

# Al-Shifa: Case study on Sultanate of Oman's National Healthcare Information System

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## Abstract

**Objectives:** Al-Shifa Healthcare Information System (HIS) is developed and being used by the ministry of health in Sultanate of Oman. This case study presents the evaluation of Al-Shifa on the standard dimensions of management information system, namely, organizational dimension, management dimension and information technology dimension.

**Methods/Statistical Analysis:** This case study employs a focus group based qualitative approach. The member of IT department at the Sultan Qaboos Hospital, Salalah, Oman formed the members of the focus group. These members are responsible for the development, support and operations of Al-Shifa, hence, provided valuable insights on which the case study has been developed. **Findings:** Evaluation of Al-Shifa on the standard dimension of information systems, namely, organization, management and information technology reveals that on organizational and management dimension, Al-Shifa as an HIS stands well. However, it's chosen and present IT infrastructure is effective but not efficient. One bottleneck in its efficiency is its client-server technology which has become obsolete. Client-Server technologies are ideal for a single organization, single location information system but it certainly shouldn't have been a choice for a country level information system, especially given the availability of web technologies and cloud computing. Similarly, a single centralized database for the entire nation would have been an ideal but its absence leads to complicated and monotonous methods of information transfer and sharing. Few healthcare units still operate as an independent unit without networking & information sharing capabilities restricting integration with other centers. **Application/Improvements:** The focus group included staff of IT department; however, the views of end users are not incorporated. A separate study is needed in order to collect end user's perspective of Al-Shifa.

**Keywords:** Al-Shifa, Focus Group, Health Information System, National Healthcare Oman

## 1. Introduction

A national health database is imperative for government of any nation for strategic policy development and delivery of efficient health care to its residents. Such an obligatory national health database cannot exist without a national Health Information System (HIS) capable of recording, processing and disseminating information to key stake holders as and when needed<sup>1</sup>. HIS offers vast potential and opportunities but not without eminent challenges. The adoption of IT in healthcare has been particularly slow and lagging behind that of major industries by as much as 10-15 years<sup>2</sup>. This is further exacerbated by the failure in HIS implementation as well as resistance to the use of the technology by healthcare professionals<sup>3</sup>. These

challenges range from issues related to the technology itself, the healthcare setting, system users and the regulatory environment<sup>4</sup>. By late 1980s, organizations and governments started realizing the applications and benefits of ICT. Owing to the many benefits of ICT in healthcare sector, it too started adopting ICT in general and MIS, in particular. An Information system designed for use in healthcare sector is termed as Health Information System (HIS).

"The health information system provides the underpinnings for decision-making and has four key functions: data generation, compilation, analysis and synthesis, and communication and use. The health information system collects data from the health sector and other relevant sectors, analyses the data and

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ensures their overall quality, relevance and timeliness, and converts data into information for health-related decision-making<sup>5</sup>.

In the Sultanate of Oman, the Ministry of Health (MoH) is the national and major healthcare services provider along with a private healthcare system. Owing to the international and regional trends and with the advancement in technology, the MoH took a paradigm shift by initiating its first ICT project in 1994 with the development of a pilot standalone HIS at a primary healthcare center in Al-Suwaiq, Oman. Faced with initial resistance of technology adoption, unclear project vision and lack of project planning, MoH took 14 years to produce its first national Healthcare Information System (HIS) named Al-Shifa 3Plus launched in 2008. Today Al-Shifa 3Plus is being used across all 200+ public healthcare centers in Oman<sup>6</sup>.

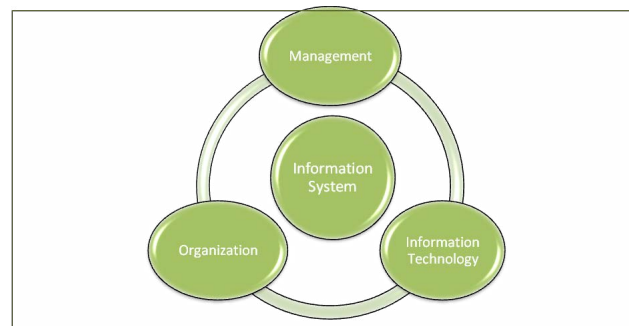
## 2. Overview of Al-Shifa

The MoH claims that Al-Shifa is a complete and comprehensive solution for end-to-end healthcare management covering over 200+ healthcare facilities of different sizes and capabilities with the following modules and functionalities:

## 3. Dimensions of Information Systems

Information systems are more than just computers as

they include a broader scope by taking into consideration the management and organizational aspects as well. To completely understand an information system, we must understand and analyze the dimensions shaping it, namely, Organization, Management and Information Technology<sup>7</sup>.



Cyclic representation of Information System

**Figure 1.** Dimension of information system.

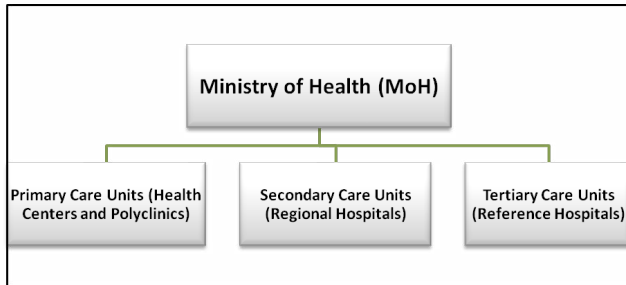
### 3.1 Organizational Dimension

In order to have a broader view of the applications and the outcomes expected from an information system, it is necessary to understand the organizational structure in which the information system is implemented. In the sultanate of Oman, the Ministry of Health (MoH) is the tertiary government organization responsible for the planning, implementing and control of healthcare through a hierarchical network of healthcare centers across the country. The government healthcare centers are classified into three categories as depicted in Figure 2.

