# Chapter 2

# LITERATURE REVIEW

## 2.0 Introduction

The basis for this chapter is to describe the literature background of Cloud Computing adoption in the global context and the Sri Lankan context. This chapter includes four areas of study. The first part describes the web service adoption which supports the business organizations to use technologies. Second part illustrates the significance of Cloud Computing in the global context. Next Part elaborates the consequences of cloud computing adoption in Sri Lankan context. And the final part explains the theoretical background of the research frame work.

## 2.1 Web Service Adoption

### 2.1.1 Web Service Adoption in Developed Countries

Interest in web services has expanded in recent years as evidenced by the increased volume of research. There are several reasons that might be attributed to the increased research activity. First, web services are seen, by many, as modern day EDI. Web service open standards combined with the proliferation of the Internet offer a low cost alternative to proprietary EDI and associated value-added networks. Second, one of the primary reasons for the interest and growth in ERP solutions such as SAP is due to the difficulty in integrating diverse information systems. With open standards such as XML web services, it is possible for these systems to communicate with each other at a low cost, greatly diminishing the need to invest in costly ERP solutions that would commit firms to a single vendor. Third, since VANs are not required to offer and consume web services, any small business that has a niche service to offer can do so without high infrastructure costs [6].

Organizational innovation adoption has received increasing attention in the marketing and management literature over the past two decades. This implicates that, organizations are experiencing high levels of regulating influences are more likely to adopt and use web service technologies. Web services are internet-based enterprise

applications that use open, extensible, markup language (XML) based standards and transport protocols to exchange data with clients [6].

Web services have placed their influences in global business, by providing various IT infrastructures, internet skills and e-business awareness. The benefits of web services are inter operatability between various software applications running on desperate platforms, accelerated application development, increase worker productivity, and improved employee and customer satisfaction [6].

### 2.1.2 Web Service Adoption in Developing Countries

Developing countries have the potential to achieve rapid and sustainable economic and social development by building an economy based on an ICT-enabled and network. With the development of ICT and the shift to a knowledge-based economy, e-transformation and the introduction of ICT is becoming an increasingly important tool for businesses in Sri Lanka. Web based technologies facilitate organizations to improve their business processes and communications, both within the organization and with external trading partners [7]. However, the adoption of ICT and e-commerce in developing countries has fallen below expectations, as they face unique and significant challenges in adopting ICT and e-commerce. Nevertheless, it is imperative for business to adopt e-commerce technologies to survive in intense competitive national and global markets [8]. Forging ahead businesses need to accept the challenges, including the barriers as they move towards successful adoption of available technologies while raising awareness of relevant support activities and preserving limited available resources to avoid severe repercussions from costly mistakes [5].

## 2.2 Cloud Computing Adoption in Global Context

### 2.2.1 Evolvement of Cloud Computing

Cloud computing has evolved through a number of phases which include grid and utility computing, application service provision (ASP), and Software as a Service (SaaS). But the overarching concept of delivering computing resources through a global network is rooted in the sixties [6]. Since the sixties, cloud computing has developed along a number of lines, with Web 2.0 being the most recent evolution [6]. However, since the internet only started to offer significant bandwidth in the nineties, cloud computing for the masses has been something of a late developer. One of the first milestones for cloud computing was the arrival of Salesforce.com in 1999, which pioneered the concept of delivering enterprise applications via a simple website. The services firm paved the way for both specialist and mainstream software firms to deliver applications over the internet [8].

"The computer industry is the only industry that is more fashion-driven than women's fashion" an author chastised the whole issue of cloud computing, saying that the term was overused and being applied to everything in the computer world. Cloud Computing is one of the major trend in Information Technology phenomenon. Cloud computing can be defined as a new style of computing in which dynamically scalable and often virtualized resources are provided as a services over the Internet. In the near future, Cloud Computing can be emerged in various directions [9].

### 2.2.2 Cloud Computing (Layered) Architecture

Cloud computing can be presented using a layered architecture. Basically this architecture illustrates the types of cloud computing services. There are three main types of cloud services: Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) [10].

