

# **The Existence of Healthcare Software and Factor Associated with Healthcare Software Adoption in Public and Private Hospitals: the Case of Addis Ababa**

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## **Abstract**

In the last decade, the field of health informatics has grown worldwide. Information communication technology has been integrated into health systems and services since 2000 G.C. Information technology is an essential tool to improve healthcare costs, safety, and the quality and equity of care. The health system faces different challenges, lack of supportive legislation, lack of budget, lack of relational collaboration and well-trained personnel is one of the factors. This study is assessed software adoption and factors affecting software adoption in public and private hospitals in Addis Ababa. The study conducted in Addis Ababa Hospitals. Both quantitative and qualitative research were done. Twenty percent of Addis Ababa's hospitals were sampled for the study using multistage and probability sampling techniques. The final sample of the study is 8 hospitals 5 public and 3 private hospitals. The quantitative data were analyzed using frequency, percentage and mean and range and the qualitative data were analyzed thematic analyses technique using open-coding. From the study, 8 hospitals 5 general and 3 specialized hospitals are identified. Only one private hospital uses an online patient appointment scheduling system, while all public hospitals use health information management systems and almost all public and private hospitals employ medical recording systems and all. Four contexts are identified as the factor of affecting health care software upgrade or implementation; Organizational context: that include expensiveness, complexity of system, and organizational culture and knowledge; Technical context: includes lack of cloud and weak internet, system complexity, incompatibility and lack of integration, and security and privacy issue; Environmental context: poor government support and internal developer, and Human context: Poor organization IT knowledge and capability.

**Keywords:** Software, Adoption, Adoption Factors, Hospital, Healthcare.

## 1. Introduction

In the last decade, the field of health informatics (HI) has grown worldwide. Information communication technology (ICT) has integrated into health systems and services since 2000 G.C [1]. The Institute of Medicine in the United States has declared that information technology (IT) is an essential tool to improve healthcare costs, patient safety and the quality and equity of care [ 2, 3].

Health systems globally are facing increasing demands for highly sophisticated services, yet they have limited resources and current and projected shortages of health professionals. In Australia, for example, health is already one of the most expensive sectors of the economy, at 9.3% of GDP. Global expenditure on ICT across all sectors exceeds \$US3.5 trillion. It driven by the desire for improvements in productivity, work practices and service outcomes. Studies have shown that the use of ICT in the health sector is capable of increasing efficiency, reducing errors, supporting more team-based care [4, 5 ,6, 7].

According to [8, 9] Africa has the greatest healthcare challenges in the world: life expectancy is 60 years, substantially lower than the global average of 72 years; maternal mortality ratio is 547 per 100,000, but 13 in high-income countries and 216 globally; under five mortality is 76 per 1000, but 5 in high-income countries and 39 globally. Africa lags in the capacity for health technology innovations, while it bears 23% of the global disease burden and 16% of the world population, with the continent expected to double its population by 2050, from 1 billion to nearly 2.4 billion. Without urgent technological, industrial, intellectual, and research-oriented health interventions, Africa cannot tackle the needs and demands of its population. If health technology innovations needed to transform health system gaps in Africa, it is important to generate country-specific evidence to identify challenges and opportunities in the region as potential resources for further interventions. In Ethiopia, ICT development has become one of the priorities and key drivers of the government for socio- economic growth and transformation in the last decade (Report from Ethiopian Ministry of science). Transform health system gaps in Africa, it is important to generate country- specific evidence to identify challenges and opportunities in the region as potential resources for further interventions [8, 9].

The adoption of the EHR, electronic patient records or digital medical records has a significant role in patient care and cost saving. Studies estimate the adoption of the EHR could save more than \$813 billion annually, prevent 200,000 adverse drug events and enhance doctor patient relationships through increased communication. This benefit may not see immediately during technology adoption. Rather, it takes a fortune during adoption, the benefit only seen at long run [10, 11].

