



RESEARCH ARTICLE

ELECTRONIC-HEALTH IN IRAQ.

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Abstract

The Iraq health sector has witnessed significant progress in recent years with some local hospitals receiving international recognition. However, this has not been accompanied by advancement of the electronic-health (e-health) field, whose applications have become a necessity for hospitals to achieve certain objectives such as enhancing the quality of healthcare, and reducing the time and cost for healthcare delivery.

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Introduction:-

There is too much Iraqi die each year as a result of medical errors that could have been prevented, according to the world health organization (WHO)(Thamer Kadum Al Hilfi Gilbert Burnham n.d.).

Beyond their cost in human lives, preventable errors also result in an estimated total cost in the hospitals and ministry of health. Medical errors are also costly in terms of loss of trust in the healthcare system by patients. One of the WHO report's main conclusions is that medical errors are commonly caused by faulty systems, processes, and Conditions that lead people to make mistakes or fail to prevent them. In response to the WHO shocking report, this study embarked on information and communication technology (ICT) to improve outcomes, reduce medication errors, increase healthcare efficiency, and eliminate unnecessary costs.

Information technology (IT) in healthcare has expanded in the health sector in Iraq. However, despite their knowledge, the important of health the health sector in Iraq is ignored. One probable reason for this problem is that the key users, including physicians and nurses, are not using the technology to its greatest potential or, in too many cases, have not begun to use the technology at all. There are several definitions for electronic-health (e-health), however in this paper use the Eysenbach's definition:

"E-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology"(Alkhamis 2012).

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As healthcare is getting more and more complex with more healthcare givers involved in patients' health, paper-based patients' charts cannot keep clinicians completely informed. Paper records can only be in one place at a time, and thus cannot be shared between 2 or more health specialists at different locations simultaneously, which has a negative impact on optimization of information management in healthcare and as a consequence reduce productivity and quality of care provided.

Therefore, records must be available in an electronic format so that health specialists can easily access and review patient's history, including allergies, medication, investigation, and laboratory tests performed. Consequently, healthcare organizations have started seeking e-health solutions that can automate and integrate business processes, enable information sharing across the organization and between different organizations, enhance services to patients, and ensure security and privacy of patient information. Nevertheless, e-health is of an importance for the following reasons: most hospitals and medical centers still record patient information on paper; the amount of health information is increasing; most of the existing information systems are of administrative nature rather than patient-care focus; most healthcare systems have historically organized the delivery of healthcare around institutions and not around patients, it is believed that e-health will enhance quality and patient safety.

Iraq country profile:-

The Iraq means different things to different people. It is land of prophets, it is the ultimate Holy Land, land of first civilization. For a large number of investment and biggest companies from Asia, Europe, and the United States (US), it is a land of opportunities. On 6 Jan 1920 is foundation of Iraq. Large reserves of oil were discovered soon after, and within a span of 6 years, commercial production of oil began.

The first step in the oil was by British Oil Company. Today, Iraq is the biggest market and trade in the Middle East.

In all these years, the Iraq has displayed remarkable economic stability. The population of Iraq is 32,000,000 and the area is 438,000 km square (Marine Corps Institute Iraq : an Introduction To the n.d.).

E-health benefits, barriers, and key applications:-

Potential benefits of e-health:-

One of the most important e-health benefits is the enhanced patient access to comprehensive and credible health information and knowledge, which will enhance the quality of care. The e-health becomes a conduit for improved and faster sharing of health records. Such sharing of information may result in a lower chronic disease management costs, lower medication costs, and lower wellness program costs. Additionally, e-health helps prevent prescribing errors resulting from clerical mistakes.

Benefits to physicians:-

Orders are placed electronically, which prevents wrong interpretations of handwritten orders. Physicians will have full control over the ordering process benefiting from the real-time alerts (drug-drug, drug-food, or allergy), which enhances the quality of healthcare. The e-health helps reduce the time of locating and reading patient charts.

