Electronic Medical Record (EMR) Technology Acceptance by Healthcare Professionals in South Africa

Anju Mammen, Richard Weeks

Department of Engineering and Technology Management, University of Pretoria, South Africa

Abstract--**South Africa is in the process of implementing a multi-billion Rand National Healthcare Insurance (NHI) strategy, the objective of which is cost effective healthcare service delivery to all South Africans. An electronic health record (EHR) system will form a vital component of the infrastructure that needs to be put into place for managing healthcare services. A brief review of the literature reveals that in the healthcare sector, even though high-end technology and detailed planning were incorporated during Electronic Medical Record (EMR) roll-out at the healthcare hospitals and clinics, it is impossible to predict whether the system would be optimally utilised or not. The primary reason is that there exists some kind of resistance amongst healthcare professional towards the use of the EMR systems.**

Thus, managing the transformation from a paper-based to an electronic system is a complex process and it highlights the importance of understanding the human aspect associated with the technology rollout and system utilisation. Since the South African health care sector is in the preliminary stage of introducing EMR technology, it is deemed essential to gain an understanding of the human factors that will contribute to the successful adoption of the EMR system countrywide.

With this in mind, this research study aimed at gaining an understanding of the perceptions of EMR technology implementation and use among healthcare personnel. It focuses on aspects related to the type of technological system deployed, user skills and organisational compatibility. It also aims to find possible solutions that will directly influence the healthcare professionals in either accepting or rejecting the technology.

I. INTRODUCTION

"The South African population has grown from 46,5 million people in 2004 to 49,9 million in 2010. The burden of disease confronting the country has also increased. South Africa is faced with a quadruple burden of diseases consisting of HIV & AIDS and TB; high maternal and child mortality; non-communicable diseases; and violence and injuries".

Department of Health [13]

The introductory quotation attests to the problematic health conditions of the citizens of this country. It is a description that adds a sense of urgency to the need to get the National Health Insurance (NHI) project of the South African Government from the planning stage to an operational reality. It is here in particular that e-health as a concept can play a significant role in engendering effective healthcare service delivery.

Department of Health's [12] final objective of the e-health strategy is to implement a fully comprehensive and integrated National Health Information System. Achieving this goal implies a need for the introduction of ICT capabilities in the hospitals, clinics and all other related healthcare institutions. EMR systems constitute such a tool that can be used to positively addressing healthcare challenges.

A. The concept of EMR/EHR systems

Spratt and Dickson [30] state that, "An Electronic Medical Record (EMR) system represent a departure from traditional paper records that keeps information of patient demographics, medical histories, and all records of patient treatment stored in a computerized format". Emphasized in the definition are two characteristics of EMR systems: firstly, an EMR system stores information related to a patient encounter at a particular healthcare delivery facility and secondly, it is a tool used to move away from traditional paper-based records.

The World Health Organisation (WHO) [38] in a similar sense describes an Electronic Health Record (EHR) system as a systematic collection of electronic health information about individual patients or populations. It states that an EHR "*is a record in digital format that is capable of being shared across different health care settings, by being embedded in network-connected enterprise-wide information systems. Such records may include a whole range of data in comprehensive or summary form.*" [38]

In analysing the two definitions, it can be concluded that information stored in the EMR system, deployed in the grass root healthcare centre, will form a subset of EHR information. Though both of these systems are used at a different level, its core function is to record and maintain comprehensive patient information. Hence, for the purpose of this research both these systems are considered to be very similar in nature.

B. Implementing EMR Technology in South Africa's public healthcare sector: The reality

Hillestad, Bigelow, Bower, Girosi, Meili, Scoville and Taylor's [19] literature reveals various benefits associated with implementing an EMR system. The potential healthcare benefits include the use of health information for short-term preventative care, near term chronic disease management and long-term chronic disease prevention and management [19]. Similarly, Beiter, Sorscher, Henderson and Talen [3]; Thomas [33]; and Rantz, Hicks, Petroski, Madsen, Alexander, Galambos, Conn, Cawiezell, Stauffacher and Greenwals [23] indicate other positive benefits, such as protecting patients' privacy, continuity of care, safe delivery

of medications with multiple safeguards, and improving clinical documentation.

It is also very evident from research studies conducted overseas that there exists some kind of resistance amongst the physicians in the use of the EMR system (Archer & Cocosila, [2]; Boonstra & Broekhuis, [5]; Yarbrough & Smith, [40]). The case study conducted by Archer and Cocosila [2] on the EMR adoption rate in Canada indicates that the reluctance amongst the physicians is a complex issue that must be examined and addressed by considering the perceptions of physicians and other decision makers in private practices or clinics.

In another similar study conducted by Boonstra and Broekhuis [5], it is suggested that *"The slow rate of adoption suggests that resistance among physicians must be strong because physicians are the main frontline user-group of EMRs. Whether or not they support and use EMRs will have a great influence on other user-groups in a medical practice, such as nurses and administrative staff. As a result, physicians have a great impact on the overall adoption level of EMR."* In a similar sense Yarbrough and Smith [40], note that *"In 2001, the Institute of Medicine (IOM) recommended that both the public and private health sectors make commitments to end the practice of handwriting clinical information by the end of the decade. Despite this recommendation, the health care community in the United States is making very slow progress in achieving this goal."*

Thus, even though the benefit of implementing the EMR technology is well documented it can be established that is not an easy process to get it right. It is ultimately the end user that determines the degree of success by accepting and utilizing the technology optimally.