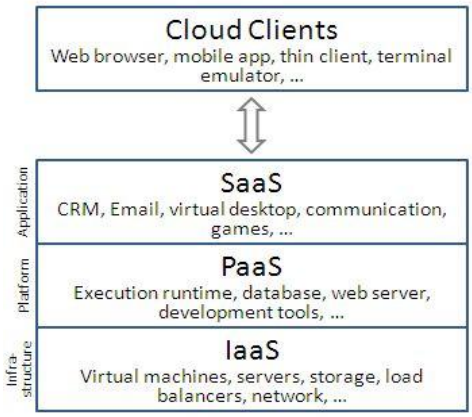


Figure 2.2.2.1: Architecture of Cloud Computing By Wikipedia

Software as a Service (SaaS) is the model in which an application is hosted as a service to customers who access it via the Internet. SaaS allows users to run applications remotely from the cloud. There is a huge benefit of SaaS is, costing less money than buying the application outright. The service provider can offer cheaper, more reliable applications than organizations can by themselves [10].

Next layer is Platform as a Service layer. As SaaS, Platform as a Service is also a application delivery model. PaaS supplies all the resources required to build applications and services completely from the Internet, without having to download or install software. PaaS includes operating systems and required services for a particular application. PaaS services include application design, development, testing, deployment, and hosting. Other services include team collaboration, web service integration, database integration, security, scalability, storage, state management, and versioning [10].

The third layer is Infrastructure-as-a-service (IaaS) refers to computing resources as a service. This includes virtualized computers with guaranteed processing power and reserved bandwidth for storage and Internet access. IaaS is the delivery of computer infrastructure as a service. A key benefit of IaaS is the usage based payment scheme. This allows customers to pay as they grow. Another important advantage is that by always using the latest technology [10].

There are two other services provided by cloud computing technology, data-Storage-as-a-Service (dSaaS), and Hardware-as-a-Service (HaaS). The data-Storage-as-a-Service (dSaaS) provides storage that the consumer is used including bandwidth requirements for the storage. Hardware as a Service (HaaS) is the next form of service available in cloud computing. HaaS doesn't provide applications to customers as SaaS and PaaS. It simply offers the hardware so that organizations can store any of their devices onto it [11].

### 2.2.3 Types of Cloud Computing

There are three types of cloud computing, private cloud, public cloud and hybrid cloud. In the public cloud (or external cloud) computing resources are dynamically provisioned over the Internet via Web applications or Web services from an off-site third-party provider. Public clouds are run by third parties, and applications from different customers are likely to be mixed together on the cloud's servers, storage systems, and networks. Private cloud (or internal cloud) refers to cloud computing on private networks. Private clouds are built for the exclusive use of one client, providing full control over data, security, and quality of service. Private clouds can be built and managed by a company's own IT organization or by a cloud provider. A hybrid cloud environment combines multiple public and private cloud models. Hybrid clouds introduce the complexity of determining how to distribute applications across both a public and private cloud [9].

### 2.2.4 Cloud Computing Definitions

There are number of definitions available for cloud computing proposed by authors. There are no any definitions specifically elaborated for cloud computing. These are the definitions that the research team could identify from previous researches. The first definition that the team could justify that can be useful to go through with further studies is "Cloud computing is an emerging approach to share infrastructure in which large pools of systems are linked together to provide IT service" [10].

Cloud computing describes a systems architecture. This particular architecture assumes nothing about the physical location, internal composition or ownership of its component parts.

Virtualized compute power and storage delivered via platform-agnostic infrastructures of abstracted hardware and software accessed over the Internet. These shared, on-demand IT resources, are created and disposed of efficiently, are dynamically scalable through a variety of programmatic interfaces and are billed variably based on measurable usage[11].

Cloud computing is basically a style or concept of computing in which massively scalable IT-related capabilities are provided "as a service". It uses the power and dynamics of internet technologies to service multiple external customers [12].