Benefits to ancillary departments (pharmacy, laboratory, radiology, nursing, and others):-

Resources in ancillary departments will be freed up from administrative tasks and hence have more time to provide higher care value and improve regulatory compliance measures. Pharmacists and nurses now spend much less time entering orders and spend more time in clinical care. The e-health will reduce the amount of time spent on phone calls to physicians to enquire about and verify the orders.

Benefits to patients:-

The e-health plays an important role in improving medication safety. It prevents medication error resulting from handwritten orders. It enhances interdisciplinary communication towards patient health. Benefits to management.

E-health helps move information instantly around the organization, reducing turnaround time for medication delivery, obtaining and processing lab work, scheduling and completing radiology exams, and other tasks. It helps standardize the healthcare process. At the national level, health data, information, and knowledge from several health centers can be combined to support public health research.

Barriers to E-health:-

In spite of the great Potential benefits of e-health, there are some barriers to e-health diffusion The adoption and implementation of a complex IT solution is influenced by the organization's ability to lower or remove the various knowledge barriers. Knowledge barriers associated with the adoption of larger-scale IT solutions, such as e-health, Can be categorized into 4 categories: project/economic barrier, technical barriers, organization barriers, and behavior barriers) (Prof, Khanapi, and Ghani 2016)

- a- Project/economic barriers. This category is concerned with the financing and project management issues faced when acquiring innovation.
- b- Technological barriers. This category is concerned with the lack of knowledge required to carry out technical tasks needed to adopt new innovations. This includes the lack of interoperability and the lack of existing regional information networks.
- c- Organizational barriers. This category is concerned with the difficulties of deploying a new technology into existing practices and processes. This includes privacy concerns and the lack of consistent national information standards and code sets.
- d- Behavior barriers. This group is concerned with the resistance to change among individuals affected by the implementation. It is also concerned with organizational power dynamics. It includes also the concerns on physicians' usage.

Critical success factors to e-health diffusion:-

In order to increase the likelihood of successful implementation of e-health applications, organizations should consider certain critical success factors. In May 2001, 13 e-health experts from around the world gathered at a 2-day conference for the purpose of developing recommendations for Computerized Physician Order Entry (CPOE) system implementation (Services 2008).

A list of high-level considerations was generated to benefit organizations thinking about implementing CPOE, and possibly other e-health applications, as follows: motivation for implementing the solution, vision/leadership/people, costs, integration/workflow/healthcare processes, value to users/decision support systems, technical considerations, management of project, training/support/help at the elbow, and learning/evaluation/improvement (Altuwaijri 2008).

Key e-health technologies. Electronic medical record (EMR):-

Key e-health technologies. Electronic medical record (EMR) is an electronic health care information record that stores patient information with full interoperability within a health enterprise. It helps connect the work produced by different medical and technical departments. All services rendered to the patient will be stored in the patient record, which secures a more integrated and harmonious interaction between the hospital departments with a view to providing an excellent health service. The EMR consists of the following (Hasanain 2015):

Patient management system that is used for making appointments, bed management, and patient follow-up while hospitalized. Pharmacy management system that helps in managing drugs automatically and notifying physicians of possible negative chemical complications of some drugs prescribed. Many manual tasks at the pharmacy will be automated, which will help make the pharmacist totally devoted to clinical work.

A laboratory information system that manages laboratory requests and stores their results automatically in the electronic health record.

Radiology information system that manages radiology requests and stores the results in the electronic health record. Billing and insurance system that helps issue bills and finalize cost accounts of medical services rendered to the patients. Staff scheduling system that manages scheduling for physicians and clinical teams.