While healthcare sectors in first world countries have already started reaping the benefits of utilising EMR technology, for South Africa, which still is in a relatively early stage of the EMR technology implementation process, there still is a long journey ahead. This situation is clearly articulated in Hendrick's [18] research. Furthermore, Department of Health [11] expresses a view that the technology adoption rate within South Africa is rather slow due to underlying issues, such as infrastructure, connectivity, basic ICT literacy, human resources and affordability planning that need to be firstly addressed. Research evidence from Cilliers [6] also suggests that in the Eastern Cape adoption of telemedicine has been underused or not used at all in many sites where these systems have been introduced. The unfolding reality is one of a need to determine the underlying reason why e-health technologies are currently not being effectively utilised in practice and identify the factors that influence EMR technology adoption within the South African context.

Keshavjee, Bosomworth, Copen, Lai, Kucikyazici, Lilani and Holbrooket [21] synthesized an integrative, comprehensive, overarching framework that identifies people, process and technology as the three components that influence the successful implementation and adoption of the technology. Further, Weeks [37] recommends that a holistic approach that focusses on all aspects of technology, namely context (healthcare), people and systems must be adopted while planning, implementing and managing the NHI initiative. However, the focus of this research study is on human/people aspects that will directly influence healthcare professionals in either accepting or rejecting the technology.

C. Research objectives

The primary objective of this research study is to analyse the importance of the human dimension of EMR technology implementation and examine the role of change management in system implementation.

In order to achieve the primary objective, the following secondary research objectives were taken into consideration:
- Gaining insight into technological factors that will influence EMR technology adoption by healthcare professionals.
- Identify the skills considerations that need to be addressed for successful technology utilisation.
- Determine the organisational attributes that may serve as barriers or facilitate the implementation of EMR systems.

The research study is mainly based on the challenges with regard to the type of technological system deployed, the user skills needed and the organisational culture within healthcare institutions, and find possible solutions.

D. Conceptual Research Model
1) Understanding the perception of EMR technology amongst physicians

For the purpose of this research, we considered the Unified Theory of Acceptance and Use of Technology (UTAUT) model developed by Venkatesh, Morris, Davis and Davis [35] to understand the complexity in determining a healthcare professional's acceptance and use of technology. The UTAUT model considers four core constructs, which have an impact on a user's behavioural intention. These core constructs include performance expectancy, effort expectancy, social influence and facilitating conditions. Holden & Karsh [20] attest to the fact that knowing the factors that shaped one's intentions would allow organizations to manipulate those factors in order to promote acceptance and increase IT use. Within the UTAUT model factors, such as age, gender, experience and degree of voluntary use, are considered as moderators in that they influence the four core technology acceptance determinants. However, in the study we are mainly focusing on aspects that directly influence EMR technology acceptance, hence these moderators are not considered.

2) Skills requirement for EMR technology roll-out

Along with the initiatives taken by government to address specific ICT related challenges persistent in the South African healthcare sector, such as lack of basic infrastructure and facilities, and lack of ICT application, it also has to address two additional problems, that of human sources capacity and developing the required skills for e-health strategy implementation. The healthcare sector of South Africa also faces the challenge of a critical shortage of healthcare professionals. South Africa's Department of Health [13] has identified that the healthcare sector in South Africa has not grown sufficiently to meet the health needs and health system requirements of its people due to the prevalent human resource challenges and skill gaps. The Department of Health's [13] objective is to create a patient-centred, quality healthcare system, ensure universal coverage and universal access to healthcare, and enable an innovative and caring environment for health professional development and patient care. This is possible through a skilled workforce team. Thus, imposing the need to measure the level of computer literacy forms an imperative part of the implementation strategy before the implementation of EMR technology.

3) Influence of organisational culture on EMR technology rollout

In the healthcare sector any innovation that is perceived to be incompatible with the aim of providing improved patient service will ultimately lead to the rejection of the innovation by healthcare professionals. Hence, it is imperative to take into account the impact of organisational attributes on EMR technology acceptance. Though the UTAUT model covers some of these organisational attributes (such as facilitating conditions and social influence), when analysing recent literature published by Venkatesh and Zhang [34] it can be established that one key aspect that was not taken into consideration while developing the UTAUT model is organisational compatibility, also referred to as organisational culture.

Schermerhorn, Hunt and Osborn [29] define organisational culture as "a system of shared actions, values and beliefs that develops within an organization and guides the behaviour of its members". Culture can be conceptualised as a variable that influences an individual's perception of how things function and consequently acts as a behavioural determinant. Hence, according to Davies, Nutley and Mannion [8] organisational culture can be interpreted as "the way things are done around here". Wise's [39] analysis of the concept of "technological culture" suggests that technology is something that is inseparable from everyday life and culture. With this in mind, it can be conceptualised that with the introduction of the EMR system (technology) it will influence ways of doing things within the clinics and hospitals, hence the need to understand its impact on technology adoption and use.