The primary goal of the study is to determine how public and private hospitals in Addis

Ababa Ethiopia's utilize healthcare IT software across a variety of settings. The study's objectives include identifying the different categories of information technology software the health sector used, factors affecting the adoption of healthcare software, the use of AI software, mobile health systems in healthcare and propose a framework that enhance software adoption in health care.

To assess the objective of the study, the study uses quantitative research to understand a type of software for healthcare the hospital use and a quantitative thematic analysis method is used to identify factor affecting software adoption. Categorical data summarized using frequency and percentage, and mean and the standard deviation is used to summarize continuous variables. For semi- structured qualitative data, the organizational level is important therefore the CEO, the medical director, and senior IT staff response is used for the analysis to get a top-down understanding of health care software adoption. The data from the interviews were analyzed by using the methodology thematic analysis of open coding technique is used for systematically identify, organize and analyze qualitative data sets to receive patterns and themes (Braun & Clarke, 2012). Thematic analysis is chosen due to the flexibility and accessibility the methodology provides according to the authors to systematically analyze the data and receive wider conceptual themes and issues. The thematic analysis is conducted by with five phases: phase 1 familiarizing ourselves with the data, phase 2 generating initial codes, phase 3 searching for themes, phase 4 reviewing potential themes, and finally phase 5 defining and naming the themes.

## **2. Literature Review and Related Work**

The medical record is a multifunctional document that used to communicate and document critical information about patients' medical care among health care professionals. Even if the medical records system is very important for effective and efficient management of medical information in the health sector, much more important in developing countries, it has never given priority and has usually been undermined, miss-handled, and even implemented in the private health sector in Ethiopia. It is very important that the healthcare facilities of Ethiopia accomplish only 45.7% of the medical information [12].

Japan's health sector use of software reviles that since in 1990s Japan's hospital begin a project of exchanging patient data (laboratory result, imaging and patient history) across different hospital initially using diskette. Japan widely use Electronic medical record (EMR) around 80% of health care are use it and other health information system (HIS) medical billing computer, picture archiving and communication system(PACS), medical appointment register system, cloud-based electronic medical records, online patient care system (Telehealth), communication app for medical staff, cloud-base PACS, Electronic patient interviewing system, home-visit medical care support system, cloud-base remote

image diagnostic and other AI software [13, 14].

Three dimensions are identified by the recently established framework (TOE) as having an impact on the adoption of innovation. These dimensions are; organizational dimensions: such as organizational scale, organizational structure, and communication process, technology dimensions: include accessibility and technological qualities, as well as an external task environment: that takes into account a country's culture, environmental factors, and legal requirements (*see Figure 2.1*). Similar to how TOE has three main aspects, another well-known framework (Hot-fit) outlines three dimensions that drive the acceptance of innovation. Organizational and technological dimensions are similar to TOE, but there is a single human dimension that is specific to user involvement (*see Figure 2.2*).

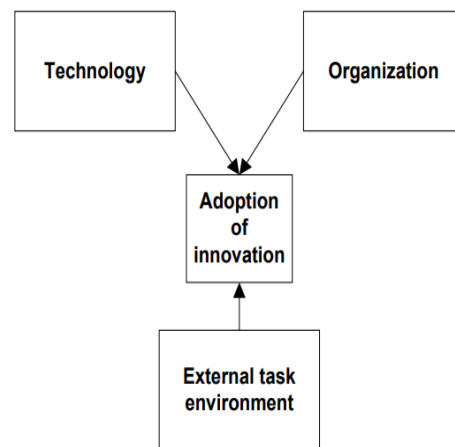


Figure 2.1. TOE framework (Tornatzky and Fleischer, 1990) factor that influence in ICT adoption [15].

