*MEDINFO 2010*
*C. Safran et al. (Eds.)*
*IOS Press, 2010*

*doi:10.3233/978-1-60750-588-4-396*

# EHR Implementation in South Africa: How do we get it right?

**Parimalaranie Yogeswaran[a], Graham Wright[b]**

[a] *Department of Family Medicine, Faculty of Health Sciences, Walter Sisulu University, Mthatha, South Africa*
[b] *Health Informatics Research Team, Faculty of Health Sciences, Walter Sisulu University, Mthatha, South Africa*

**Abstract**

*In an environment of expanding demand on the health care system to provide equitable, accessible and safe health care, usage of information communication technology is one of the strategies identified to fulfil such expectations. Electronic Health Record (EHR) is an important tool towards achieving better health care using such technology, although, across the world EHR implementation has experienced a high failure rate. Nevertheless South Africa has made a strategic decision to implement EHR system in the public health sector. An evaluation toolkit was developed, to measure the state of readiness of health institutions in South Africa in implementing EHR based on Kaplan and Norton's work on Balanced Score Card (BSC), and the subsequent variant model developed by Protti. A Critical Success Factor (CSF) scorecard to assess the state of readiness and a Balanced Score Card matrix to be used as a strategic framework was developed. These tools were validated using critiques by a panel of experts. The toolkit developed has the potential to assist the organization towards a better EHR implementation path.*

***Keywords:***

BSC, Balanced Score Card, Evaluation, EHR Implementation, Critical Success Factors

## Introduction

South Africa is a developing country consisting of vast rural areas. The South African Health Care System consists of public and private health sectors. The Public Health sector caters for 82% of the population, and accounts for 40% of health expenditure. The balance of the population (18%) is served by the private sector, which enjoys 60% of the health expenditure. The public sector is funded and provided for by the state through its National and Provincial Department of Health (DOH). Health services are free at the point of delivery in the primary health care facilities. The secondary and tertiary levels of health services are provided for a nominal payment, based on each individual's income. However, vulnerable populations such as children (under 18years), elderly (over 60 years), pregnant mothers, and patients suffering from conditions like Human Immunodeficiency Virus (HIV) infection, tuberculosis and epilepsy and so on, receive free health services, even at the secondary and tertiary levels.

The country is inundated with inequitable health service delivery between its rich and poor, as well as rural and urban populations. The use of technology is hoped to improve the quality of health services, as well as reduce the inequality between rural and urban health service delivery.

Although advanced Information Communication Technology is available in many urban healthcare institutions, most rural facilities do not even have computer technology. On the other hand, even though the telephone infrastructure is lacking in rural parts, mobile phone technology (e.g. 3G technologies) is widely used across the country.

The potential benefits of the EHR system (better, safer and equitable health care) are well known,[1-3] but more than 50% of the information systems either fail, or fail to be utilized to their full capacity.[4,5] Even among developed countries, the degree of adoption of EHR varies largely.[5] Lessons learned from the past caution us about the barriers and challenges facing EHR implementation projects in healthcare institutions.

Many models [5-9] have been presented by researchers for the successful implementation of information systems in healthcare sector. However, none of them is a readymade solution to the problem, as implementation is highly dependent on the context of the organization, with its technology, people and organisational issues. The degree of adoption of EHR is difficult to predict, as it has been shown that different organisations, and different units within one organisation, adopt some functionality of the EHR better. [10]

Healthcare organisations are complex due to the fact that various units, divisions, people, sectors and technology, all work together to reach an objective. In complex organisations, the poor performance of one area, affects the performance of the other areas, essentially giving rise to the snow ball effect. Therefore, complex healthcare organisations present huge people, and organisational, issues in the quest to change from paper to EHR. [11]

More and more emphasis is put on the need to address the people and organisational issues for achieving success. [12-17] The EHR should not be seen as a technological issue, but rather as a socio-technological one.[15] The emphasis is on the requirement for the technology to change to adapt people's work flow, and the people to adapt to a different way of work-

ing to adopt the technology. Success will be difficult without this 'fit'.

The aim of the project was to illustrate a way to maximize the chances of success in the envisaged National EHR implementation project in South Africa. The objective was to develop a toolkit to assess the state of readiness of health organisations in South Africa to implement EHR. In order to fulfil this objective, two instruments have been developed based on Kaplan and Norton's work on Balanced Score Card (BSC), and the subsequent variant model developed by Protti.; first, a critical success factor (CSF) scorecard, and the other, a strategic planning and management framework matrix.