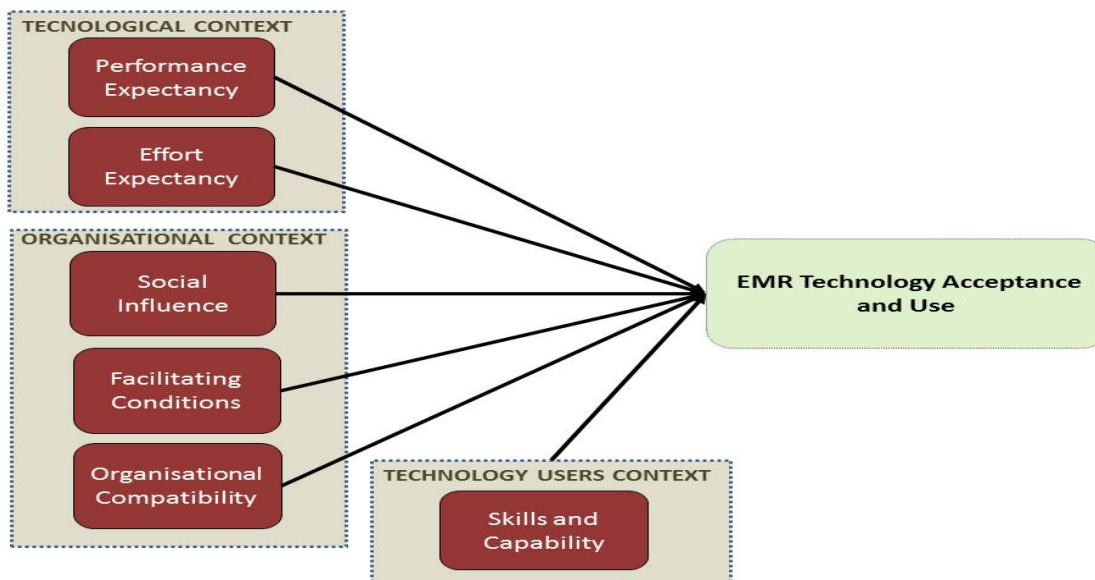With the preceding discussion, the research model developed for this research study is depicted in figure 1.

Figure 1: Modified UTAUT Model
Source: Adapted from Venkatesh, et al. [35]

II. RESEARCH METHODOLOGY

A. *Research approach*

The research study methodology adopted was analytically descriptive and not statistically oriented in nature, thus constituting a qualitative research study. This approach was deemed appropriate, since the descriptive insights gained from the technology users and technology suppliers would provide rich information on the challenges encountered in practice. The research design in effect therefore followed a narrative, enquiry-based approach, the accent being on learning from interviewees "hands-on" experience.

B. *Research process*

The research process entailed a literature research to gain an understanding of the key concepts of the research study, as well as to build a theoretical model to serve as bases for the research. The research study further constituted a narrative enquiry. Information was gathered by means of a semi-structured interview process with the relevant managers involved during the technology implementation process. The aim was to gather "narratives" from the respondents interviewed as regards their perceptions as to EMR technology and challenges that they faced during the technology introduction and its utilisation.

C. *Research sample and interview background*

The data collection primarily focused on healthcare technology providers and solution implementers who have successfully rolled-out healthcare technologies at South African healthcare facilities. Amongst various technologies that are currently available in South Africa, the enterprise content system (ECM) from Datacentrix, EMR technology from Synaxon and mobile healthcare technology from Mezzanine were considered for the purpose of this research study. The research included interviews conducted with healthcare delivery practitioners, nurses and electronic data capturers, as well as healthcare social workers at a particular clinic in Gauteng that is a pilot site for the NHI initiative. It was agreed that all respondents from the clinic would remain anonymous for the purposes of the research according to confidentiality agreements. Respondent names are consequently not divulged and referred to as "Respondent A", "B", and so on up to "G". Table 1 illustrates the identified roles and the corresponding respondents for each role that were intervened at the clinic.

TABLE 1: IDENTIFIED ROLES OF RESPONDENTS INTERVIEWED AT THE CLINIC

Representative Role	Respondents
Senior Medical Officer	Respondent A
	Respondent B
Dentist	Respondent C
Professional Nurse	Respondent D
Administrator	Respondent E
Data Capturer	Respondent F
Group of Healthcare Workers	Respondent G

Source: Own research

Due to the time consuming nature of interview approach, only one clinic and three service providers were selected for conducting the interviews. In addition, due to the conversational nature of narrative inquiries, the research questions were not always specifically phrased as presented in this report. The questions were paraphrased and adapted depending on the responses received from the interviewees. Notably, the respondents were extremely open to share their extensive experience, views and insights that they had acquired in practice.

III. RESULTS

A. *Gaining an understanding of the "system user's" perception of EMR technology*

Questions 1: Do you believe that adopting the digital route to capture patient information will play an important role in improving clinical health services or do you prefer to continue working with the paper-based system?

Questions 2: What are your major concerns about the health information (EMR) technology?

Questions 3: What key features and functionalities do you expect from the technology that will allow you as system users to improve medical service quality and embrace the technology?

The purpose of the above questions was to discover the technological factors that would influence the technology adoption process. During the interview process with healthcare clinicians, it appeared that they share mixed feelings about the technology. According to Respondent A [24] **system practicality,** namely the capability of the system to meet users' requirements and allow them to get their work done efficiently, and **interoperability** with other health information technologies are important criteria for technology acceptance. Respondent D [25] confirmed that clinicians do not have the luxury to spend lots of time with a single patient; hence, the system should be easy to use and should allow them to record the patient information easily. **System usability** featured as another critical feature. The healthcare workers interviewed, Respondents G [27], appeared to share the same sentiments.