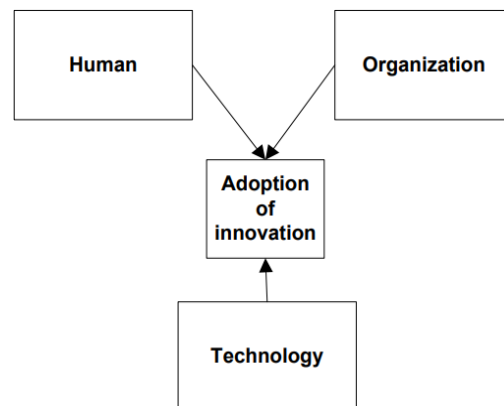
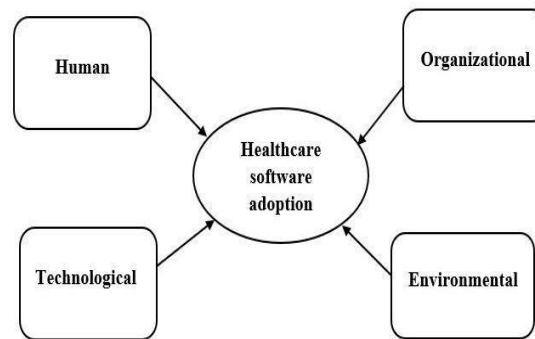


Figure 1.2: Hot-fit framework factor that influence in ICT adoption [16].

The well-known framework the TOE and HOT-fit are not covering all factors that influence adoption of innovation. Considering the two framework and combining together the following framework is constructed therefore the healthcare software adoption can be

influenced by Human context, organizational context, technological context, and environmental context (see Figure 2.3) and this need to be proofed.



*Figure 2.3 Factor that influence healthcare software adoption framework adopted from TOE and HOT-fit framework.*

A systematic literature review study in PubMed, EBSCO host, and Google Scholar on factors associated with adoption of health information technology (HIT) system of three modes of HIT: Electronic health record (EHR), Electronic medical record (EMR), and computerized provider order entry (CPOE) system. This study identifies internal organizational and external organizational factors associated with the adoption of HIT [17].

According to studies in Sweden, Germany, and United States surgical centers on adoption and implementation of hospital IT systems (HIT) in ambulatory surgical care, six barriers in the adoption and implementation phase were identified under three categories: Organization barriers (expressive and complex implementation); Human barriers (two factors: internal resistance to change and lack of internal IT knowledge and capability); and Technical barriers (lack of system integration, complexity of HIT system, and privacy and security issues). The eight enablers in the adoption and implementation of HIT system in ambulatory surgical care fall under four categories: Organizational enabler (context includes computation and management support, change management and incentive, and business case); Human enabler (which includes internal IT education and training); Technical enablers (use of tailored and customizable system, and user-friendly system); and Environmental enablers (which includes external implementation support, government policy and regulation [55]).

### 3. Qualitative & Thematic Analysis

This study tries to understand the existence of software adoption in 5 private and 3 public hospitals in Addis Ababa. 5 of them are general hospitals; the rest 3 are specialized hospitals. This hospital has a maximum of more than 120 years and a minimum 12 years

history of establishment (1902-2011GC). In Ethiopian year 2014 or September 11/2022 up to September 12/2023 These three public hospitals give service to 2,880,000 up to 6,200,000 or average 4,826,667 patient and the five-private hospital to 49,900 up to 234,000 or average for 152,380 patients.