Computerized physician order entry:-

Is a process of electronic entry of physician's orders and instructions for the treatment of the patients, These orders are communicated over an EMR to the medical staff (nurses, Therapists, or other physicians) or to the departments (pharmacy, laboratory, or radiology) responsible for fulfilling/documenting the order. This system is not a technology, rather it is a workflow design (or redesign) of clinical processes that integrates technology to optimize physician ordering of medications, laboratory tests, and so forth. It uses clinical decision support systems and links to hospital systems to generate prompts and alerts during the ordering session to notify of potential errors such as contra-indicated medications, or routes, or duplicate orders. Integration with other hospital information technology

systems including electronic patient records, pharmacy, laboratory, and other services provides the physicians with all the information necessary to develop and transmit an effective, error-free order(Qurban, Fahd, and Medical n.d.).

Telemedicine:-

Is a technology that allows physicians to provide healthcare at distance through advanced electronic communications systems. Treatment here involves remote examination, automated forwarding of examinations and analyses' results, exchanging expertise, conducting operations, and other medical applications. These medical applications make use of computer and communications systems in transferring medical information to other locations for remote diagnosis.

Research works in this field succeed with the advancement of using robots in surgical operations(Almuayqil, Atkins, and Sharp 2015).

Multipurpose smart card:-

It is a card that contains an integrated circuit to store, retrieve, and transfer data. This card services many purposes worldwide. However, its official use in the Kingdom is only confined to commercial purposes. Some countries have already made use of the smart card for health purposes where certain health information elements extracted from the citizens' electronic health record are added to the card(Yurt 2008).

Picture archiving and communication systems (PACS):-

This system aims to replace manual medical imaging systems that depend on radiological films with a digital system that enables more than one physician to examine digital images through a computer network.

This overcomes the problem of lost images, which reduces the cost of taking images for the second time. It normally contains advanced systems to control the image's coordinates, which facilitates easy examination and reference. The low price of digital storing systems led to the decrease in the price of PACS, which consequently made this technology quite popular in a large number of hospitals(Yurt 2008).

Electronic health record (EHR):-

This is a nationwide system that serves the health sector in terms of presenting the patient's information electronically, which gives way to deduce personal and public information, and provide information for decision support and performance quality. The electronic health record requires wide networks to share health information. Public health is the leading field in using this technology with a view to achieving 2 main goals: linking health organizations inside and outside their geographical spheres, and activating interaction lines among patients, physicians, healthcare providers, and health planners(Nassar, Othman, and Yahya 2013).

International trends of e-health:-**Australia:-**

One of the great e-health experiences, so far, is the Australian national electronic health record implementation project. The project is called Health Connect, and began operation in 2002. The basic model is to extract summary information from locally collected patient data, which is aggregated to create a centralized record that may be shared among health institutions and authorities.

The program is a joint initiative among Australian, State, and Territory Governments(Stroetmann et al. 2006).

It is estimated that the program will save Australian \$300 million per year by reducing errors and duplication of efforts. Enrolment in the program is Voluntary in which patients, and their health providers, choose which elements from patients' records may be extracted and transmitted to the Health Connect record which can be added to or updated by the providers with the consent of patients.

Canada:-

Along with the technology advances, Canada initiated a major initiative for e-health and EHR and is considered one of the leaders in that field.

This has been considered seriously since 1997 when the Minister of Health established the Advisory council on Health Infrastructure. In 1999, the council released the final report: "Canada Health Info way: Paths to Better Health". As a result, the Canadian government established an independent, not-for-profit corporation called Canada Health Info way with a mandate of accelerating the adoption of interoperable EHR across Canada.

The corporation became operational in early 2002, with a total capital budget of \$1.2 billion (CDN) from the federal government. Info way has embraced a plan with a core objective of providing electronic health records to half of the Canadian population by 2010 (Stroetmann et al. 2006). These records will include patient information and provider registries that include diagnostic images, laboratory test results, medication profiles, hospital clinical reports, immunization history, and public health data.

United States:-

Since the 1999 report on medical errors from the Institute of Medicine, health care organizations have been alerted on the financial and health risks associated with paper-based medical records. Therefore, they established the Office of National Coordinator (ONC) to call for action and launch strategic framework.