Respondent E [26] claimed that a major problem experienced with the system is that it is slow, "*It takes fifteen minutes to register a patient in early hours of the mornings which is not feasible when there are sixty patients queued at half past seven.*" This affects the overall clinic productivity**.** System **speed (system performance)** to retrieve data emerged as an important factor needing consideration. Other factors mentioned include **system availability, data security and multi-disciplinary integration**. Specifically noted in the interview was that the clinic served as a training centre for medical students making it imperative that the system design incorporates an additional level of supervisory approval on the diagnosis and the prescribed medication. Respondent A

[24] explained, *"we are a teaching facility and we cannot make short notes. There are lots of things that we need to ask the patient. My concern if we spoon feed the students using the system then when the system is not available the student forgets to pose critical diagnosis questions to patients."* Consequently, technology **flexibility to accommodate all users'** needs is a major concern for healthcare professionals. In general, the concerns raised by "technology users" essentially revolve around system performance and usability. As long as the technology allows the clinicians to optimise and improve healthcare service delivery, they are willing to explore the use of the system.

According to Davidson and Chismar [7], when the EMR system can help realize the vision of increased multidisciplinary cooperation, increased standardization of clinical decision-making, increased flexibility of physician preferences for system interfaces, and increased interdependence of practitioners and staff through system operations, it will influence technology adoption and acceptance. Another similar study by McGinn, Gagnon, Shawn, Sicotte, Mithieu, Leduc, Grenier, Duplantie, Abdeljelil and Legare [22] idendified the few other factors that influences technology adoption. Factors related to technology includes perceived usefulness, productivity, resources available, outcome expectancy and interoperability. The literature, therefore, tends to support the findings emanating from the interviews conducted. Tierney, Pageler, Kahana, Panteleoni and Longhurst [32] documented the effects of introducing EMR technology on medical students and found that EMR system enables content relevant education, facilitates research and quality improvement education, reduces time spend on data gathering, allows efficient profiling and tracking of trainees, and offers potential for effective integration of network of care providers. This enhances system utilization. The literature, therefore, appears to support the findings emanating from the interviews conducted.

B. ICT skills requirement for effective utilisation of the technology

Question 4: Can you describe the key ICT skills shortages that exist in the healthcare sector?

Question 5: What measures were taken to address these challenges?

The purpose of the referenced questions were to determine prevalent skills challenges and identify appropriate measures to proactively address them.

In general, respondents concurred that there exists information and communication technology skills shortages in the healthcare sector. Respondent D [25] in concurrence stated that *"I have a colleague that doesn't know anything (referring to computer knowledge) ... can't even press the required button on the computer ... who is most of the time working here ... how do they expect her to work here?"*

Dorrington [15] classified skills shortages into technology user skills shortages and IT technical skills shortages. He indicated that the clinical staff (physicians) exhibit a competent level of computer knowledge. However, the challenge lies within the nursing community. Dorrington [15] mentioned that "the *problem area tended to be the clerks and nursing staff... at one of the hospitals the nursing staff made it clear that their job is to take care of patients and not chuck the keyboard so that was a big challenge...and this attitude is because they have zero IT skills"*. Other ICT skills shortages highlighted included core IT technical skills, which involves understanding the system specification, designing the network architecture, and building the LAN infrastructure and hosting facility. The hospitals do not have dedicated IT resources to administer the network infrastructure, which imposed a significant challenge during the implementation.

Dorrington [15] indicated that scheduled training sessions and system demonstrations on the ECM system were organised and played a significant role in ensuring the people concerned had acquired the required skills. As noted by Daniels [9], there is consensus that South Africa is characterised by an acute shortage of highly skilled computer-related professionals. Healthcare professionals therefore need to know how to use technologies optimally. Consequently, the Health Professions Council of South Africa (HPCSA) included programmes that will improve their ability to use computer-based technologies and IT skills form part of curriculum reform, according to Seggie [28]. Similarly, Asah [1] articulates that computers are completely under-utilized by the nursing profession as nurses are still sceptical about the use of computers. The study recommends the introduction of computer training to transform the current situation and for nurses to become computer literate. Early exposure to computers at the nursing colleges will promote the development of positive attitudes towards computer use and bridge the digital gap. Thus, it can be concluded that the literature tends to support the findings emanating from the interviews conducted.

C. External facilitating conditions that influence the adoption of technology

Question 6: Can you explain the critical role players and their role in enabling the technology adoption?

Question 7: What were the major challenges faced during the implementation of the project?

Question 8: Describe the impact on the performance of the organisation after introducing the technology.

Question 9: Do you think that the introduction of the technology has changed the way the healthcare centre operates/functions?

The questions were directed at gathering information on organisational factors that influenced the implementation and change management process. Vest [36] contends that, though most attention is given to technological barriers, other non-

technological factors, such as organisational characteristics and environmental conditions hinder the implementation of effective Health Information Systems (HIS). Hence, it is critical to conduct an analysis of these factors.

1) Facilitating conditions

Pertinent insights gained from the interviews, that necessitates consideration, is the issue of 'resistance to change'. Responded B [24] confirms that *"Huge resistance has been picked up…especially because I think the previous time we tried to implement the system it did not work …There are few other things they don't want; they don't like an appointment system for patients. They don't want an appointment system, but with the system we will have appointments. It is new way of running the clinic."* Suggested therefore is that the more radical the transformation, the more difficult it will be to get the users on board. A step-by-step approach can be more effective, as it permits time to adapt to the change. Clearly, it is critical for organisations to follow a systematic and a phased **change management** approach when implementing a radical change within an existing working system. The literature study by Goddard [16] provides supporting evidence.

Emerging from the interview process is the need to follow a well-managed **project management** approach for the EMR implementation. Strydom [31] stated that one of the challenges of dealing with a healthcare project is the need to actively manage project timelines. A project with clearly defined requirements and led by a project champion with sound leadership skills and understanding of project management processes can reduce project implementation failures. This challenge can be addressed by adopting a team approach from the project inception to the system handover and utilisation phase. Hartley [17] accentuates the fact that implementation needs to be a team effort that includes the EHR system vendor, the project manager, the information technology team and physician champions.