Among all this the research team has decided to pursue one particular definition. This definition is proposed by Wikipedia and it is proposed in a standard way.

Cloud computing is Internet ('Cloud') based development and use of computer technology ('Computing'). The cloud is a metaphor for the Internet (based on how it is depicted in computer network diagrams) and is an abstraction for the complex infrastructure it conceals. It is a style of computing where IT-related capabilities are provided ―as a service, allowing users to access technology-enabled services from the Internet ("in the cloud") without knowledge of, expertise with, or control over the technology infrastructure that supports them [9].

### 2.3 Cloud Computing Adoption in Sri Lankan Context

In today's globalized world, technology has increasingly become an important element for firms to compete and prosper. The technological readiness pillar measures the agility with which an economy adopts existing technologies to enhance the productivity of its industries, with specific emphasis on its capacity to fully leverage information and communication technologies (ICT) in daily activities and production processes for increased efficiency and competitiveness [13]. Although cloud computing is a popular technology in the western region, still the majority of the organizations in developing

region belongs to either " investigating" or " has not considered at all" category [14]. This statement is clearly evidenced through figure 2.2.1.

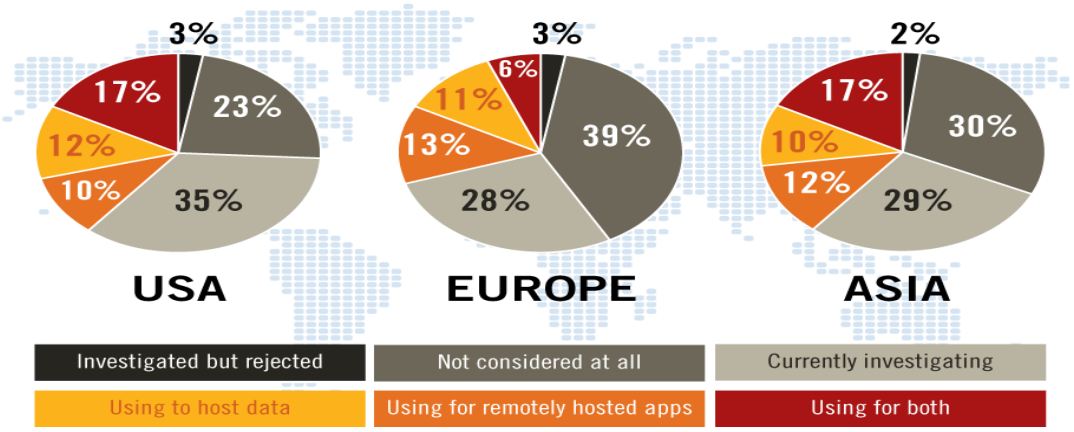


Figure 2.3.1: Organization's Position In Relation To Cloud Computing, By Region

There are some other factors related to the characteristics of the organization, which affects the adoption of ICT related technologies. The current level of technology usage within the organization affects the process of adoption and creates lack of awareness; uncertainty about the benefits of electronic commerce; concerns about lack of human resources and skills; set-up costs and pricing issues; and, concerns about security as the most significant barriers in developing countries [14].


Figure 2.3.2: The Single Biggest Inhibitor to the Adoption of Cloud

(For those considering implementation)

Due to lack of facilities to analyze the potential to the cloud adoption most organizations yet to be explored the adoptability of cloud computing. It is revealed that less attention has been paid to developing countries with different economic, political, and cultural circumstances. Identifying the differences is an initial step to understanding the process of technology adoption [14]. This provides clear evidence that there is gap between technology and the organizations adoption.

### 2.4 Technology-Organization-Environment Model

The authors propose to use Fleischer's Technology-Organization-Environment model to analyze factors in order to revel factors that are operating business environment. This model will incorporate the factor framework that has been proposed by the research team to be supported by the technological, organizational and environmental issues that can be raised gradually [15]. The Fleischer's Technology-Organization-Environment model includes three factors that affecting the adoption of web service can be summarizes as follows:

• **Technological Factor**, which represents the pool of technologies available for adoption by the organization. Since web service adoption requires a substantial degree of technical competence to ensure smooth and efficient adoption, the question can be viewed as the degree of match between the characteristics of the internet based technological innovation and the current technological setting of an organization [15].