By July 2004, the ONC outlined 12 strategies to achieve the main goal. According to the study, only 17% of clinics applied the EMR. The main goals of the study are to inform clinical practice by bringing EHRs directly into clinical practice; interconnect clinicians in order to allow information to be portable and move with citizens from one point of care to another; personalize care in order to help individuals manage their own wellness; and improve population health (Hillier et al. 2011).

European countries:-

Most European countries are advanced in using electronic medical records. The countries with the largest proportions of general

Practitioners using EMR are Sweden (90%), the Netherlands (88%), Denmark (62%), and United Kingdom (UK) (58%), Finland (56%), and Austria (55%). The National Health Service (NHS) in the UK, which established the effort since 1948, has conducted wide pilot programs of EHRs and patient held electronic records over 2 years. By April 2005, it became responsible as a guide toward the country's EHR initiative to access the national electronic patient record (EPR) within the next 10 years over 300 hospitals in England, and connecting the patients to this service. The EPR will provide support for clinical and administrative tasks and track clinical pathways according to patients' conditions (Ingenico Corporate Communication 2012).

Turkey:-

E-Health studies which are professionally conducted by the Turkish Ministry of Health are based on the studies on Turkey Health Information System Action Plan which were started in 2003 and completed in January 2004. This plan was prepared as a result of a very intensive work with 10 separate working groups including governmental institutions, universities and non-governmental organizations (Yurt 2008).

Saudi Arabia:-

In recognition of the vital role played by information and communications technology, Saudi healthcare providers and health stakeholders have been increasingly relying on advanced systems of information and communications technology. Unfortunately, this has not been accompanied by a coordinated effort to set up a unified national network and repertoire for the health records.

There are a large number of different health information systems independently in use particularly in the big regional hospitals without being connected to each other (Almuayqil, Atkins, and Sharp 2015).

Table 1:- E-health strategies in some countries (Nasiripour et al. 2012).

Australia	Germany	Sweden	Britain	Turkey	Japan	Iran
Individual Health Record (IHR)	Patient's ID, E-health card, adequacy center	National Practice Plan to use IT in health and social services	Increased investment in IT, electronic appointment service, e-health record and electronic prescribing	Citizen centric e-health projects	Studying patients direct care system, ICT Agencies' cooperation for development policy	Security and standards architecture, creating integrated data sources of health information system, management development of public knowledge to access health information

Current Healthcare in Iraq:-

Iraq's healthcare system is classified as primary by the world health organization, which indicates it is based upon "practical, scientifically sound and socially acceptable methods and technologies made universally accessible to individuals and families in the community through their full participation in the spirit of self-reliance and self-determination.

The Iraqi healthcare system is in great need of rebuilding since the invasion of 2003 and fall of the Saddam regime. Numbers from the various surveys reflect this: According to MICS, the Multiple Indicator Cluster Surveys administered by UNICEF and the Iraqi government, the number of immunized children dropped from 60.7% in 2000 to 38.5% in 2006. It bounced back to 46.5% in 2011, but this number is still considerably lower than pre-invasion rates. According to the World Health Organization, in 2011 Iraq's doctor to patient ratio was 7.8 to 10,000. This rate was exponentially lower than surrounding countries—Syria, Lebanon, Jordan and Palestine(Thamer Kadum Al Hilfi Gilbert Burnham n.d.).

The Iraqi healthcare system is primarily central, with certain allocation of government funding going towards the sector per year. According to the World Health Organization, there are 1,146 primary health centers headed by mid-level workers; and 1,185 health centers, headed by medical doctors. There are 229 hospitals, including 61 teaching hospitals. Government spending on healthcare has increased in the last ten years, according to the World Bank: In 2003 spending was at 2.7% of GDP, and in 2010 it had jumped to 8.4%. However, the disbursement of these funds remains in question, as there is still a lack of facilities, medication and staff to show for it.