IT network capability within the South African public sector institutions **and broadband penetration** remain areas of concern. De Jongh [14] maintained that *"…the absolute challenge experienced with our systems is broadband connectivity."* Lastly, **user training and post-implementation support** are targeted as critical factors that influence EMR implementation. Dorrington [15] indicated that *"...very little technical support is required it is more of user support that is required."* Since South Africa's healthcare sector is characterised by a critical shortage of medical staff and high patient turnover, training programmes are affected because the staff are overworked and they cannot make time during work hours to go on training. Therefore, it is essential for management to focus on balancing the workload.

2) Social influence

In terms of social influence that drives the technology acceptance, the research focuses on internal social factors, mainly the healthcare management team who work closely with technology users and understand the complexity within the healthcare service system. From respondents' answers, it became apparent that without the **senior management involvement and commitment** into the project, it is practically impossible to implement change reforms. Dorrington [15] contends that *"One of the key factors is that you need senior management buy-in, if your senior managers don't truly believe in it you going to struggle."*

Bonner, Ruekert and Walker [4] attests that radical projects need some level of strategic direction concerning the objectives to be accomplished and the procedures to be followed. Early and interactive decision-making on control mechanisms, such as goals and procedures for monitoring and evaluating the project, will facilitate better results on the project. Thus, the **leadership** role played by the senior management team influences the EMR technology adoption. Lastly, management also plays a significant role in ensuring that measures are put in place to see that all staff members are enthusiastic and motivated to use the system and adapting to the change.

3) Organisational compatibility/culture

The picture that emerges from the interviews conducted with technology users is that the use of paper-based medical record systems has created values, beliefs, norms and practices that have become ingrained in medical practitioners' mind-sets. They believe that the existing paper file system allows them to get their job done effectively; hence, they do not see the need to change. In response to the question presented to interviewees regarding their opinion/belief about the EMR system, a trend emerged which seemed to suggest that physicians and nurses are not comfortable with the transition from the existing paper-based files to an electronic system. The apparent reasons are that uncertainty exists as to how the system will affect day-to-day clinical operation. Thus, the effect of cultural change on the job performance is an important aspect that requires attention.

Analysing the responses gathered on how the system will change the way things are done at the clinic, Respondent D [25] was of the view that it will not have a major impact and that they will still continue to function as they have always done in the past. Respondent B [24] highlighted certain functions within the clinic will change with the technology introduction, an example being the appointment system that will influence the registration process. However, Respondent A [24] indicated that it is not yet possible to comment on the impact of the change on the organisation culture, since the system is not currently fully functional. Thus, three different views emanated, which reflect lack of clarity on the future state of the clinic.

When comparing this with the ECM system deployed at the Khayelitsha and Tygerburg hospitals, the element of culture change is also evident. However, as expressed by Dorrington [15], the change was welcomed by most of the people involved. Datacentrix starting with scanning in the patient records and making the digital copy available to physicians and nurses, and at the same time retaining the paper-based system introduces a gradual cultural change. Once the users are accustomed to and comfortable with the culture of using the computer to retrieve patient information, then the next stage where physicians and nurses start capturing patient information on the system. By following this process, the change in the culture was not so drastic but more emergent in nature, thereby providing users with sufficient time to adapt to the change.

Datacentrix [10] reiterates the advantages of deploying the system, which includes removal of bottle necks (long waiting line for files), eliminating the movement of physical patient records and thus minimising the potential issue of lost files and creating "anytime anywhere" access to scanned content, and at the same time preserving wet signatures and hard copies for regulatory compliance. By showing the benefits and at the same time preserving the traditional culture allowed technology users to accept the change easily. This approach is termed as evidence-based interventions. By retaining aspects of the traditional culture and incorporating new emergent meanings and values, practices found to be more effective will emerge into a new dominant culture.

D. 'User habit' – A factor that influences EMR technology adoption

When referring to the clinicians' reactions towards the EMR technology, the consensus has been that they have portrayed and expressed interest in the use of technology in their day-to-day clinical operations. However, other healthcare staff members, such as the nursing and administrator staff, portray reluctance and anxiety towards the use of technology. This is because these users are habituated and comfortable to function in a defined way. Dorrington [15] noted "*the younger the user the easier it is to make them comfortable with the system, however there are exceptions. This is because in their whole working career they had to stay informed with what's happening around ... In general the longer they have been working in a particular way the harder is it to change their mind set*". Thus, user habit forms an integral aspect that needs to be considered when introducing a new technology within the healthcare sector.

