ADOPTION OF CLOUD HEALTH INFORMATION SYSTEMS AMONG HEALTHCARE PROFESSIONALS IN PAKISTAN

BY

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ABSTRACT

The term healthcare interoperability is predominantly interconnected with the successful capability of exchanging information, methods, and policies in the medical sector. It encompasses restructuring the process of storing the patient's data and other health-related information, which helps medical specialists in successful interpretation and evaluation of the patients' condition. Cloud computing, which is one of the state-of-the-art advancements in Information Technology, has provided a substitute mode in managing and accessing health data. This technology relies on different online software applications, which are used through the internet by a great number of people. Pakistan's medical industry is still in its early stages to adopt the technology of cloud computing. Nevertheless, healthcare data, for instance, X-Rays, medications, and patient history, of both government and nongovernment hospitals is proliferating significantly in size, diversity, and rate in this country. As a result, it has caused some significant problems to the medical industry from two distinctive viewpoints, including poor IT integrity and information intricacy. Hence, to maintain and manage records of healthcare, it is imperative for the medical sector in Pakistan to access the importance of cloud computing. Several factors that are influencing medical specialists of hospitals of Pakistan in adopting cloud health information systems be examined in the survey. A questionnaire was designed based on the conceptual model. The quantitative research design has been adapted. A survey questionnaire was distributed among the healthcare professionals of Pakistan hospitals was conducted to determine the key factors affecting healthcare professional's adoption of cloud computing services. The survey results led to identify certain factors related to the service quality and system quality in terms of cost effectiveness, Internetwork Facilitating Conditions, Performance Expectancy, compatibility, Complexity, Data security, Data Privacy, Hardware Modularity, Software Modularity. The effect of these factors on healthcare professionals' behavioural control and confirmation to adopt cloud computing services was investigated. A seven-point Likert scale was used throughout the questionnaire. Total number of 450 questionnaires were distributed to healthcare professionals and 390 were responded, the response rate is 86.66%. From these returned questionnaires only 355 were usable, so response rate is 91%. The collected data has been analysed using SPSS and PLS-SEM. The results showed that the Cost effectiveness, Perceived Usefulness, Performance expectancy, compatibility, Usability on healthcare professionals' confirmation and behavioural control were statistically significant and had a positive effect on adoption of the cloud computing in the Pakistan hospitals.

خلاصة البحث

يرتبط مصطلح التشغيل البيني للرعاية الصحية في الغالب بالقدرة الناجحة على تبادل المعلومات والأساليب والسياسات في القطاع الطبي. ويشمل إعادة هيكلة عملية تخزين بيانات المريض والمعلومات الأخرى المتعلقة بالصحة ، مما يساعد الأخصائيين الطبيين في التفسير الناجح وتقييم حالة المرضى. قدمت الحوسبة السحابية ، وهي واحدة من أحدث التطورات في مجال تكنولوجيا المعلومات ، طريقة بديلة في إدارة البيانات الصحية والوصول إليها. تعتمد هذه التقنية على تطبيقات برمجية مختلفة عبر الإنترنت ، والتي يستخدمها عدد كبير من الأشخاص عبر الإنترنت. لا تزال الصناعة الطبية الباكستانية في مراحلها الأولى لاعتماد تقنية الحوسبة السحابية. ومع ذلك ، فإن بيانات الرعاية الصحية ، على سبيل المثال ، الأشعة السينية والأدوية وتاريخ المرضى لكل من المستشفيات الحكومية وغير الحكومية تنتشر بشكل كبير في الحجم والتنوع والمعدل في هذا البلد. ونتيجة لذلك ، فقد تسبب في بعض المشاكل الكبيرة للصناعة الطبية من وجهتي نظر مميزتين ، بما في ذلك ضعف تكامل تكنولوجيا المعلومات وتعقيد المعلومات. وبالتالي ، للحفاظ على سجلات الرعاية الصحية وإدارتها، من الضروري للقطاع الطبي في باكستان الوصول إلى أهمية الحوسبة السحابية. يتم فحص العديد من العوامل التي تؤثر على الأخصائيين الطبيين في مستشفيات باكستان في اعتماد أنظمة المعلومات الصحية السحابية في المسح. تم تصميم استبيان على أساس النموذج المفاهيمي. تم تكييف تصميم البحث الكمي. تم إجراء استبيان مسح على المتخصصين في الرعاية الصحية في مستشفيات باكستان لتحديد العوامل الرئيسية التي تؤثر على اعتماد أخصائي الرعاية الصحية لخدمات الحوسبة السحابية. أدت نتائج الاستطلاع إلى تحديد بعض العوامل المتعلقة بجودة الخدمة وجودة النظام من حيث الفعالية من حيث التكلفة ، وشروط تسهيل العمل عبر الإنترنت ، وتوقع الأداء ، والتوافق ، والتعقيد ، وأمن البيانات ، وخصوصية البيانات ، ونمطية الأجهزة ، ونمطية البرامج. تم التحقيق في تأثير هذه العوامل على التحكم السلوكي لأخصائيي الرعاية الصحية وتأكيد اعتماد خدمات الحوسبة السحابية. تم استخدام مقياس ليكرت المكون من سبع نقاط خلال الاستبيان. تم توزيع 450 استبانة على المتخصصين في الرعاية الصحية وتم الرد على 390 ، وبلغ معدل الاستجابة 86.66٪. من هذه الاستبيانات التي تم إرجاعها ، كان 355 فقط قابلاً للاستخدام ، لذا فإن معدل الاستجابة هو 91٪. تم تحليل البيانات التي تم جمعها باستخدام SPSS و PLS-SEM. أظهرت النتائج أن فعالية التكلفة ، والفائدة المتصورة ، وتوقع الأداء ، والتوافق ، وقابلية الاستخدام على تأكيد أخصائيي الرعاية الصحية والتحكم السلوكي كانت ذات دلالة إحصائية وكان لها تأثير إيجابي على اعتماد الحوسبة السحابية في مستشفيات باكستان.