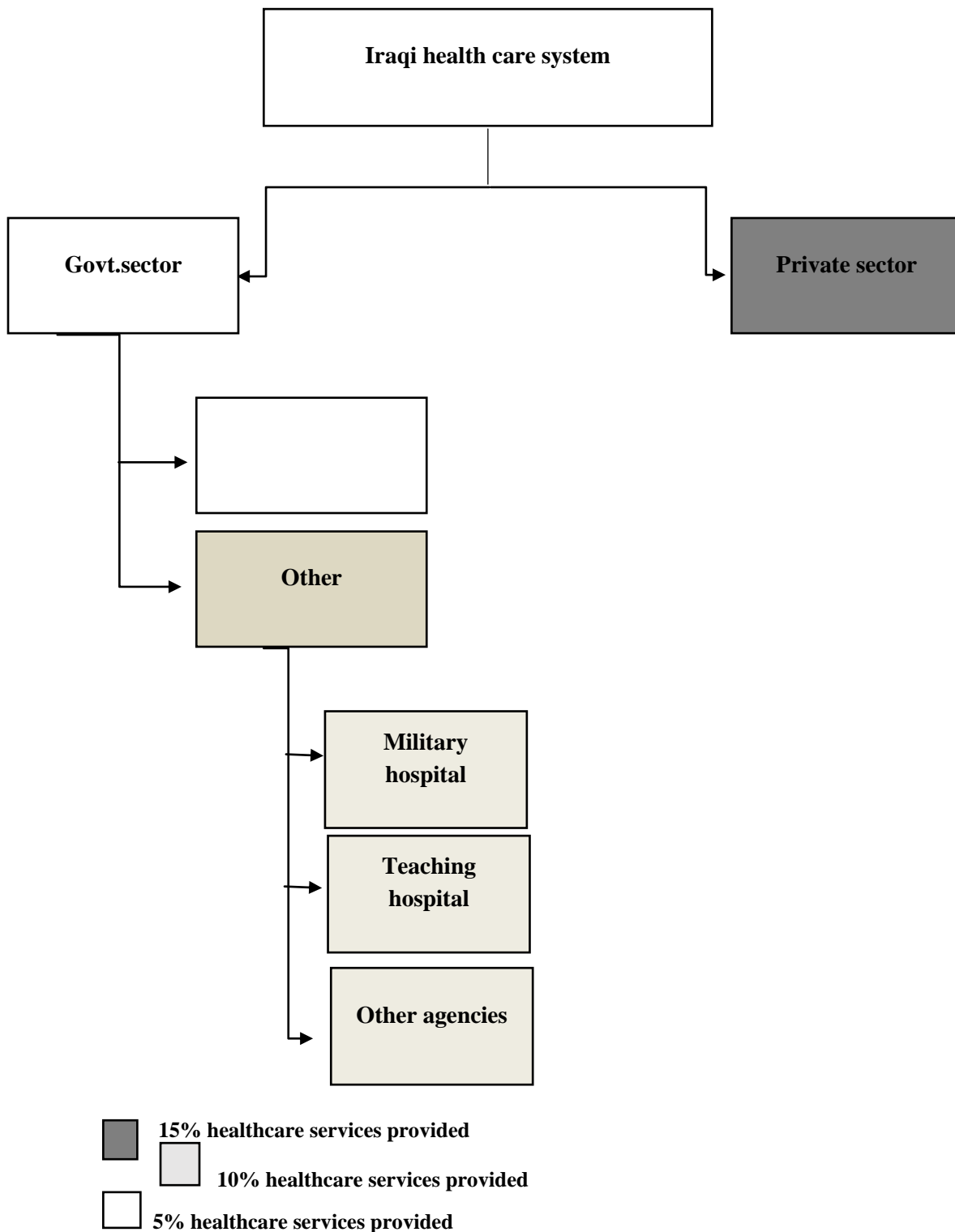


Fig1:- Current structure of the health care in Iraq (MOH= ministry of health)

Iraq Health Insurance:-

Currently 96.4% of Iraqis are without health insurance. There is no health insurance system to serve the public, and so they rely on the Iraqi central government-run public health care system, with little advocacy or diversity of treatment options (Melaragno and Ollunga 2003).