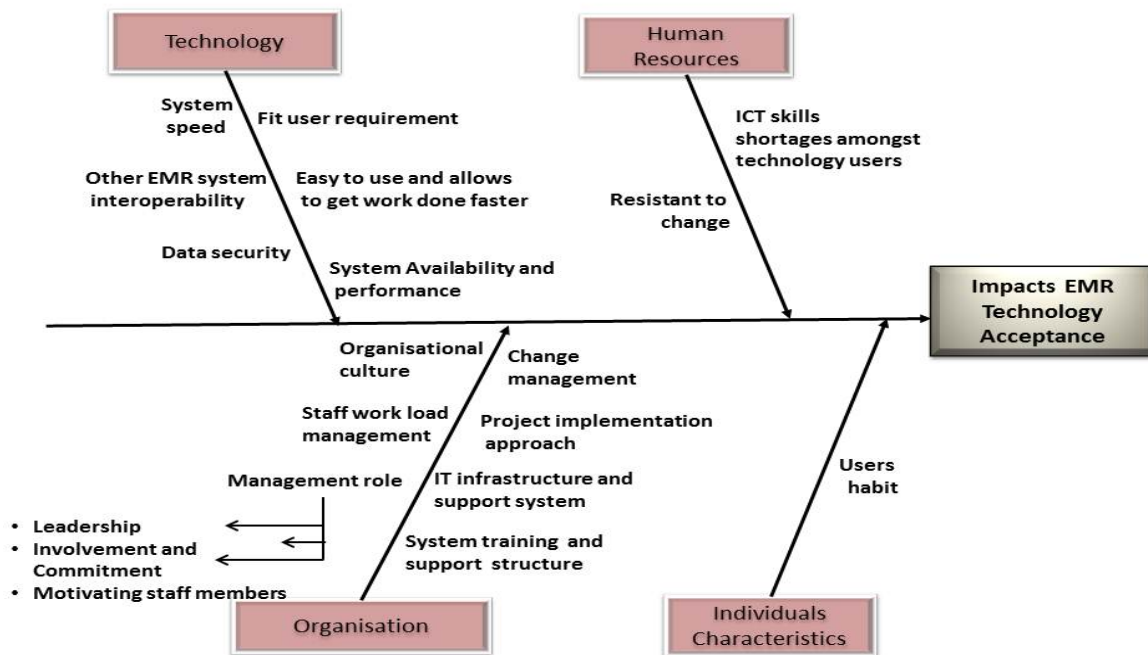In summary, the findings of the research are presented in figure 2.

Figure 2: Fish-bone diagram
Source: Own research

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Understand healthcare professionals' expectations from the EMR technology

Based on the responses derived from the interviewees, it is evident that users require a system that will allow them to do their job efficiently. The research model illustrates two factors, performance expectancy and effort expectancy that influence technology adoption in healthcare. Also according to literature, they are ranked as the top two factors that influence technology acceptance. Other technological factors that were identified during the interview process include: system availability, interoperability, speed, multi-disciplinary integration, flexibility, data security and ease to use the system. They have also been supported in the research literature, thus confirming the significance of considering these factors when introducing a new technology in the healthcare sector.

It is therefore, recommended that a holistic approach must be adopted when designing and implementing an EMR technology within the healthcare institutes around the country. Each technology user group's expectations from the system differs which, in turn, influences their decision to adopt a new technology. Adopting the basic systems engineering principles of system development which is establishing the user requirements prior to technology roll-out will ensure that challenges and expectations within each user group are met. The outcome of engaging with all relevant stakeholders and incorporating all aspects of system life-cycle and users' needs will be a well-designed and value adding system which will be easily acknowledged and utilised. Hence, careful planning and on-going, critical evaluation of progress are central to the successful implementation of major health information technology. Taking a lifecycle perspective on the implementation of technological systems will help organizations to avoid some of the too commonly encountered pitfalls and improve the likelihood of successful implementation and adoption.

B. Key ICT skills deficits identified in the South African healthcare sector.

Respondents from the healthcare institutes, as well as the healthcare technology service providers, concur that they face challenges and resistance to use the system amongst certain healthcare professionals (such as nursing staff) due to inadequate computer literacy. The literature study also supports the above observation and affirms the validity of the objective under consideration. The research reveals that not only user IT skills shortages are prevalent in South Africa, but the country also lacks the required competency to design and implement IT infrastructure. Hence, from a skills development perspective, it is contended that significant consideration must be given to the development of both computer usability skills and IT systems infrastructure design and implementation.

Therefore, it is recommended that focused planning and setup of well-designed training programmes and facilities are required in order to address these challenges. User training can be provided through on-job training and personal development programmes, which requires the support of the management team. Another recommended way of promoting the use of computers within the healthcare sector is through supporting computer-based applied interventions in people's day-to-day work at secondary and tertiary education institutes. By using these two approaches there will be a time when they will converge and the output will ensure IT literate healthcare professionals.

C. Organisational factors that influence EMR technology adoption

An important conclusion derived from the discussion is that social influence, facilitating condition and organisational culture play a significant role in enabling the technology acceptance process. The study identified that the ECM technology received a warm welcome while, on the other hand, there exists uncertainty and resistance to utilise the EMR system at the clinic in Gauteng. The major difference lies in the strategic intervention of adopting a phased approach in introducing the new technology. By initially retaining the paper files to record patient diagnoses and at the same time, ensuring that the clinicians and other healthcare practitioners can access this information the next time only via the ECM system gives the users the flexibility to adapt themselves to the change. Though the final objective is to move completely to a paper-less environment, it has to be managed so that it does not create a conflicting and restrictive environment. It is, therefore, suggested that pertinent thought be given to organisational culture when implementing the EMR system in public sector healthcare facilities.

