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Investigating quality and value added of Hospital Information System (HIS) in a medical and educational center of Shiraz

Dr. Rouhollah Tavallaee[1], Nahal Aarabi[2*]

[1] Faculty member of Shahid Beheshti University, Tehran, Iran, tavallaee.r@gmail.com
[2] PhD Student of Technology Management, Hamadan Branch, Islamic Azad University, Hamadan, Iran, aarabi@sums.ac.ir
*Corresponding author's E-mail: aarabi@sums.ac.ir

ABSTRACT

Considering positive effects of hospital information system on treatment process and organizational performance, it is necessary to evaluate the quality of services provided by such systems. Hospital information system is regarded as an integrated information system with potential effects on effectiveness and efficiency of hospital management. If information systems are inappropriately designed, they impose negative impacts on health care efficiency and quality. Organizational culture and employees' attitude toward information technology is a major factor affecting implementation of information systems. The present study was carried out to evaluate quality and value added of knowledge management.

Keywords: Hospital Information System (HIS), knowledge management, intellectual capital model, process, Picture Archiving and Communication System (PACS).

1. Introduction

Medical educational centers provide services for citizens. Such a center may be initially designed as a certain title, but after a couple of decades becomes a general or special hospital. Hospital information or HIS is comprehensive software for integration of information about patient for exchanging general information about patient among various units and other medical centers to facilitate medical care practices, quality and satisfaction and to reduce the costs. The main duty of HIS is to use computer and communication devices to collect, store and support hospital activities at practical, tactical and strategic levels. HIS objective is to establish a system for processing, retrieving and linking official and patient care information for all activities related to hospital. In designing HIS, requirements of all employees should be considered and the system should be compatible with users' skills and knowledge (Marjan Ghazi, 2013). In HIS, data should be stored consistently in data bases and be accessible to authorized users whenever and wherever needed; moreover data should be in a format compatible with special requirements of the user. In general, the main objectives of HIS can be summarized as follows:

- Enhancing personnel's efficiency level
- Elimination of redundant processes
- Optimization of managerial methods
- Implementing computer as the work tool
- Extraction of information and statistics by faster and more accurate methods
- Promoting health care services
- Establishing a well-designed and standard hospital system
- Linking the data to medical engineering systems
- Creating an information communication between hospitals and medical institutes across the country
- Achieving a distributed information bank at national level and communicating with global health care networks.

It is obvious that a great revolution will be achieved in health care and medical management by implementing HIS software that will be followed by:

1. Reduction of costs
2. Increase in revenue
3. Reduction of average patient staying index and bed occupation
4. Exact calculation of patient cost
5. Facilitating hospital budgeting process
6. Creating the best and timeliest hospital management tool
7. Homogenizing and equalizing hospital personnel working trend
8. Reduction of paper consumption as communication tool
9. Accelerating access to information
10. Optimization and facilitation of hospital operations
11. Optimization of related processes from clients' reception to discharge

12. Reduction of error probability in daily activities of the personnel
13. Improving medical servicing level (Minavand).

Extension of this system during recent two decades in various countries including Iran further elucidates its position. Implementation of this system in hospitals of different regions in Iran indicates availability of cultural infrastructure and suitable technology for creation and complementing medical systems according to global standards. Regarding rapid progress of technology in recent years, HIS has gained a new face which is valuable from both managerial and clinical perspectives. Availability of equipment equipped with clinical computer-based devices and softwares designed for special clinical and Para-clinical sections together with us of this software by developed medical societies, its applications for international communication and necessity for privacy in HIS field have directed this complex set of information and technology to integrated information architecture. During recent years, medical educational centers especially hospitals in Iran have initiated mechanization of their information systems. At first, the main goal for establishing such systems was to reduce the costs imposed by bureaucracy in official and manual systems; however, improved quality of medical care is now of great importance. Information systems prepared by a team or inspired by a technology optimize work flow and prevent from bureaucracy (Ro Bishop, 2015). The goal is to store all medical information of a patient in an electronic file that is accessible in every point of the country using global computer network. Unfortunately, the majority of software available in Iran is based on customer's demand and not a holistic and systematic vision; they are not compatible with each other as they are designed for different patients and creating a linkage among them is difficult and costly either from financial consideration for buyer or from engineering force for manufacturer. Availability of consensus standard, by reduction of abovementioned costs, is beneficial for both HIS developers and the corresponding users. HIS has practical capabilities representing a new issue in Iran. HIS is a software that, similar to every technology, is a two-sided coin. Its application, besides numerous benefits, imposes new limitations; while not using such a tool will hinders our country from development.