APPROVAL PAGE

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DECLARATION

I hereby declare that this thesis is the result of my own investigations, except where otherwise stated. I also declare that it has not been previously or concurrently submitted for any other degrees at IIUM or other institutions.

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To my dear father, Professor Anwar Uddin Ujan

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HIS	Health Information System
IT	Information Technology

CHAPTER ONE

INTRODUCTION

1.1 OVERVIEW

There has been an exponential and rapid growth in IT since the beginning of 21st century, which has a considerable effect on information systems and areas related to it. It must be put into consideration that health information management is not anyway exception. IT has played a significant role in healthcare systems. Resultantly, it promoted quality of healthcare, and access to healthcare services. It resulted in an evident reduction in medical costs and errors. Yet, it is required to pay considerate attention to IT acceptance while making an implementation of any Health Information Systems (HIS). According to the Medical Records Institute (2003), Internet-based health applications such as electronic health records, electronic prescribing, and mobile health, are the ultimate goals of most healthcare organizations. The discussion on the use of the Internet, for enhancing the efficiency of healthcare industry and reducing errors in care delivery processes, has been tackled in many studies. Despite these efforts, implementation of health information systems is lagging in health care organizations (Abdelhadi; Ahmadi, Dehnad; Hosseini, 2014).

Healthcare systems are generally adopted in the healthcare sectors to give adequate support for research activities, teaching, and public services. The effective computing application in health sectors can make it possible for healthcare professionals to monitor patient's health record (Hatch & Cunliffe 2013). It is used in homes, hospitals, and relevant organizations in many developed countries. Additionally, the goal of health services is to accommodate public requirements such as certain

recommendations for food, drugs, and safety policies to sustain healthful environment for different geographical regions.

Previous studies have advised about the protentional of emerging technologies in improving healthcare service practices by giving more opportunities to perform activities essential for presentation, detection, tracking, and treatment of diseases (Rogers 2010). Thus, Information Technology (IT) acts as the primary antecedent to provide adequate medical services for the health sector. Recent consideration of IT solutions like electronic health systems introduced considerable benefits to help healthcare organizations specially in solving typical errors along with offering an agile technique to access and process many patient's facts as well as protecting their own health records and also providing sufficient storage spaces (Jena et al. 2009)

"The health information system (HIS) provides the underpinnings for decision-making and has four key functions: data generation, compilation, analysis, synthesis, communication and use. The health information system collects data from the health sector and other relevant sectors, analyses the data and ensures their overall quality, relevance and timeliness, and converts data into information for health-related decision-making (World Health Organization, January 2008)".

Computer and information technology interventions resulted in new development of HIS adoption. Advanced technologies cause forceful social, cultural, and cognitive changes that turn out to be exasperated health care practitioners. According to Black et.al (2011), there is a direct relationship between HIS adoption and improved health care quality system with growth in the quality and quantity of collecting data along with decrease in the medication and clinical errors. (Black etal,2011). The HIS adoption in clinical settings is not fast up to the level of expectation. There are many barriers to this slow adoption such as unproven return on investment

between the payers and beneficiary, change in clinical workflow, patient privacy and confidentiality issues, lack of standards. The lack of knowledge and skill competencies are very important as these barriers are less studied and quantified in the past (Hersh W, 2008).

Numerous ramifications have been resulted in the healthcare distribution due to the accelerated revolutions concerning cloud services. The most contemporary electronic health systems are still confronting difficulties related to online connectivity, cost, customer support, and tragedy recovery (Laupacis et al. 1992). The medical industry can indeed acquire phenomenal benefits by the implementation of cloud computing in this context.