Saddam Era Healthcare:-

From 1993-2003 the Saddam regime reduced public health expenditure by 90 %. This resulted in a serious deterioration within the healthcare system, with salaries of medical personnel decreasing and malnutrition and water-borne diseases becoming more and more common.

In 2003 the American Invasion unfortunately destroyed nearly 12 percent of Iraq's hospitals and two public health laboratories. However, the US occupation and subsequent international aid spurred the operation of 240 hospitals and 1200 primary health care centers (Melaragno and Ollunga 2003).

Current Key Players in Iraq Healthcare system:-

The World Health Organization Representative's Office in Iraq "supports the Government and health authorities at central and local level in strengthening health services, addressing public health issues and supporting and promoting research for health. Physicians, public health specialists, scientists, social scientists and epidemiologists provide appropriate technical support and collaboration upon the request or acceptance of national authorities."

Other key players include USAID, United Nations agencies, such as UNDP, other humanitarian organizations as well as development partners.

Cancer in Iraq:-

The top concern among most governorates in Iraq is the increasing rise of cancer rates. When interviewing the government of Kurdistan, one official reported that the number one priority of service provision was oncology centers. The need for these oncology treatment centers is great as increasingly diagnosed patients are having to seek treatment outside Iraq—in more developed countries with stronger healthcare systems, such as Dubai, Lebanon, or the United States (Thamer Kadum Al Hilfi Gilbert Burnham n.d.). Patients pay a high price for travel expenses and for healthcare outside Iraq, but they are willing to do so because the treatment in these regions is of much more quality than what is offered in Iraq.

Healthcare Treatment in Iraq:-

According to one Iraqi resident, living in Al-Kut, the Iraqi healthcare system is not nearly as beneficial as foreign healthcare systems. She was diagnosed with a spinal injury and was told she needed surgery. She researched the cost of surgery in Kirkuk—and was quoted the price of \$7,000. Because her native Iraqi hospital did not offer post-operative care (she would be allowed to stay in the hospital only until the evening after the surgery, and then would have to return home right away), she chose to travel outside Iraq to receive the surgery, for a sum total of \$10,000. She chose to receive the surgery outside Iraq so she could receive follow-up treatment and care for her surgery, and not risk infection by going home the same day.

Investment Opportunity:-

There are significant investment opportunities within the healthcare sector in Iraq. The anecdotal evidence cited above is common among native Iraqi residents. Their perception of their own healthcare system is not positive, and is suspicious. The Iraqi central and local governments are aware of the gaps in their current system and are seeking guidance to fill these.

Proposed model for e-health diffusion in Iraq:-

In this section, a new model for the adoption and implementation of e-health programs in Iraq is proposed. The model is based on the theory of diffusion of innovations (Rogers 1995), the theory of barriers to innovation, the studies of critical success factors (Services 2008), and the advancement of project management theories. The model, shown in Figure 2, consists of 3 main components; the first component is concerned with the stages taken by organization to deploy e-health programs, which is in turn composed of 4 stages: visioning, matching vision, deployment, and evaluation and improvement. In visioning the phase, health organizations define the corporate mission, objectives, and strategy. This phase is mainly concerned with identifying and prioritizing the organizational problems and opportunities that form the basis of the need to acquire innovations (Rogers 1995).

Ideal strategy for e-health should aim to:-

1. Increase the efficiency and effectiveness of health organizations;
2. increase return on investment of health assets and resources;
3. focus on patient and provide better patient care that is continuous and integrated;

4. provide secure access and support planning and quality management. The second phase is concerned with the fit between a need identified in the first phase and the innovation (e-health application) proposed. In this stage, we should determine whether the innovation would at least solve one of the problems identified in the first phase.