D. Fourth construct that influences EMR technology acceptance

During the research interviews it is evident that 'user habit' has significant to any new technology adoption process. The longer the users are accustomed to working in a particular way, the more difficult it is to change the habit. Hence, it is recommended that necessary measures must be taken in order to ensure that the use of computers and the development of ICT skills are encouraged at the secondary and tertiary institutions particularly amongst the nursing community. Implied is that the earlier they are exposed to the use of healthcare technologies, the easier will be the adoption process. Consequently, a new construct called 'individual's characteristics' has been incorporated in the UTAUT model. Figure 3 depicts the adapted framework for EMR technology adoption, based on the insights gained from this research study.
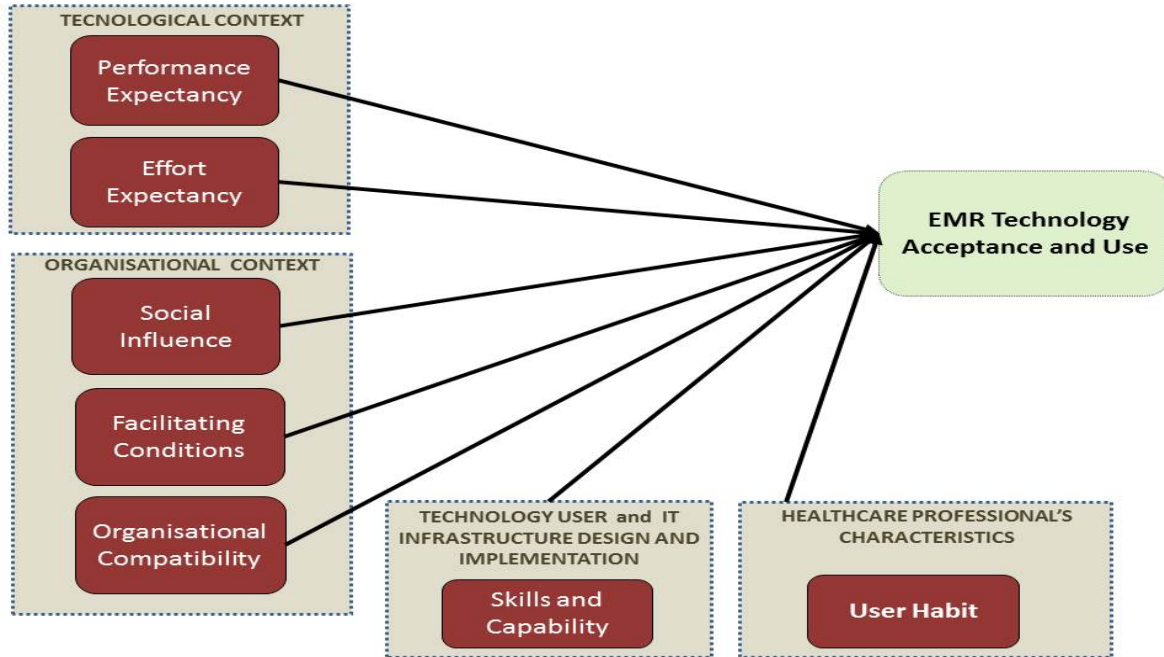
Figure 3: Framework for EMR technology adoption
Source: Adapted from Venkatesh, et al. [35]

REFERENCES

[1] Asah F. 2013. Computer usage amongst nurses in rural health-care facilities in South Africa: obstacle and challenges. Journal of Nursing Management, 21(3):499-510.

[2] Archer N. & Cocosila M. 2009. Improving EMR System Adoption in Canadian Medical Practice: A research model. In: Proceedings of the 2009 World Congress on Privacy, Security Trust and the Management of e-Business. Canada, 25-27 August, Saint Jones: New Brunswick.

[3] Beiter PA., Sorcher J., Henderson C. & Talen M. 2008. Do electronic medical record (EMR) demonstrations change attitudes, knowledge, skills or needs? Informatics in Primary Care, 16(3):221-227.

[4] Bonner JM., Ruekert RW. & Walker OC. 2002. Upper management control of new product development projects and project performance. Journal of Product Innovation Management, 19(3):233-245.

[5] Boonstra A. & Broekhuis M. 2010. Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions, BioMed Central Health Services Research. [Online] Available at: http://www.biomedcentral.com/1472-6963/10/231 [Accessed on 30 September 2012].

[6] Cilliers L. 2010. Critical success factors for Telemedicine Centres in African countries. [Online] Available at: http://ufh.netd.ac.za/handle/10353/384 [Accessed on 28 September 2012].

[7] Davidson EJ. & Chismar WG. 2007. The interaction of institutionally triggered and technology-triggered social structure change: An investigation of computerized physician order entry. MIS Quarterly, 31(4): 739-758.

[8] Davies HTO. Nutley SM & Mannion R. 2000. Organisational culture and quality of healthcare. Quality in Health Care,9(2):111-119.

[9] Daniels RC. 2007. Skills Shortages in South Africa: A Literature review. [Online] Available at: http://dspace.cigilibrary.org/jspui/handle/123456789/7482 [Accessed on 4 August 2013].

[10] Datacentrix. 2012. Khayelitsha hospital creates and maintains electronic patient records. Infocentrix, 2012(1):8-9.

[11] Department of Health. 2011. National Health Insurance in South Africa. [Online] Available at: http://www.polity.org.za/article/national-health-insurance-in-south-africa-policy-paper-august-2011-2011-08-12 [Accessed on 28 September 2013].

[12] Department of Health. 2012(a), National e-Health Strategy South Africa 2012-2016. [Online] Available at: http://www.doh.gov.za/docs/stratdocs/2012/ehealth_Strategy_South_Africa_2012-2016.pdf. [Accessed on 28 September 2012].

[13] Department of Health. 2012(b). Human Resources for Health Strategy for Health Sector2012/13-2016/17. [Online] Available at: http://www.doh.gov.za/docs/stratdocs/2012/hrhstrat.pdf [Accessed on 24 August 2013].

[14] De Jongh J. 2013. Electronic Medical Record (EMR) Technology Acceptance by healthcare professionals in South Africa. (Mr De Jongh is the Chief Executive officer at Synaxon and is involved with the EMR project at the clinic in Gauteng).