**Critical Success Factors Scorecard**

Critical success factors (CSF) are defined as the limited number of areas in which satisfactory results will ensure successful competitive performance. [18] The CSF come from the areas of hardware, software and the people and organisational issues. In this paper the CSF used by Protti [19] for the assessment of the state of readiness to implement Information for Health in the National Health Service in the United Kingdom was identified as the baseline instrument. This baseline CSF list was modified for two reasons. Firstly, the structure of the health system of the United Kingdom is different from the South African health system, and secondly the experience from the past EHR implementation projects highlights the need for addressing the people and organisational issues among the CSF.

There are eleven CSF identified for the CSF scorecard. Each of these CSF is described below.

***Clinical initiative linkage***: Protti claims that explicit linkage of EHR project implementation to clinical services and clinical governance is important for success.[19[ The IT strategy (EHR) should be part of the organisational strategy in order for it to be successful.[20] Only then can the organisational strategy influence the IT, which in turn can influence the organisation, as an isolated EHR project will be neither successful nor sustainable.

***Clinician involvement***: Involvement of clinicians (doctors, nurses, pharmacists etc.) is an essential factor to ensure success.[21,22] The involvement and participation of clinicians in the process allows for the EHR to be designed /modified to fit local needs, and develop a sense of ownership by the users. This will further assist in the system gaining acceptance.

***Stakeholder involvement***: All stakeholders need to be actively involved in the process of EHR implementation. The involvement of top management is always critical for success. The IT section and their support services also need to be part of this process in order for these divisions to understand the clinical work process, which will ensure that the technology fulfill the user's expectations.

The involvement of the community through various structures (hospital board, Non Governmental Organization, patient interest groups) is also equally important as a means to get the public corporation as transparency of process and access to information are people's constitutional rights. Participation from community representatives will provide the community with an opportunity to understand the rationale of the system and to raise any concerns (e.g. issues surrounding confidentiality etc). This understanding and participation enable easier acceptance of the EHR. Therefore the participation of all stakeholders at the EHR implementation committee is essential to maximize success.

***Investment strategy***: There is a need to have a clear commitment in terms of the budget allocation from national, provincial and institutional levels, along with a clear spending process in place at the facility. There is a need to ring fence the budget for the EHR implementation, and to appropriately budget for the future IT infrastructure, considering the available facilities. This will facilitate the sustainability and the success of the project. [23]

***Local vision***: It is important to have a clear local vision regarding the EHR project, as it is this that informs people of the ultimate goal. In addition, the organisation must identify local issues and recognize barriers to the implementation of the project to enable them for intervention.

***Information management***: The benefit of an Information System is dependent on its data quality. Hence, the establishment of processes to address data quality issues is critical.[19] Maximizing the data quality at all levels should be an active part of the project implementation.

***EHR Implementation committee***: An established EHR implementation committee with Chief Executive or an equivalent as chair for the project is mandatory.[19] The use of a 'consultant' to chair the committee will not derive adequate support from the employees, and will not be sustainable in the long run. The committee should be able to anticipate and influence requests from both end users and management.

***Project management leadership***: Having an experienced project manager in a full time post (someone who will move the agenda forward with minimal dependency on management consultants) is crucial for success and sustainability. [24]

***Technical infrastructure***: The organisation must have a thorough understanding of the types, costs, standards and plans for all IT systems, as well as a strategy for future development. The dynamic development of hardware and software in the IT field makes the understanding of IT systems, and its applications, vital for success. This ongoing development result in additional expenditure for the organisation and the health community needs to have the capacity to manage this as part of the future development.

***Human resource***: Comprehensive assessment of the required Information Management Technology personnel types, skill levels, etc, is very important, as a lack thereof will directly impact on the project implementation. It is understood that within the life cycle of an organisation new personnel join, even as others leave, and there should be a process in place to assess and train staff with the future in mind.[25] Developing a culture of 'sharing knowledge' among employees will ensure that the organisational knowledge base is adequate at all times.

Thus, knowledge management should be a key strategy in the EHR implementation project.

***Change management***: Protti, in 1999, did not include "change management" as one of the CSF. However, he discussed the importance of 'change management' and 'culture' as risk factors in his report. The experience from the failed IT projects in the past two decades, and the attribution of the implementation failure to people and organisational issues warranted the inclusion of change management in the CSF score card.

