

# Digitization of Hospital Services and Operations: A Conceptual Framework

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## Abstract

Information and Communication Technology (ICT) is revolutionizing many sectors but health sector is lagging in adopting ICT. In the manual system, much of the data is difficult to access and is not available in real time. There is lack of coordination between clinical service providers (doctor, nurse, patient and management) and other services such as pharmacy, procurement, laboratory and radiology. Digitization of hospital is vital in providing quality and cost-effective services to patients and improving support services. The increased digital adoption in the healthcare sector today has brought in major breakthroughs in information sharing, research, treatment methods, and communication models of the healthcare providers. However, the use of digitization in hospitals is not well understood and well structured. There is a need for common framework which will support all stakeholders of the hospital. This paper attempts to provide a framework for digitization of hospital operations and services.

**Keywords:** Digitization of hospital, Framework for hospital digitization, Virtual hospital, Challenges for digitization, Operations management of hospital

## 1. Introduction

Information and Communication Technology (ICT) is revolutionizing many sectors but health sector is still lagging behind. Due to shortage of healthcare facilities, people are not able to reach the medical facility in the early stage of disease; also processes in the hospital are more complex in nature. In the manual system, much of the data is very difficult to access in real time. There is lack of coordination between doctor, nurse, patient and management. Digitization of hospital is now the buzzword in healthcare sector for providing better, low-cost, and efficient services to patients and other stakeholders.

The healthcare market has grown by leaps and bounds to a whopping US\$100 billion and is expected to further grow at an estimated CAGR of 23 percent by 2020 reaching around worth of US\$ 280 billion.<sup>1</sup>

This tremendous growth of the industry has posed the need

to streamline its operations, infrastructure, and patient data for efficient healthcare service delivery. Today, the emerging technological advancements are transforming the way healthcare services cater to a greater proportion of the population in the country. New technological developments are constantly infiltrating the healthcare sector. Everything from healthcare ICT and EMR to telemedicine and tech-enabled care is transforming the medical sector and indeed revolutionizing the way healthcare is delivered. As India is moving towards the increasing convergence of technology, the healthcare fraternity has to adopt technology to provide efficient healthcare services.

The increased digital adoption in the healthcare sector today has brought in major breakthroughs in information sharing, research, treatment methods, and communication models of the healthcare providers. It has also facilitated new tools and innovations that enhance the outreach of healthcare services and offer new ways to practice medicine.

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However, the use of digitization in hospital is not well understood and well structured. There is a need for common framework, which will support all stakeholders of the hospital. The aim of this paper is to provide such a common framework for digitization of hospital operations and services.

In the rest of the paper, we will present the need and advantages of digitization, Common framework for digitization of hospital operation and services, challenges and solutions and finally we present the conclusion and future implications of framework for future digitization of the hospital.

## 2. Need for Digitization and Its Advantages

To do the digitization of hospital services and operations, first is a needs assessment and gap analysis of present processes for what is and what needs. How much time the staff, patient and providers take in current system and how much time it saves after digitization needs to be assessed. There is a need for customization and optimization of the digitization process and assessment of how much time it will be required for a functional system to be monitored. Detailed workflow analysis of what needs to be digitized and what are the expected outcomes has to be studied.

For operational perspective, what are the processes that need to be digitized, i.e., human resource, finance, hospital services, procurement, logistics, and patient records? We should keep in mind what patient records will be saved/ stored in the hospital and what the patient will have to generate on their visit.

For user perspective, what the clinical care providers in the hospital by doctors, nurses, lab reports, what information patient and relative can be accessed, how patient and relatives will be integral part of information sharing during the patient care in the hospital? If there is need for an outside hospital consultant, then what information and

how the outside healthcare providers will be integrated with the hospital?

Internet of Things (IoT) is going to revolutionize healthcare.<sup>5</sup> According to the author, technology can reduce errors during delivery of care. IoT can also help the people at their home, in rural and urban areas and extend the scope of healthcare to where the people are.