• **Organizational Factor**, which is a source of structures, processes and attributes that constrain or facilitate the adoption of internet based technologies. Many dimensions can be part of the organizational context which can influence the Implementation process of web service adoption such as, the role of top management, financial readiness, degree of centralization, formalization, quality of human resources, and amount of slack resources available internally, and size of organization [15].

• **Environmental Factor,** which is the arena in which the organization conducts and influences its consumers. One of the primary reasons for web service adoption is that organizations could be driven towards it by the actions of competitors, as well as,

establishes a connection with other organizations for better collaboration and the expectations of citizens and business [15].

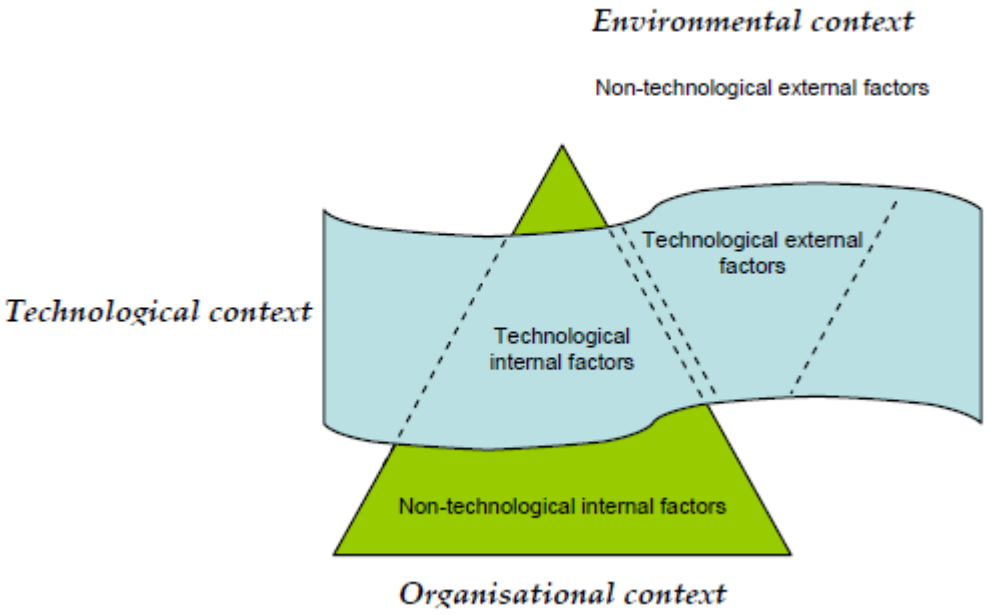


Figure 2.4.1: Technological, Organizational and Environment Framework [15]

## 2.5 Literature Related To Technological Aspects of Cloud Computing

Technological context, in general, refers to the application or object of new technology adoption. Various researchers have studied and confirmed the importance of a variety of first- and second- order constructs that affect the technological context. The researchers asserted the importance of the internal technology resources (infrastructure, technical skills, developer, and user time) for successful IT adoption. These theoretical assertions were supported by a number of empirical studies conceptualized and studied the technological context by identifying and operationalizing technology competence through three second-order constructs: IT infrastructure, Internet skills, and e-business awareness[13].

The technological context is refined into three first-order variables:

(1) Security concerns;

(2) Reliability; and,

(3) Deployability [13].

Organizations are dependent upon their information systems for everyday operations. Information system databases hold crucial data about customers, suppliers, processes, and business transactions. Compromising the security of these systems can be very costly to the organization in terms of unsatisfied customers resulting in a loss of goodwill, potential litigation, and a likely reduction in business [13]. Since web services are relatively new technologies, their use poses new security problems to organizations. Because of the importance to both the provider and consumer of the service, security has received considerable attention in recent literature strain the importance of security in building trust between the provider and consumer of web services. It is been noted that security as a major obstacle to the adoption of web service technologies.