At the end of this phase, the organization decides whether or not to approve the innovation project. In the event that the project is approved, the third phase of the process, deployment, begins. This phase includes all decisions and actions related to the deployment of the innovation. It includes also the assimilation and the integration of the innovation within the organization. At the end of this phase, the e-health innovation solution is deployed within the organization.

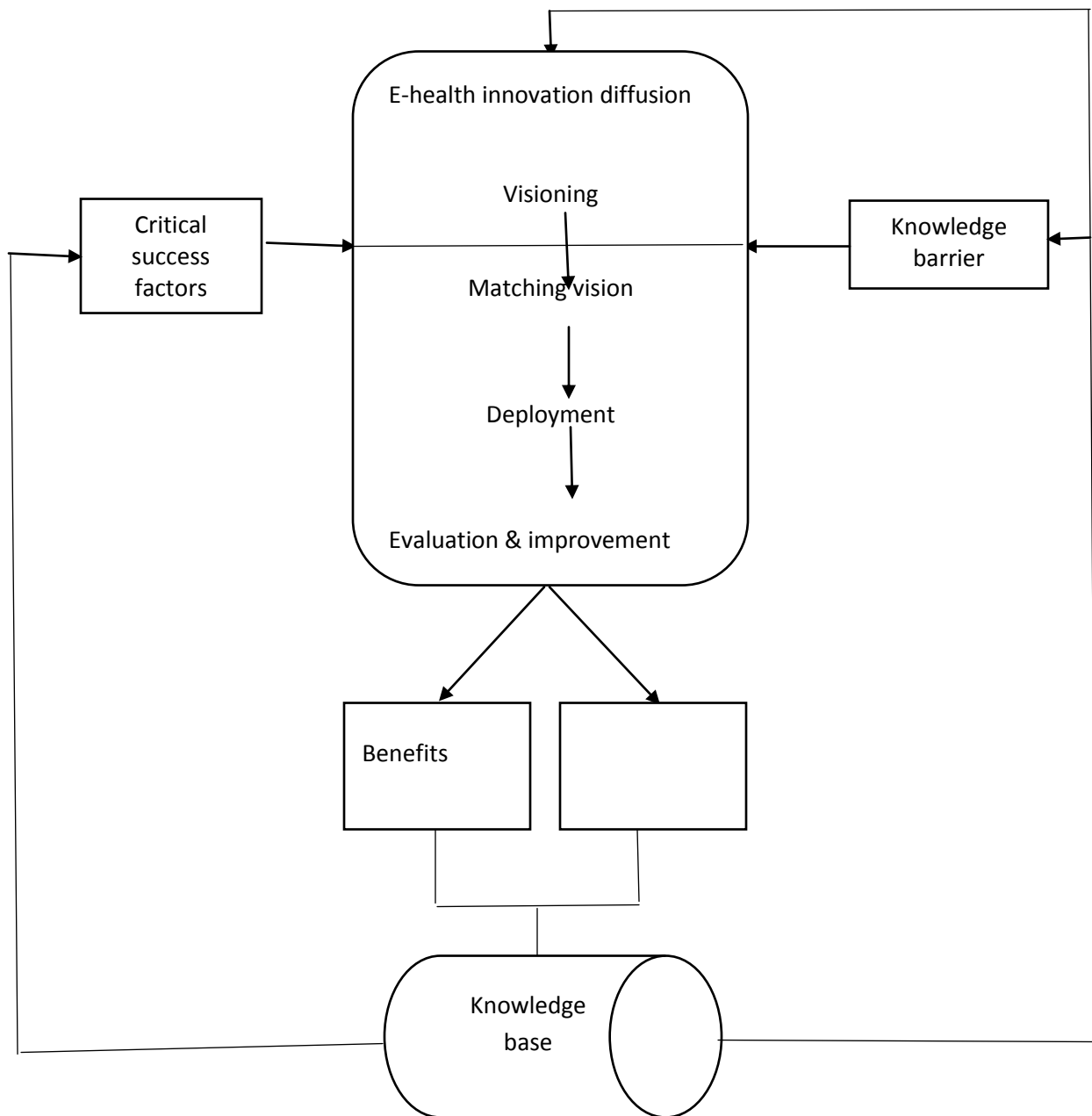


Fig2:-a proposed model for e-health diffusion.