[15] Dorrington C. 2013. Electronic Medical Record (EMR) Technology Acceptance by healthcare professionals in South Africa. (Mr Dorrington is the ECM, project manager at Datacentrix and was responsible for the management of the ECM project at the hospital).

[16] Goddard BL. 2000. Termination of a contract to implement an Electronic Medical Record System. Journal of the American Medical Informatics Association, 7(6):564-568.

[17] Hartley CP. 2010. Managing your practice's transition from paper to EHR. [Online] Available at: http://www.physicianshr.org/docs/The-Path-from-Paper-to-EHR.pdf. [Accessed on 8 August 2013].

[18] Hendricks F. 2012. Factors to Consider when Planning an Electronic Health Record (EHR) System Implementation: Global Lessons for South Africa. [Online] Available at: https://scholarsbank.uoregon.edu/xmlui/bitstream/handle/1794/12256/Hendricks2012.pdf?sequence=1 [Accessed on 25 August 2013].

[19] Hillestad R., Bigelow J., Bower A., Girosi F., Meili R., Scoville R. & Taylor R. 2005. Can Electronic Medical Record Systems Transform Health Care? Potential Health Benefits, Savings and Costs. Health Affairs, 24(5):1103-1117.

[20] Holden RJ. & Karsh BT. 2010. The technology acceptance model: Its past and its future in healthcare. Journal of Biomedical Informatics.43(1):159–172.

[21] Keshavjee K., Bosomworth J., Copen J., Lai J., Kucukyazici B., Lilani R. & Holbrook AM. 2006. Best practices in EMR implementation: a

systematic review. [Online] Available at: http://www.competestudy.com/documents/Best_Practices_in_EMR_Implementation.pdf [Accessed on 24 February 2013].

[22] McGinn CA., Gagnon M., Shawn N., Sicotte C., Mathieu L., Leduc Y., Grenier S., Duplantie J., Abdeljelil AB. & Legare F. 2012. Users' perspectives of key factors to implementing electronic health records in Canada: a Delphi study. BMC Medical Informatics and Decision Making, 12(105):1-13.

[23] Rantz MJ., Hicks L., Petroski GF., Madsen RW., Alexander G., Galambos C., Conn V., Cawiezell JC., Stauffacher MZ & Greenwals L. 2010. Cost, Staffing and Quality Impact of Bedside Electronic Medical Record (EMR) in Nursing Homes.Journal of the American Medical Directors Association. 11(7):485-495.

[24] Respondent A. & Respondent B, 2013. Electronic Medical Record (EMR) technology acceptance by healthcare professionals in South Africa. (The respondents are the senior medical officers in the clinic)

[25] Respondent D, 2013. Electronic Medical Record (EMR) technology acceptance by healthcare professionals in South Africa. (The respondent is a professional nurse at the clinic)

[26] Respondent E, 2013. Electronic Medical Record (EMR) technology acceptance by healthcare professionals in South Africa. (The respondent is the clinic administrator)

[27] Respondent G, 2013. Electronic Medical Record (EMR) technology acceptance by healthcare professionals in South Africa. (The respondents are the health workers posted at the clinic)

[28] Seggie JL. 2010. MB ChB curriculum modernisation in South Africa: Growing doctors for Africa. African Journal of Health Professions Education, 2(1):1-14.

[29] Schermerhorn JR., Hunt JG. & Osborn RN. 2008. Organizational behaviour, 10th ed. Jefferson: John Wiley.

[30] Spratt AD. & Dickson KE. 2008. Change factors affecting the transition to an EMR system in a private physician's practice: An exploratory study. Proceedings of the Academy of Health Care Management, 5(2):21-25.

[31] Strydom C. 2013. Electronic Medical Record (EMR) Technology Acceptance by healthcare professionals in South Africa.(Mr Syrydom is the senior architect at Mezzanine and is involved with the EMR project at the clinic in Gauteng).

[32] Tierney MJ., Pageler NM., Kahana M., Panteleoni JL. & Longhurst CA. 2013. Medical Education in the Electronic Medical Record (EMR) Era: Benefits , Challenges and Future Directions . Academic Medicine, 88 (6):748-752.

[33] Thomas P. 2010. Improving clinical Documentation in the EMR world. Healthcare Financial Management, 62 (2):70-74.

[34] Venkatesh V. & Zhang X. 2010. Unified Theory of Acceptance and Use of Technology: US Vs. China, Journal of Global Information Technology Management, 13(1):5-27.

[35] Venkatesh V., Morris MG., Davis GB. & Davis FD. 2003. "User Acceptance of Information Technology: Toward a Unified View". MIS Quarterly, 27(3):425-478.

[36] Vest JR. 2010.More than just a question of technology: Factors related to hospitals' adoption and implementation of health information exchange. International Journal of Medical Informatics, 79(12):797-806.

[37] Weeks RV. 2012. Healthcare Services Management: A Systems Perspective. Journal of Contemporary Management, 9:382-401.

[38] World Health Organization. 2006. Electronic Health Records: Manual for Developing Countries. [Online] Available at: http://www.wpro.who.int/publications/docs/EHRmanual.pdf [Accessed on 15 August 2013].

[39] Wise JM. 2006. Technological culture. [Online] Available at http://www.cct.go.kr/data/acf2006/mobile/mobile_keynote2_Macgregor.pdf; [Accessed on 25 August 2013].

[40] Yarbrough A. & Smith T. 2007.Technology Acceptance among Physicians: A new take on TAM. Medicare Care research and review, 64(6):650-672.