**Table 1.** Al-Shifa modules

Module	Description
Computerized Physician Order Entry (CPOE)	The primary source of electronic data capturing.
MIS	Provides individual healthcare center's administrators with the details of clinical activities for efficient day to day operations.
Nabd-al-Shifa	A National Level Decision Support System (DSS) providing a graphical representation of the Key Performance Indicators (KPI) with data accumulated from 200+ healthcare centers.
E-Referral and E-Notification	E-Referral links over 70+ healthcare centers catering to the inter-institutional appointment requests for inpatients, ambulance, laboratory, radiology and other healthcare services. E-Notification was Initially designed for notifications on epidemics, communicable and non-communicable diseases, this system was later expanded to incorporate adverse events, births, death, trauma, etc.
Blood Bank Management System	A national repository of blood bank inventory and administration.

Source: (<https://www.moh.gov.om/en>, 2016)



Diagrammatic Hierarchical flow as per MoH, Oman

**Figure 2.** Organizational Hierarchy in the Ministry of Health (MoH), Oman.

The ministry of health has established a network of over 200+ healthcare units across the urban and rural landscapes/regions/territories of Oman. These units are classified primarily on their location, services offered and size. The most basic types are the primary care units providing general and non-critical treatments in urban as well as remote and rural regions of Oman. Regional hospitals generally located in the capital cities of each region/state providing multi-specialty healthcare services are termed as Secondary Care Units. The Tertiary care units are large national hospitals providing the widest variety of healthcare services for patients referred from secondary units. These tertiary units practice core specializations in a particular area<sup>8</sup>. Al-Shifa health information system is been used across all levels of healthcare units with the ministry of health acting as the reporting body.

### 3.2 Management Dimensions

A typical organization consists of at least three levels of management i.e. senior management responsible for taking long term strategic decision and monitor & control of finances. Middle management carries out the plan of the senior management and responsible for monitoring of routine business operations. The operational management consists of workers who actually produce the product or deliver the service. Healthcare centers in Oman too follow a similar management hierarchy under ministry of health.

An efficient Healthcare Information System must seamlessly address and cater to the needs of all levels of management hierarchy. Al-Shifa has been designed and developed to meet the needs of all levels of management. Al-Shifa's Computerized Physician Order Entry (CPOE) module serves the operational management employees and acts as the primary source of data capturing and

entering. The Management Information System (MIS) module of Al-Shifa delivers the essential information needed by the middle management for the day to day operations of the healthcare facility. This module allows the hospital administrators to drill down to the detail of clinical activities, events, ongoing operations and intra/inter hospital services. Nabd-Al-Shifa is the data warehousing and business intelligence suite which provides the national level healthcare statistics with graphical representation (charts) of the Key Performance Indicators (KPI) of data accumulated from 200+ healthcare centers. These statistics and charts enable the top management to analyze the overall functioning of healthcare centers across the sultanate<sup>9</sup>.



As per MoH, Oman

**Figure 3.** Management hierarchy, Ministry of Health (MoH), Oman.

### 3.3 Information Technology Dimension

In an information system, Information Technology (IT) acts as the vital tool needed to implement, operate and deliver the needed objectives of the information system. An organizational IT Infrastructure includes but not limited to the following:

- Computer Hardware
- Computer Software
- Data Management Technology
- Networking and Telecommunication Technology

Much of the success or failure on an information system depends on the choice of IT Infrastructure. IT infrastructure not only plays a pivotal role in delivering the objectives but also determines the sustainability of the information system. Rapid developments in IT infrastructure technologies coupled with the ever

**Table 2.** Al-Shifa's IT infrastructure

Sr. No.	IT Infrastructure Element	Description
1.	Computer Hardware	The computer hardware chosen for Al-Shifa was the latest of its time. It uses HP ProLiant series computers for its server side computing. On the client end, there is no uniformity in the brand or configuration as the client machines has increased gradually with time.
2.	Computer Software	Operating System: The servers run on RedHat Linux OS and the client machines uses Windows 8.  Enterprise System: Al-Shifa is developed using Oracle Developers 6i as front end (user interface) and Oracle 11g Database as back end (database).
3.	Data Management Technology	The leading RDBMS product, Oracle 11g Database server are being used in Al-Shifa. Al-Shifa does not have one centralize database for the entire country, rather uses distributed database architecture with local databases in each healthcare unit.
4.	Networking and Telecommunication	Most but not all health care units are interconnected with lease lines hired from OmanTel which are used for Intra-healthcare unit computer networks. Within a healthcare unit, LAN networks are established and used for client-server communication.

Source: Primary Source

increasing usage and higher performance demands makes choosing the right IT Infrastructure the most crucial decision. Table 2 demonstrates Al-Shifa's Infrastructure.

## 4. Conclusion

Evaluation of Al-Shifa on the standard dimension of information systems, namely, organization, management and information technology reveals that on organizational and management dimension, Al-Shifa as an HIS stands well. However, its chosen and present IT infrastructure is effective but not efficient. One bottleneck in its efficiency is its client-server technology which has become obsolete. Client-Server technologies fare well for a single organization, single location information system but it certainly shouldn't have been a choice for a country level information system, especially given the availability of web technologies and cloud computing. Similarly, a single centralized database for the entire nation would have been an ideal but its absence leads to complicated and monotonous methods of information transfer and sharing. Few healthcare units still operate as an independent unit without networking & information sharing capabilities restricting integration with other centers. This lack of information at the top level of the management leads to incomplete statistical representation of the overall health statistics of the nation posing another threat to the Ministry of Health's (MoH) aim of building a national e-health repository. In order to fulfill the MoH's

aim of a building a national health e-repository, Al-Shifa's IT Infrastructure will have to go through a complete revamp.

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