Evaluating performance is an important step for ensuring the quality of the innovation deployment. This phase emphasizes process flow optimization and continuous expansion of the system to gain a competitive advantage. The second component deals with the main knowledge barriers to IT innovation diffusion. Organizations should address the knowledge barriers as follows: Economic barriers. These barriers should be addressed during the visioning phase of the first component. As the visioning phase is usually affected by the availability of funds. Technical barriers, these include the technical infrastructure readiness and have high impact on the deployment phase of the first component. Organization barriers. Organizations should address change management processes to align e-health with existing practices and processes. Behavior barriers. Organizations should address clinicians' resistance to e-health. The third component is concerned with the critical success factors of e-health innovation deployment as suggested by various literatures. Organizations should determine and consider factors that are critical to the success of e-health projects. Usually this is achieved by investigating other e-health programs experiences. Critical factors may have more influence on some phases of the implementation process. For example motivation for implantation, e-health vision, and cost/ benefit factors have more influence on the visioning phase. However, the integration, values to users, project management, technology, and training factors has more influence on the deployment phase. After the successful deployment of innovation, the list of benefits and lessons learned feeds a knowledge base which in turn feeds all components described in the model. Knowledge sharing behaviors facilitate learning among project team members and enable them to resolve problems similar to situations encountered by others in the past, thus enabling more successful projects. The proposed model calls for the establishment of an e-health Program Management Office (PMO) to implement corporate strategy for e-health project management. The main goal of this office is to translate the organization's strategic plan into e-health projects and programs. The PMO is accountable for enterprise-wide distribution of project management best practices. The main advantages of this model is the strategic alignment of projects, which bears on the synergy created by the management of relations between projects, and the ability to develop a better understanding of the challenges faced in carrying out information systems projects, the factors for success, and the strategies required to take advantage of IT. The acts of sharing are very important since a project's knowledge will have small impact on the organization unless it is made available to other projects. Such learning organizations would be aware of the repeated knowledge barriers to innovation adoption, and a well-defined plan to address these barriers would be developed. Moreover, the knowledge base will help these organizations refine their strategies and prioritized plans. This allows for focusing on preparation for future projects, we conclude that over the past 4 decades, Iraq has spent billions of dollars in developing and improving the quality of healthcare and expanding its coverage in the country. Due to this rapid expansion, healthcare providers in Iraq have varied. This variation of health service providers has led to variations in the administration, financial management, and Information systems, which in turn led to a lack of a unified system for the health record. As a result, patient history is scattered amongst different healthcare providers with no one provider having the complete patient record except in very rare cases where the patient chooses to receive healthcare from one provider at all times. One additional negative impact of this problem is the great waste of efforts and money resulting from treating patients repeatedly for the same health problems in several medical centers. Patients may as a result be asked to repeat x-rays and other tests and may be given different medications, which may present patient safety threats.

Conclusion:-

As a result of the healthcare system need attention to and support from the government, Iraqi health services have advanced slowly over recent years in all levels of health services: primary, secondary and tertiary. As a consequence, the health of the Iraqi population has worsened. The MOH has introduced some reforms to its services but is not enough to improved healthcare system. Despite these Slow and complicated procedures. Health services, and in particular public sector health services, are still facing many challenges. These include: human resource development; separation of the MOH's multiple roles (financing, provision, control and supervision of health care delivery); diversifying financial sources; implementing the cooperative health insurance, privatization of public hospitals, effective management of chronic diseases; development of practical policies for national crises; establishment of an efficient national health information system and the introduction of e-health. In order to address these challenges and continue to improve the status of the Iraqi health care system, the MOH and other related sectors should coordinate their efforts to implement and ensure the success of the new health care strategy.

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