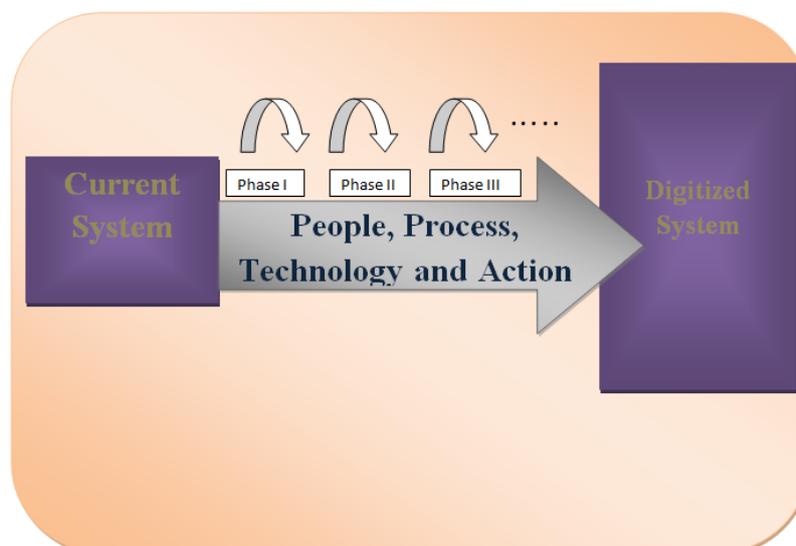
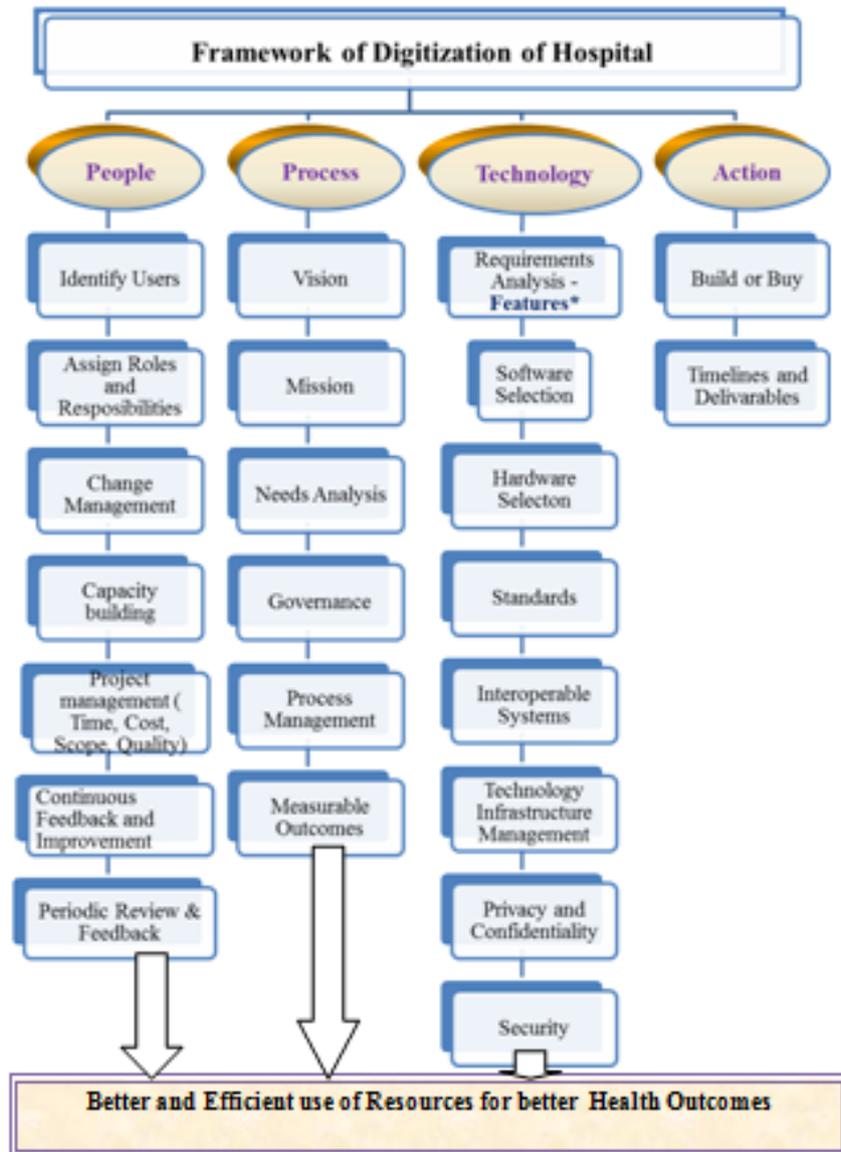
Digitization of hospital services and operations requires involving all stakeholders for their inputs and capacity building of all stakeholders for implementation of digitization. Before digitization, we would have to decide what quality of care digitization could provide to the current system.

## 3. Conceptual Framework for Digitization of Hospital Services and Operation

An information ecosystem framework for Sub-Saharan Africa was suggested by Victor et al.<sup>4</sup> According to them, investment in ICT depends upon many factors such as precursors, mediators, moderators, and outcomes fueled by ICT investments. IBM Global Business Services<sup>3</sup> suggests that "ICT must be robust". Technological infrastructure is a building block of digitization and complexity must be managed.

The guiding principles of digitization framework include: patient-centered care including feedback of patient satisfaction, efficient and affordability, real time and historical access, tracking of activities and early warning system, and visualization of all activities in one framework.

The framework was designed for improvement of health and health outcome by improving the efficiency of hospital staff and resources, saving and reducing of cost, early diagnosis of disease, increased life expectancy of the patient, behavioral change, better treatment, quick access to services, quality of care, etc.