2. Literature review

In the hospital of interest, HIS software was implemented as is the case for other hospitals and the primary requirement is creation of proper infrastructure. Implementation of HIS depends on organizational revolution and all factors affecting this implementation should be carefully considered. In between, human force plays the most important role and thereby employees training, survey, informing and users' acceptance are crucial factors. Today, improved computer technology is a reliable and cost effective tool for integration of various practical softwares in medical and health care places. Its probable way is awareness based on facts and future demands. The most important step toward implementing HIS is to launch an integrated system for coordination and communication among different centers with ability to transfer information between medical centers ranging from health houses to the largest medical centers. Three important issues should be considered for HIS establishment:

1- Network and hardware infrastructure

2- Software (HIS)

3- Users

Before addressing these three issues, hospital should form a monitoring team. The hospital manager will be the head of this team. At least, manager of finance, a nurse, quality office manager, a computer expert and medical document expert should be present in this team. Super expert or expert of medical documents is assigned as the HIS manager (depending on ability of hospital human force). The team initiates its research based on a consistent plan and regular sessions. The first task is to find an experienced advisor for achievement of team goals. The main duty of this team is to study physical condition and HIS acceptance rate among hospital personnel and investigate change of manual system to HIS and to find a standard HIS. Informing managers of all units and paving the way for future change in the system provides organizational culture for accepting the new system. In attempting to promote HIS acceptance among the employees, managers should provide a hierarchical and developmental culture within the work place (Tabibi, 2013). Besides cultural task and preparing the personnel for system change and even participation of employees who are future users via request for suggestion, research on hardware can be initiated.

1. Network and hardware infrastructure

Establishing a contract with an authenticated company for launching the system within the hospital according to the latest technology in the country is the first step for hardware infrastructure. In this network, special foresights and upgrading possibility should be considered. For possessing a standard network and an appropriate backbone, advisor's comments and facilities of the contracted firm should be used as much as possible. It is also necessary to prepare network topography based on hospital building plan. A new unit called HIS management or hospital IT center should be added to the existing organizational chart. Server, administrator, central pack and even UPSs will be placed in this center. The next step is to estimate the number of active nodes and purchasing the same number of computers and accessory devices. Hardware especially server can be bought after selection of software according to compatibility with the software.

2- Software (HIS)

Regarding lack of sufficient knowledge about HIS among managers of Iran hospitals and medical universities, resulting from lack of an appropriate strategic planning by responsible authority in ministry of health and medics, and lack of IT unit in the hospitals and considering the importance of this step, two methods are proposed for obtaining the software among which managerial board and hospital manager along with HIS team should decide which one is compatible with hospital policies.

2-1- Purchasing a ready software (HIS)

The abovementioned team should investigate and gain sufficient information about the systems already exist in the country. Communication with HIS developers (ASPs) is not difficult. The best scenario is to ask the developer to introduce the most successful website or hospital under its

coverage. HIS team should visit and inspect that website carefully. Visiting the system closely, interviewing with users and operational managers and holding sessions with top and intermediate managers and even academic bodies who have launched the system and exploiting their experience will help to conclude and decide about that HIS.

2-2- Possession of an exclusive HIS for university or hospital

In this approach, instead of searching for a ready system, the university investigates native software developer firms and adopts the most authenticated and experienced one and makes a contract with that firm. The hospital becomes a pilot and an agent from the firm stays at the hospital and starts programming and system analysis in relation to HIS team. After preparing the first phase, the program is tested by assistance of HIS team and the work proceeds step by step and based on hospital requests; the program is modified until reaching the final phase. Besides its numerous advantages, the main disadvantage is that this approach is time consuming. By finishing programming procedure and final test, the system is actually launched. Success of this approach greatly helps the university because now it has a HIS that can install it in its affiliated hospitals and, more importantly, the university can create a link among its hospitals.