The heightened focus on the socio-technical approach of information system implementation further support this. There should be clear and established strategy and process in place to manage change in the organisation as well the technology Therefore it is vital to have an accepted change process in place. Change management should have multiple strategies to achieve the desired change, both in people and the organisation.

Nine out of the 11CSF from Protti's Model remained the same in the SA version. However, LIS Programme board was replaced by EHR Implementation committee. This was due to the difference in the basic administrative structure between the South African and the United Kingdom's health systems. The CSF of supporting the General Practitioners Practices, Primary Care Groups and PCTs was removed and change management was included as it covered a broader area of support during the implementation.

The CSF scorecard should be completed by the project manager/Chief Executive Officer/ Officer in charge along with IT person in-charge. The instrument can also be completed by the project committee members to obtain an overall sense. The organisations which fell short can go through the exercise at a later stage and re-evaluate their state of readiness.

***Scoring***: Each CSF is scored on a scale of zero to three. On this scale, a score of three implies that that particular CSF is 'fully in place' according to the definition of the CSF, and zero implies it is not in place at all. A score of one is close to not ready (zero), and a score of two is close to being ready (three). Any CSF scoring zero or one is taken as falling critically short in the preparation process of EHR implementation. It indicates that the situation needs urgent attention and serious intervention to rectify the shortfall. The choice of 0-3 as the score was selected to avoid a neutral number being the midpoint such as 1-5. This is to ensure that a decision is made as to whether the CSF is in a state of readiness or not. [19]

Scoring by numbers should be taken as an indicator rather than absolute, as this exercise aims to identify the organisation's state of readiness before implementing the project. The CSF scorecard allows a maximum score of thirty three (11 factors x3). If an institution scores less than sixteen overall, then it should be expected that in order to achieve successful implementation, a great amount of work is needed in the organisation. [19]

It is also important to avoid situations where the total score may be more than sixteen, but in which some of the critical success factors are scoring zero or one. In a complex system like health care, the performance of one critical factor influences the others, either positively or otherwise and the importance of the interrelationship between the factors needs recognition. Achieving a balance among the factors is as equally vital as their individual performance.

**BSC - Strategic Planning and Management Framework**

*Table 1 – BSC four perspectives*

| ***User perspective*** *(Customers' & stakeholder's view)* | ***Business value perspective*** *(DoH view)* |
|---|---|
| **Mission**<br>To add value to health service delivery<br><br>**Key Question**<br>Would the EHR fulfill the needs of the clinical community?<br><br>**Objectives**<br>Establish good relationship with the user community (clinicians)<br>Clinician Involvement<br>Satisfy end users of EHR<br>Clinical Initiative Linkage<br>Stakeholder Involvement | **Mission**<br>To add value to the SA Health System<br><br>**Key Question**<br>Would the EHR implementation accomplish its goal and contributing value to the South African Health System?<br>**Objectives**<br>Ensure that the proposed EHR project provide business value to the health system<br>Local Vision<br>Control EHR project costs<br>Investment Strategy |
| ***Internal operations perspective*** *(process based view)*<br>**Mission**<br>Implement EHR project in an efficient and effective manner<br><br>**Key Question**<br>Would the EHR project be implemented in an efficient manner?<br>**Objectives**<br>Anticipate and influence requests from end users and management<br>EHR Implementation Committee<br>Provide cost effective training that satisfies end- users and ensures data quality<br>Information Management<br>Effectively manage EHR related problems that arise<br>Project Management Leadership | **Future readiness perspective (***Innovation and learning view*)<br>**Mission**<br>Deliver continuous improvement in the EHR and prepare for future challenges<br><br>**Key Questions**<br>Is the EHR implementation prepared for potential changes and challenges?<br>**Objectives**<br>Anticipate, prepare and act on EHR related changes needed in the future<br>Change Management<br>Continuous upgrading of skills through appropriate training and development<br>Human Resource<br>Conduct research into emergin technologies for the SA health system<br>Technical Infrastructure |

The Balanced Score Card (BSC) is an instrument meant to assist organisations in proactively planning their performance

in line with the organisational strategy, rather than evaluate the organisation on its performance as a retrospective exercise. [26, 27].The original BSC was developed for the corporate sector, and thus the perspectives were designed with terminology to suit the corporate scenario.