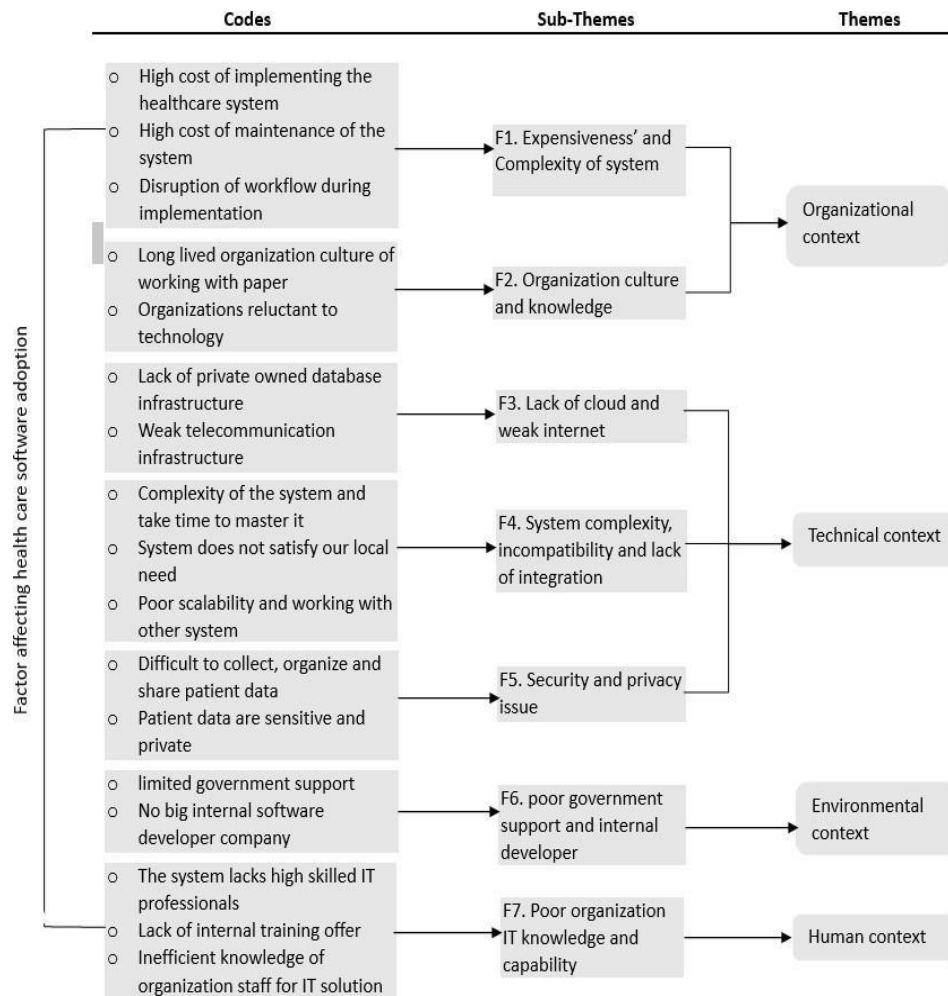


Figure 3.1: Thematic map of identifying factor affecting healthcare software adoption in public and private hospital Addis Ababa.

This study found that public and private hospitals use software differently; the public hospital invests in the Health Management Information system (HMIS), whereas the private hospital does not. On the other hand, a few private hospitals use an online system for booking patient appointments. In both public and commercial hospitals, automation is required for services including referral linkage systems, diagnostic and treatment plan systems, online patient registration systems, and home care systems that are now performed manually. The study pointed out that there are no health-related mobile apps or powerful AI software's that assist healthcare services. Based on the qualitative study and thematic

analysis the following context that affect software adoption are identified (*see Figure 3.1*).

**Organizational context:** high cost of implementing healthcare system and long lived organization culture of working with paper, **Technical context:** lack of database infrastructure and weak telecommunication infrastructure, complexity of the system and lack time to master it, System does not satisfy our local need and nature if the health care data to collect and store, **Environmental context:** limited government support on technology area and no big internal software developer company, and **Human context:** the system required skilled and technical staff. The cost of implementation the health care system in terms of time and resource is the major challenge of the hospital.

#### 4. The Proposed Framework

Based on the qualitative analysis thematic map, four contexts are identified as factors that influence software adoption. These four contexts are derived from several sub-themes that make-up the four contexts were from the responses of different respondents and are factors affecting the implementation and upgrading of healthcare software. This study suggests (*see figure 4.2*) a framework practice to follow to increase the adoption of healthcare software by offering a prescriptive technique of telling what to do to attend to a bigger outcome and increase the adoption of healthcare software based on the thematic findings. Organizational setting; establish financial assistance to offset the costs of technology and maintenance, provide training on the benefits of software over paper-based systems, introduce software, and maintain continuous support; Technical context: promote local investment, upgrade telecommunications facilities, address system integration, and security issues, and develop localized and user-friendly systems, Environmental context: get government supports and establishes local software developer company, and Human context: enhancing IT expertise through training and graduating qualified IT professionals would help healthcare software usage.