2. Users

Users are the actual owners of the software and the real players of the system. Without assistance of the users, no system will be successful. The main issue is resistance of users. Every change is followed by some types of resistance and changing manual system to an electronic one such as HIS would meet more severe resistance resulting from:

1- Users are accustomed to manual systems
2- Fearing that they can't work with new system
3- Fear of losing their position by advent of new system
4- Fear of losing current interested group
5- Uncertainty about the goals and intentions of managers for changing the system
6- And so forth

To fight this resistance, special measures should be taken before launching the system. Users should be aware about establishment of the system in advance so that their resistance will be minimized in the time of system launching. Computer training sessions can be held for the employees. Holding ICDL classes is the most effective choice in this regard (Nikmaram, 2008).

When system is established, manager and staff of HIS team together with HIS developer firm should teach the software to the users. A training plan should be set by the team manager and proposed to the units so that training program proceeds through the year. By increasing users' awareness about software and computer, the probability of system's success will be enhanced. A main issue about the users is retaining their motive and tendency to continue working with the system until their full dependency on the system. This task should be done by hospital management. Encouraging support is of especial importance during parallel working with manual and electronic systems which intensifies users' work load. On the other hand, strength, weakness, opportunities and threats without use of HIS and its related advantages were investigated. It can be concluded that to render these opportunities to strengths, it is necessary to

plan and mange and also to create some changes. Some hospital units such as diagnostic sonography, bone density and infirmary are so profitable and their extension and development requires assistance from the ministry. It should be mentioned that delegation of some units such as radiology, laboratory and pharmacy to private sector will increase profitability.

Establishment of HIS in the hospital took two years during which the most authenticated local company was selected and a strategic contract was signed.

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Considering Casten three dimensional model of knowledge strategy dimensions (Casten, 2007), hospitals are highly eager to active research, collection and extension of knowledge and are more interested in storing knowledge among the people instead of storing the knowledge in official storing devices or an internal network. Knowledge networks are the tools for communication among the expert within and out of organization to exchange knowledge for a certain goal. Knowledge importance depends on its application and knowledge management systems and strategies should accelerate knowledge flow to its application place. A major challenge for success of knowledge management systems is cultural factors and low tendency of people to share their knowledge. Knowledge sharing is an important issue and knowledge network is realized by this concept. Indeed, knowledge sharing is a new basis for innovation and application. Regarding HIS, presence of a network facilitates knowledge sharing. Since factors affecting knowledge sharing are divided in to two individual and organizational categories, knowledge sharing in HIS is realized by available network and every unit can share the knowledge needed by other ones. Hospital manager is often the responsible person for general and managerial decision making who, by means of knowledge sharing among various units, will be able to access the information required for decision making in a short time and hence can make decision on time. This will be followed by saving in time and other costs. Access limit is defined for all users. Among these users are hospital managers and every manager can direct his management toward a knowledge-based nature by information and knowledge he obtain from the system. Improvement of decision making process enhances discipline in the work and on time completion of works which consequently provides higher profits for the hospital (H Ahmadi, 2015). For example, when manager is aware about the materials stored in the store and demands of various units, he will be able to order the required items on time and thus prevents from lack of necessary items in the hospital. This is true for other cases.

3. Methodology

This is a descriptive research. Data have been gathered through questionnaire. Its statistical population includes staff of one Educational and health centers in Shiraz.