Protti, for his work with National Health Services, modified the original BSC with appropriate terminology of the perspectives to better suit the context and the purpose of health institutions as 'Four Possible Perspectives in an Information Management and Technology' for health. The authors use Protti's terminology with some modifications in order to better suit the context of the South African health system. [19]

The purpose of this tool as a strategic planning and management framework is to assist health organizations in strategically planning for the implementation of EHR, and then later assessing and reviewing their performance according to their strategic goals. At this juncture, the framework will be used as an instrument to systematically work on their strategy, with the intension to improve or enhance the performance, taking into consideration the four different perspectives.

Following the concept of the BSC as a performance management tool, and the importance of the relationship of the perspectives to each other, the CSF were packaged into one of the four perspectives. The placement of the CSF in different perspectives allows one to understand the importance of the CSF against the backdrop of the total performance of the organisation, as well as the interdependence of the factors. The CSF can thus be easily linked to the specific strategic goal, and be followed up. The CSF in different perspectives also allows one to look at the balance among the different factors in each perspective, a vital component for success.

It will also allow the health organisations to align their objectives in different perspectives to achieve their vision, as well as enhance the performance of the other perspective. Mapping the strategy of the organisation in this manner will also create a common understanding among the employees. [28] The tool will act as a transparent strategic framework for all the employees in the organisation, and may yield better cooperation and understanding towards EHR implementation. It is hoped that developing a visible common objective will benefit the organisational culture in acknowledging and accepting change with less resistance.

**Validation of the Assessment Toolkit**

The development process of the assessment toolkit included a validation process. A panel of international and national experts critiqued the instrument related to its theoretical underpinning, content and format. There was a general consensus from the experts that the proposed toolkit to be an important development, as there is a need for such an instrument. They also found that the timing of the development of the toolkit was appropriate in the context of South African EHR policy and implementation process.

The selection of the CSF was found to be both relevant and appropriate, with the inclusion of change management to the CSF seen as necessary. The BSC theory of looking at the performance of the organization through four different perspectives (modified by Protti) was accepted as relevant and appropriate. The experts agreed that the critical success factor score card would be able to provide valuable information about the state of readiness of the institutions, whilst the four perspective matrix would assist the institutions in identifying shortfalls within the perspectives, and in developing interventions towards achieving the strategic goals of the implementation project. The matrix also provides insight into the future performance of the organisation.

The experts were of the opinion that the toolkit had the potential to contribute positively towards the successful implementation of EHR in South Africa.

As part of the validation a pilot study was conducted on priority ranking and weighting of the CSF by health workers. Clinicians' involvement and investment strategies were two of the CSF scored highly by the health workers. The study showed that the importance placed on the CSF by doctors and nurses were different and probably based on their workflow. Further, the importance given by the health workers to the four perspective matrixes, (BSC) was not equal in that health workers did not consider the business perspective as important as the other three perspectives. The survey showed that there was correlation between the ranking and weighting of the CSF.

From the information gathered from this pilot study, it is recommended that a full scale study is needed to understand the health professionals views regarding the CSF, workflow and other issues related to EHR implementation.

The tools developed in this study integrate the CSF with the Balanced Score Card matrix. Therefore the state of readiness assessment, the strategic planning of the implementation as well as the future assessment of the implementation will be a continuum rather than three unlinked exercises. It will assist the planners, managers and the health workers to see the interdependency between the CSF and BSC.

In conclusion the toolkit developed to assess the state of readiness of health organizations in South Arica to implement EHR has the potential to assist the organisation towards a better EHR implementation path. The second tool of BSC matrix will further guide them in moving the strategy to action plan and increase the probability of success.

A future study in the Eastern Cape is planned for a real world testing and validation of both instruments developed in this study.

**Acknowledgments**

The authors would like to thank all those who kindly spent time to comment on the draft tool and CSF's, the members of the expert panel and the health workers who participated in the pilot study.

## References

[1] Middleton B, Hammond WE, Brennan PF, Cooper GF. Accelerating U.S. EHR Adoption: How to Get There From

Here. Recommendations Based on the 2004 ACMI Retreat. JAMIA 2005; 12: 13-19.

[2] Bates DW, Gawande AA. Improving safety with information technology. N Eng J Med 2003; 348: 2526-2534.

[3] Aarts J, Peel V. Using a descriptive model of change when implementing large scale clinical information systems to identify properties for further research. Int J Med Inform 1999; 56 (1-3): 43-50.

