on the importance of backing up in general. Also, another interesting fact that was indicated in this study, that 30% of users use cloud backup as the quickest method of saving a file that they are currently working on to be accessed later. Previous studies show that computer users used to use a USB drive as a quickest way to save their files. Now, cloud backup is taking part of that stake of being the quickest way to save a file for later use.

This study also indicates that photos are the most type of data that is being backed up to the clouds. As a result, cloud service providers can target new adopters by altering their message around the importance of photos to people. On the other hand, people can use this interesting fact to startup a new cloud based businesses for photo backup and sharing such as; animoto.com. Also, the study indicates that majority of participants agrees that the cloud backup is secured, reliable, and provides a good value for the cost. My recommendation for future studies to evaluate those factors; security, reliability, and cost and their influence on consumers' decision to adopt to cloud backup. I also recommend the evaluation of the cloud backup ease of use as another factor that might influence the adoption rate.

11. Recommendations

The primary conclusion from this study was that age and gender were not related to the likelihood of adoption of cloud backup. Based on this conclusion, there were two implications for professional practice presented above. First, based on the finding that age, gender, income, and education were unrelated to the adoption of cloud backup, it was recommended that cloud backup providers will have a better chance to mass market to all

consumers in the United States without limiting their criteria based on the demographic or background characteristics of their potential customers. Second, based on the finding that nearly 40% of the participants stated that they did not currently use cloud backup, it was recommended that cloud backup providers should educate people on the importance of backing up in general and on the advantages of cloud backup. For example, the speed of cloud backup (contrary to the conventional wisdom that (USB drives are the quickest way to save their files) and the use of cloud backup for more than just storing pictures (the most common type of file backed up via the cloud in the current study) could be entry points for increasing the percentage of consumers who adopt cloud backup.

In addition, four recommendations for future research were developed and were presented in the Implications for Future Research section of this chapter. First, it was recommended that future researchers should expand the list of potential independent variables to include variables such as one's familiarity with computers, choice of a college major (e.g., in a technology-related field or not), computer platform (PC versus Mac), or other similar variables. Second, it was recommended that future researchers perform qualitative or mixed-method studies in order to develop a more comprehensive picture of cloud backup adoption. Third, it was recommended that the results from this study (i.e., that age, gender, income, and education were not related to the adoption of cloud backup) should be verified in additional samples (such as those from outside the United States). Finally, it was recommended that the relationships between other compute usage variables (such as storing music files in the cloud rather than locally) and the adoption of cloud backup should be examined in order to develop a comprehensive picture of cloud backup adoption.

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