Source: Change Management in EHR Implementation – provided by The National Learning Consortium developed by Health Information Technology Research Center.<sup>2</sup>

## Information to be Digitized and Its Uses

For effective and real-time monitoring of hospital services and operations, a dashboard should be created according to the roles and responsibilities of different users. Reports in digitized system should be interactive, easy to read, and real time. Who will enter the data and who will access data according to their roles and responsibilities should be clearly defined.

Patient prescription and referral system and patient feedback system must be digitized. Patients can give their valuable suggestions to improve the services and quality of operation. Radio-frequency identification (RFID) tag can be used for patient localization, supply chain management, Inventory control, etc.

In order to avoid misuse of the digitized system, confidentiality and privacy should be maintained.

## Virtual Hospital

Virtual hospital helps to break the digital divides between rural and urban, rich and poor. In the virtual hospital, resources are distributed on different locations but these can be shared by any person at any time and at any location for personalized treatment. For this, cloud computing and other communication technologies are used to integrate and share the information. Virtual hospital can be used for sharing the information at different healthcare services such as PHCs and CHCs. the biggest advantage of virtual hospital is to provide advanced treatment and medicine to the all people irrespective of rural or urban areas. Patient can connect with the doctor through chat, audio and video, mobile apps, health monitoring system place in residential areas or remote area.

Friedman<sup>6</sup> argues that for less expensive healthcare, virtual visit with doctors and nurses sitting in front of desktop or laptop and bed-less hospitals will be the future of healthcare.

## Linkage between Electronic Health Records (EHR) and Electronic Medical Records (EMR)

Electronic Health Record (HER) is the digitization of history of a patient's health record. It consists of complete and updated information of lab reports, any allergies, past diagnostics of disease, and electronic medical records (EMR) is also digital version of patient's record, which consists of disease diagnostics reports, laboratory reports, and treatment given to patient by the doctors. The benefits of linkage of EHR and EMR is the better tracking of patient records, real-time and updated information for treatment, reduction of medical errors, early treatment, quality of care, etc. It also helps in clinical decision making, improvement of staff efficiency, and overall reduction of cost.

## Revenue Cycle Management

Revenue cycle management is a financial process, which consists of all administrative and clinical activities associated with claim process, payment and revenue generation.<sup>7</sup> It starts from the registration of the patient, patient taking different services, proper coding of data, claim process, third-party insurance company linkage, and finally settlement of bill. For effective revenue management cycle, patient history should be captured accurately so that claim process will be easy and quick. For capturing the patient history, we can use the electronic health record of the patient. Revenue cycle management process also includes the quick denial of claim process of the patient for which they were not eligible. The benefit of this includes the patient, and the hospital knows which services were eligible for reimbursement from the insurance company and which were not. In order for quick flow of claim data from the hospital to the insurance company and vice versa, standardization of capturing of patient data can be used. Revenue cycle management process must contain the repository of denial and accepted claim data for verification and early management of new patient claim data. By using this repository, hospital staff can see whether the patient was eligible for claim or not.

## Considerations for Software and Hardware

- User friendly
- Open-source software platform for long-term access
- Standardization and interoperability for different formats and data transfer
- Internet speed
- Storage of data internally or cloud based
- Security
- Backup and disaster recovery plan
- IT support
- Online as well as offline operation
- Flexibility in data access, reports
- Helpdesk for IT support

## Lesson Learned from Successful and Unsuccessful Models

Before digitization of hospital services and operation, we should study model hospitals that have undergone total digitization. We study the smart card, kiosk model for digitization. We also study the unsuccessful attempt of digitization as documented and what should we learn from them.

## Monitoring, Periodic Evaluation

- Monitoring indicators, system for accessing progress and addressing bottleneck
- Needs assessments, midline evaluation and end-line evaluation

- Budget will be define as per need assessment which includes Annual maintenance charges, Recruitment of staff and Help desk costing

#### 4. Challenges and Solutions

Some of the challenges anticipated are summarized in the table below:

**Table 1. Challenges and Solutions in Digitization of Hospital**

Challenges	Solutions
Resistance to changes	Behavior change communications
Lack of knowledge of IT amongst health professionals	Capacity building
Lack of knowledge and experience in latest technology	Capacity building
Lack of motivation/incentives	HR policies
Fear of reductions in Jobs	Team building exercises
SOPs are not made	Collective process making
Resources are lacking	Buy-in from senior management
Speed of Internet	Backups and offline mode
Doctor, patient feel that they spend more time in typing rather than examination	long term implications of digitization to be highlighted
Ethical and Legal problems	Everything has to fit ethical framework
Power failure	offline mode, access on mobiles

#### 5. Conclusion

The framework presented in this paper helps us to understand the implication of digitization system and related issues over the manual operation of the hospital. This framework is divided into four parts which is useful to identify the requirements, issues and stakeholders so that correct information will get in right time at right location. In the future, we will investigate the feasibility of framework to digitized the hospital operations and services

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