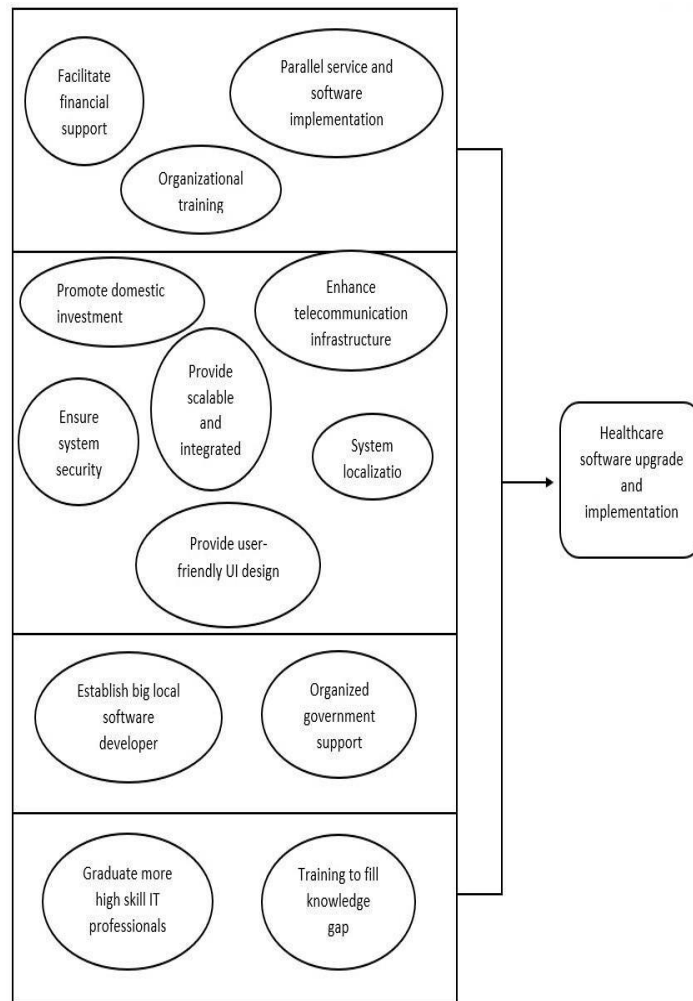


Figure 4.2: The Proposed Farmwork; Practices to Increase Software Adoption

## 5. Discussion

Study in Sweden, Germen, and United State identified three context that that influence hospital IT adoption; Human context, organizational context, and technological context; in human context two factor are identified internal resistance to change and lack of internal IT knowledge; organizational context system implementation complexity and expensiveness of technology is the factor; in technological context include lack of system integration , complexity of health information system and privacy and security issue but in my study finding some of the factor are similar with the above study but there is one extra context that influence in software adoption which is environmental context which is limited government support and lack of big local software development firm. Addis Ababa public and private hospital widely use electronic medical record system, laboratory management, pharmacy, and health information management system but only one hospital have medical appointment registration system and no sign of AI supported software and mobile-based software which interacts with patient.

## 6. Conclusion

The backbone of most public and private hospitals' software implementations is an electronic medical recording system. Four contexts are identified as the factor of affecting health care software upgrade or implementation; Organizational context: expensiveness and complexity of system, organizational culture and knowledge; Technical context: lack of cloud and weak internet, system complexity, system incompatibility and lack of integration, and security and privacy issue; Environmental context: poor government support and internal developer, and Human context: Poor organization IT knowledge and capability.

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