Another concern that is closely associated with security is web service reliability [13]. In previous researches it is been suggested that the perceived reliability of a technological innovation has a profound effect on its adoption. Researchers also argue that resolving security and reliability issues are critical in the widespread adoption of web services. Security and reliability issues, with respect to web services, are yet to be resolved. Most of the studies argue that web services, today, miss the functional reliability because the current models do not consider 'real world' issues likely to influence organizational acceptance of these technologies.

Web services are fast becoming the de facto integration standard for applications [13]. However, web services are still experiencing technical issues related to security, availability, and performance. Most of the functionality surrounding security, reliable messaging and transactions of the web services are integrated. While some web services standards such as SOAP and UDDI have matured on several criteria others such as WS-

Transfer and WS-Business Activities are still evolving. Such lack of mature standards may be an issue in the deployability of web services. As much as the perceived deployability is higher of the service, the potential for adoption and use of web services increases [13].

Considering the technological benefits, technology is updating every minute. Therefore businesses are always attempt to change the technology as soon as possible. In recent past cloud computing is most popular technology in the world. The arrival after the cloud computing technology, the data access became easy and data can be retrieved data at anytime, from anywhere in the world. In the perspective of cloud computing software, the user can utilize and enjoy the latest releases of the most powerful and popular software products, without the anxiety of licensing issues and costly time-consuming upgrades.

### 2.6 Literature Related To Organizational Aspects of Cloud Computing

Organizational context refers to the affect of organizational characteristics on the decision to adopt new innovation. A variety of authors have examined organizational parameters as independent variables to technology adoption [13]. The authors recognized the importance of considering organizational characteristics in information systems adoption and acceptance specifically; the adoption literature proposed that firm scope and size are important organizational factors for technology adoption [13].This was also confirmed in the information systems literature. The researchers found that the greater the scope of the firm, the greater the demand for IT investment and established that firm size is strongly associated with investments in information technology.

Firm size has been consistently shown to be a good predictor of IT adoption in organizations. Large firms have more resources, greater economies of scale, and can take greater risks associated with innovation adoptions. Small firms, because of their resource constraints, do not readily adopt newer technologies [13]. However, small firms are more agile and flexible than large firms. When controlled for technological and financial resources, larger firms use technology to a less significant level. Also the small

firms cannot risk resources to adopt unknown or undeveloped innovations. Since web services standards are still evolving, this research proposes that large firms can easily take in the risks of cloud computing adoption to their organization.

Firm scope, another common organizational factor, is defined as the geographical extent of the organization's operations [13]. Past research has shown a positive relationship between firm scope and IT usage. In the context of web services, an organization that has operations in several geographic areas with several business partners will achieve more benefits through the use of a standardized technology than an organization with narrow scope.

In the present research model, two additional variables are recognized under the organizational context:

(1) Technological knowledge, which in general, represents the totality of institutional technological knowledge resident within an organization;

(2) Perceived benefits [13].

This institutional knowledge is comprised of the sum of technological expertise by all members of an organization and is reflected in the technological sophistication of their operations [13]. Technological knowledge has been identified and validated as a measurable factor in understanding and describing the organizational context. The greater the technological knowledge of an organization, the greater the potential for adoption and use of web services

Perceived benefits are the judgments of members within an organization, (generally users and managers of users), that the adoption of new technology and the retirement of a legacy system will have a notable benefit on individual- and organizational-level performance [13]. Perceived benefits have been confirmed as an important organizational context variable. In this study, perceived benefits represent managers' perceptions regarding the overall benefits of adopting web services.

**2.7 Literature Related To Environmental Aspects of Cloud Computing**

Every organization wants to use innovations because they cannot get more advantage of industry environment [13]. But organization has to face some environment factors as customers, suppliers other trading partners and government factors [13]. On other hand

when an organization adopts the technological innovation, the Organization needs to identify external factors which reflect the IT innovation beyond the organizational context.