4. Finding

Knowledge management is not a new issue. Human civilizations have retained and transferred the knowledge through successive generations to understand the past and to predict the future. The thirst for knowledge is more intensified in modern dynamic business environments. Internet and information technology (IT) have created new challenge for creation, retention and management of the knowledge. During recent decades, philosophies, approaches and methodologies have been developed for business improvement. This development results from integration of business activities and scientific theories during recent decades. Literature review indicates that various issues related to economics, intellectual capital, organizational studies, human resources, etc have been proposed in this field. Considering three components of knowledge management including individuals, process and IT, establishing a proper IT-based infrastructure greatly helps knowledge management and is regarded as an appropriate tool for knowledge management. Integration of technology and human structure is necessary for moving toward organizational goals (Tavallaee and Rashidi, 2011). Knowledge management models express a wide range of visions cited in literature. Description of these models can be used in structural researches and organizational applications of knowledge management. Human resource indicates knowledge of employees in an organization. Employees create intellectual capital via their competence, attitude and agility. Human capitals include skills, proficiency, problem solving ability and leadership styles. Human resource for launching HIS includes all hospital employees including medical and official staff, managers and other personnel and their knowledge. Each individual has his own skills and suitable access limit based on their duties is defined in the system. Structural asset includes all non-human capitals including executive instruction, organizational graphs and strategies. The main topic of customer asset is information that attracts and retains the customers. In HIS context, customers are clients visiting the hospital and discharged after receiving the required services. Since scholars and participants of intellectual capital growth agree on three constituting components (human asset, structural asset and customer (relationship) asset), intellectual capitals are modified by structural, human and customers. Different models of intellectual capitals are compared in table 1.

Table 1: Comparison of different models of intellectual capitals

Model types / Dimensions of intellectual capital	intellectual capital	Scandia's navigator model	**intangible asset monitor**	Balance scorecard	Proposed model for HIS
Employees	Human capital	Human capital	Individuals' competence	Growth and learning	*Human capital*
Structure	Structural capital	Structural capital	Internal structure	Internal processes	*Internal processes*
Customers	Customer (relation) capital	Customer capital	External structure	Customer	Customer

According to table 1, dimensions of intellectual capital include employees, structure and clients cited in different models based on the priority given for measurement of internal and external social and human capital. Some models are more focused on customer, some on human and some on structure. In the model proposed for HIS, reliance should be on a strategy because hospital units are highly interdependent. In this model, for employees' dimension, human asset including medical and official staff and hospital manager are considered. In structure dimension, internal processes for various tasks are considered; and for customers' dimension, clients and customers should be considered. According to priority of model's dimensions and after determining the indices, a relevant questionnaire was prepared and after data collection and analysis, the following results were obtained:

- Regarding human asset dimension, items such as personnel efficiency level, using computer as work tool, information extraction by more accurate and faster methods, accelerated access to information, reduction of error probability in daily works of personnel and to some extent, improved quality were observed,. From managerial perspective, a growth was seen for optimal finding of managerial methods.
- Considering internal processes dimension, items such as elimination of redundant trends, establishment of a standard working system, equalization and homogenization of personnel work trend, reduction of paper usage as information transfer tool, increased revenue, optimization and acceleration of hospital operation and quality improvement were observed.
- Regarding customers dimension, since the clients were low income people and there was limited number of indices, items including optimization of related processes from registration to discharge of the clients, improvement of medical services and to some extent, satisfaction were observed. This situation implies that quality is improved.

Since HIS was established only two years ago, items such as data linking with medical engineering systems, establishment of national information communication between hospitals and achieving a distributed data bank across the country and its communication with global medical and health care networks was not measurable; evaluation of such items needs more time.

5. Conclusion

It seems that HIS establishment had positive effect on treatment and hospital performance. Organizational culture and employees' attitude to IT are among the factors affecting success of information systems. In evaluation of HIS quality and value added based on the proposed model (human asset, internal processes and customers dimensions), HIS success, quality improvement and value added were expected; in some cased improved quality was observed and in other cases, longer time was required.

Recommendations for future studies

The results obtained in this research contain remarkable notes that can be used in future studies. These notes include:

- In some cases, holding training sessions in the form of general and special workshops for users of each system seems necessary.
- Holding monthly regular sessions among users and experts of hospital and program seems necessary to reflect the requested and their results to hospital managers.
- A major function of every software is its ability to record the reports. It seems that required reports should be reviewed from both qualitative and quantitative perspective and necessary modifications should be made in the report recording to improve managerial decisions.
- According to the results obtained in this study, it is recommended that efficiency of the software be evaluated by assistance of the users in each unit in the form of individual and partial plans.
- Through the time and by linking the systems to each other, some recommendations can be suggested to establish information communication between hospital units (HIS and PACS) and also between medical centers across the country and to achieve a national information bank and communication with global health care networks.

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