[4] Lorenzi NM. Beyond the gadgets. BMJ 2004; 328: 1146-1147.

[5] Keshavjee K, Bosomworth, Copen J, Lai J, Kucukyazici B, Lilani R, Holbrook AM. Best Practices in EMR Implementation: A Systematic Review. In: Proceedings of the 11th International Symposium on Health Information Management Research. [Online] 2006 Available from: http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=1839412&blobtype=pdf [Accessed 15th June 2009].

[6] Kotter J. Leading Change: Why transformation efforts fail. Harvard Business Review, 1995; 59-67.

[7] Aarts J, Peel V, Wright G. Organisational Issues in Health Informatics: a model approach. Int J Med In, 1998; 52: 235-242.

[8] Ash JS, Stavri PZ, Fournier L. Principles for a successful computerized physician order entry implementation. AMIA Annu Symp Proc. 2003; 36-40.

[9] Lorenzi NM, Riley RT. Organizational issues= change. Int J Med Inform 2003; 69: 197-203.

[10] Ash JS, Bates DW. Factors and Forces Affecting EHR System Adoption: Report of a 2004 ACMI Discussion. JAMIA 2005; 12 (1): 8-12.

[11] Lorenzi NM, Riley RT. Managing Change: an overview JAMIA 2000; 7: 116-124.

[12] Kaplan B. Addressing Organizational Issues into the Evaluation of Medical Systems. J Am Med Inform Assoc 1997; 4: 94-101.

[13] Tang PC, Ash JS, Bates DW, Overhage JM, Sands DZ. Personal Health Records: Definitions, Benefits, and Strategies for Overcoming Barriers to Adoption. J Am Med Inform Assoc 2006; 13: 121-126.

[14] Berg M. Patient care information systems and health care work: a socio-technical approach. Int J Med Inform 1999; 55 (2): 87-101.

[15] Aarts J, Doorewaard H, Berg M. Understanding Implementation: The case of a computerized physician order entry system in a large Dutch University Medical Centre. JAMIA 2004; 11 (3): 207-216.

[16] Aarts J. Understanding Implementation: A socio technical appraisal on the introduction of computerized Physician order entry systems in Dutch and American Hospitals. PhD Thesis. Erasmus University Rotterdam. 2005

[17] Coiera E. Four rules for the reinvention of health care. BMJ 2004; 328: 1197–9.

[18] Gordon D, Geiger G. Strategic Management of an Electronic Patient Record Project Using the Balanced Sore Card. Journal of Healthcare Information Management 1999; 13 (3): 113-123.

[19] Protti D. An assessment of the state of readiness and a suggested approach to evaluating Information for Health: An information strategy for the modern NHS (1998-2005). 1999. Available from: http://www.bcs.org/upload/pdf/prottireport.pdf [Accessed 15th April 2008].

[20] Bryant J. The Nature and Purpose of Information System and Information Technology. Presented at the M.Sc in Health Informatics course, Mthatha. 2008

[21] Fenton SH, Giannangelo K, Stanfill M. Essential People Skills for EHR Implementation Success (AHIMA Practice Brief). Journal of AHIMA, 2006;77 (6): 60A-D.

[22] Braude R. People and Organisational Issues in Health Informatics. JAMIA 1997; 4 (2): 150-151.

[23] Bash P. Electronic Health Records and the National Health Information Network: Affordable, Adoptable and Ready for Prime Time? Ann Intern Med 2005; 143: 227-228.

[24] Lorenzi NM, Riley RT. Managing Technological Changes: Organizational aspects of Health informatics. 2nd Edition, New York: Springer Verlag; 2004.

[25] Ash JS, Zoe S, Gilad, JK. A consensus statement on considerations for a successful COPE implementation. JAMIA 2003; 10 (3): 229-34.

[26] Kaplan RS, Norton DP. The Balanced Scorecard- Measures that drive Performance. Harvard Business Review 1992; 71-79.

[27] Kaplan RS, Norton DP. Using the Balanced Scorecard as a Strategic Management System. Harvard Business Rview 1996;74.

[28] Kaplan RS, Norton DP. Having Trouble with your Strategy? Then Map It. Harvard Business Review 2000; 78 (5).

**Address for correspondence**

Prof Parimalaranie Yogeswaran'
Department of Family Medicine, Faculty of Health Sciences,
Walter SIsulu University, Mthatha, South Africa
pyogeswaran@wsu.ac.za