Competitive pressure has long been recognized as an adoption motivator in the innovation adoption literature the researchers have analyzed the strategic rationale underlying competitive pressure as an IT adoption driver [13]. The researchers suggested that, by adopting information systems, firms might be able to alter rules of competition, affect the structure of the industry, and influence new ways to outperform their competitors, thereby changing the competitive environment. This analysis of the relationship between competitive pressure and technology adoption can be extended to web services like cloud computing.

Also the past researches suggested that if regulatory agencies require the adoption of specialized standards, that firms may experience higher transaction costs in order to meet the necessary objective. In addition, it is been noted that organizational non-compliance with environmental regulations may produce additional transaction costs and potential legal outcomes resulting from these activities. The government can encourage adoption, specifically e-business adoption, by developing business and tax laws that are beneficial to the organization [13]. Therefore, in the context of web services, the Organizations that experience high levels of regulatory influence are more likely to adopt and use web services technology.

Trading partner readiness was identified and recognized by several authors as a factor in technology adoption [14]. To explore the absence of trading partner readiness, this study proposes that an index of trading partner readiness, modified and labeled as dependent partner readiness can be developed and measured against the degree of intention to adopt and use web services [14]. Web services and organizational partnerships go well beyond the individual organization. The decision to use web services is influenced by the technology already adopted or rejected and by those related partnerships that permit the manufacture, distribution and use of products and services.

This study proposes two modifications to the configuration of the environmental context:

(1) The application is a web service which is an organizational-level consumer;

(2) An additional variable is added that reflects the degree and perception of predictability, reliability and usefulness of the vendor/provider of the web service [14].

### 2.7.1 Supplier Marketing Activity

Supplier marketing activity can significantly influence the probability that an innovation will be adopted by organizations. An important role is played by the launch strategy and launch tactics that is applied by the supplier. Different marketing variables can inspire or facilitate the innovation adoption.

Three main factors can be expected to significantly affect adoption probability,

1. The targeting of the innovation,
2. The communication on the innovation,
3. The activities the supplier undertakes to reduce the risk of adoption for the potential customer [14].

### 2.7.2 Targeting

Watchful and specific targeting of the innovation towards selected potential adopters can facilitate acceptance in the market. Potential adopters such as innovative organizations and individuals, heavy users of the product category, or heavy users of the preceding technology may be more receptive to the innovation than others. Also, targeting potential adopters that in any other way may benefit from adopting the innovation obviously can be beneficial. In addition, targeting efforts need to consider the opportunity organizations have to adopt an innovation

Consequently, marketing communications indirectly affect potential adopters' propensity to consider adoption of an innovation [14].

### 2.7.3 Risk Reduction

By reduction of risks associated with early adoption of an innovation, such as implementation risk, financial risk and operation risk, the adoption of on innovation can be motivated. The innovation may be given on trial to the customer for a certain period of time or the supplier may decide to absorb major risks of adoption by offering the potential adopter the innovation at a low introduction price. In some cases of high technology marketing this may even be necessary to gain market acceptance [14].

### 2.7.4 Environmental Influences

In addition to social influences, the business environment of a focal firm may determine its adoption behavior in different ways. First, the potential adopter firm may derive an intrinsic utility from the fact that business partners within their network have previously adopted the innovation (i.e. network externalities). Also, competitive pressures may incite adoption In the literature different relations between industry competitiveness or concentration and innovation adoption have been found. In the industrial organization literature, support can be found for a positive influence of both high industry concentration and low industry concentration on the adoption and diffusion of innovations [14].

## 2.8 Chapter Summary

The chapter provides evidence for the identification of the research gap to proceed further with the objective of the research study. The significance of cloud computing is presented in global and Sri Lankan context. Theoretical background which is required for the continuation of the research is justified. From the theoretical background, the factors are identified to design a conceptual model for the adoption of cloud computing