Cloud computing services, which could be regarded as a service solution and rely on cloud processing, encompass the management and process of health-related data in a distributed health environment (Philipson & Jena 2013). These days, cloud services provide a flexible solution in enhancing efficiency along with the competitive power of an institute. The contemporary technology provides innovative approaches for delivery yet processing services and applying is an essential requirement. Emerging countries do not fully understand the low application of cloud services (Sant 'Anna et al. 2007). This could be owing to the dynamic configuration of cloud computing that offers computing services and consists of numerous operating capabilities, which are mainly utilized for the data management of an organization in a prevalent, widespread and universal method. The cloud computing supports software, systems, and platforms at autonomous places. Moreover, it comprises of services that are shared and are accessible anywhere through the Internet (Schultz & Wanda 2004).

After studying the literature about cloud computing, it was declared that plenty of studies mainly emphasized on functions of SaaS (Software as a Service), which are

provided to both government and nongovernment medical sectors. However, there is another terminology called PaaS, which is Platform as a Service, and it is mainly the technical side that helps in running those services. The third area of cloud computing is IaaS (Infrastructure as a Service) and it is related to the visual effects of platform infrastructure.

This work deals with cloud computing services that are offered to the health industry of Pakistan. Software as a Service is acknowledged in the environment where service deployment models are considered as its base. Requirements are served by each of these models, and they are provided by public, private, community, and hybrid clouds.

World population now exceeds six billion; most of whom reside in the developing world (U.S. Department of Health and Human Services, 2004). Developing countries with constantly booming populations require the enhancement of their health care delivery systems. One potential way to do this is through Information and Communication Technology (ICT), which could dramatically advance the quality of the health care systems, as well as the efficiency of health care workers in the developed and the developing countries (U.S. Department of Health and Human Services, 2004).

The Pakistan Government is Minister of Health Affairs and Services allocated the total of Rs 9,863 million in the budget of 2013-14, which is higher by 25.7% and 24.9% respectively when compared with budget and revised estimates of 2012-13. The allocation for hospital services forms the major component under this classification. According to the report released by Dr Haroon Khan, President, eHAP, Pakistan," health care has suffered from a history of neglects & considered as severely underperforming. Yet healthcare is crucial to build a prosperous & stable economy & society.

1.2 CLOUD COMPUTING

Cloud computing is basically the software and equipment, and it is known as the drill of using the network of remote servers on the internet. Its basic purpose is to store, manage and precede the data by keeping it safe from third parties (Public work). This is basically a general technology which is used to describe data centres over the internet available to many users (IUP). In the year 2000, this technology became ordinarily reachable to all Mandi).

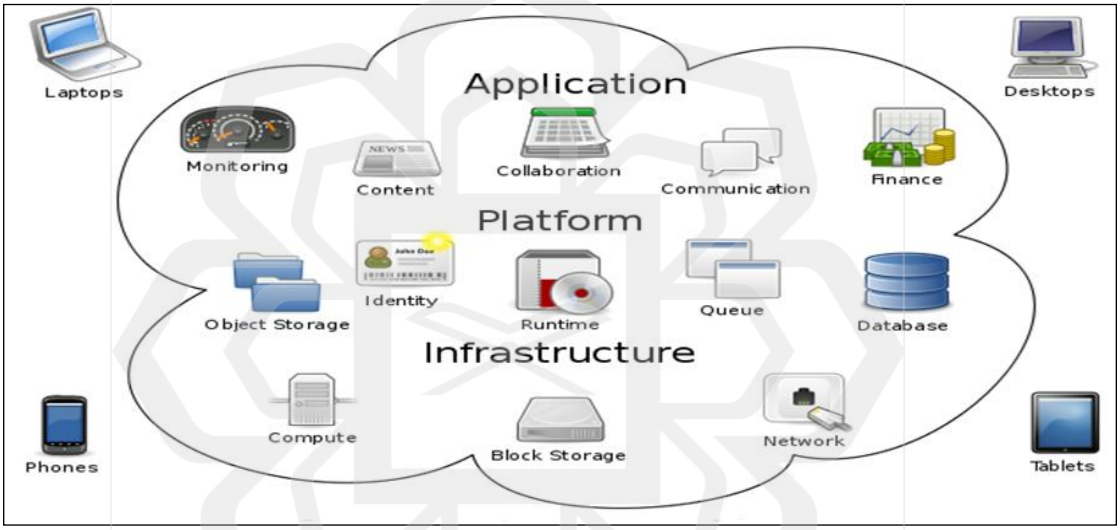

Figure 1.1 Service models of cloud computing

1.2.1 Features of Cloud Computing

Broad network access:

One of the main features of cloud computing is broad network access which means that people can access computer resources through a wide range of devices like through smartphones, tablets, PC's etc.