# A FRAMEWORK AND RECOMMENDATIONS FOR IMPLEMENTING INFORMATION SYSTEMS IN RADIOLOGY SERVICES

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**Abstract**

The aim of this framework is to allow the radiology departments of health services achieve their objectives when attempting to implement their information and communication technologies (ICT). It provides a flexible and adaptable way of relating the objectives to the business process. This will enable the radiology department to be capable of developing the necessary deliverables that are consistent with management information system. The framework is made up of elements, processes and tools. The elements are the expected deliverables; the processes are the activities that go on within the radiology department whereas the tools help implement the model.

*Keywords: information system, business process, radiology services, ICT.*

## 1. INTRODUCTION

Information and communication technologies (ICT) is the overall management and control of an organisation's investment in information including identifying and sharing management information ensuring that standardisation, control security and integrity of data is stored in a way that benefits an organisation. ICT and its role however has been stressed over the years but organisations have not learned from abandoned information systems development projects (Ewusi-Mensah, and Przasnyski, 1995) to 'rethink' how to learn from such mistakes. Interestingly, work on upgrading and improving ICT requires attaching great importance to establishing the legal and regulatory environment and the technical methods that would secure the optimum use of the resources of knowledge (Sipior et al, 2005). The necessity to enhance joint action between governments, international and regional organisations, the private sector, the civil society organisations and other concerned bodies on how ICT will improve the retrieval, transfer, monitoring of information accurately is lacking (Yeo, 2002).

In the health service for instance ICT and records management within and across the NHS has led to problems between healthcare delivery. This is because Information and communication at discharge reduces certain discrepancies during information management stages such as unable to retrieve, transfer and store information accurately (Duggan *et al,* 1996). According to Pillings (2003) although most hospitals have systems for keeping patients' information it is mostly paper based and difficult for hospitals to access these information from other hospitals and clients. Arnott, (2003) emphasised that in the radiological department transferring images across other hospitals is a major problem. In response to some of these there is an ample evidence that problems regarding communications and the increase in clinical management for information keeping underpins clinical governance and often results in duplication and inaccuracy of information processing amongst internal and external staff

(Ogoe *et al, 2005*). A recent case study found out that, radiology sectors of health services information processing and transfer of records and images across other hospitals are a major problem. As a result of this, duplication and inaccuracy of information processing amongst internal and external staff often exist. The framework is capable of acting as a guide for future integration of information systems within the health service. The framework consists of successes and failures of the department's past and current IT/IS projects; planning and exploiting information systems development initiatives; prioritising the implementation of the projects to deliver IS projects. The elements, processes and tools used in the framework are based on findings (Ogoe *et al*, 2005).

### 1.1 Methodology

The method adopted for evaluating the framework was *Communicative* (Blumer, 1979). The validity of the findings was ensured through additional questioning of the respondents. This form of validity was established through presentation of the findings where the conclusions were followed and tested (Miles and Huberman, 1984). Based on the review of literature and interviews, the framework is capable of helping the radiology department implement their information systems with ease. The important part of the implementation of the system is the evaluation.

## 2. THE FRAMEWORK

A critical look at the study found out the success and failures of the department's past experience and current IS/IT Projects commitment, co-ordination and the communication. It is recommended therefore that a suitable set of tools help pinpoint any lapses Figure 1. The use of current tools such as SWOT analysis, to identify the strength, weaknesses, opportunities and the threats in relation to the past IS/IT projects. PEST analysis will help the political culture in the organisation, economic strength for the execution of the project, the socio-cultural environment within the organisation and the technology available for the project. Finally the critical success factors for the project is to identify the performance measure that must be achieved for the Radiology department to succeed in its environment. It may relate to objectives, mission, program activities and projects. Failure of critical success factor of the RD projects result in failure to achieve the affected goals.

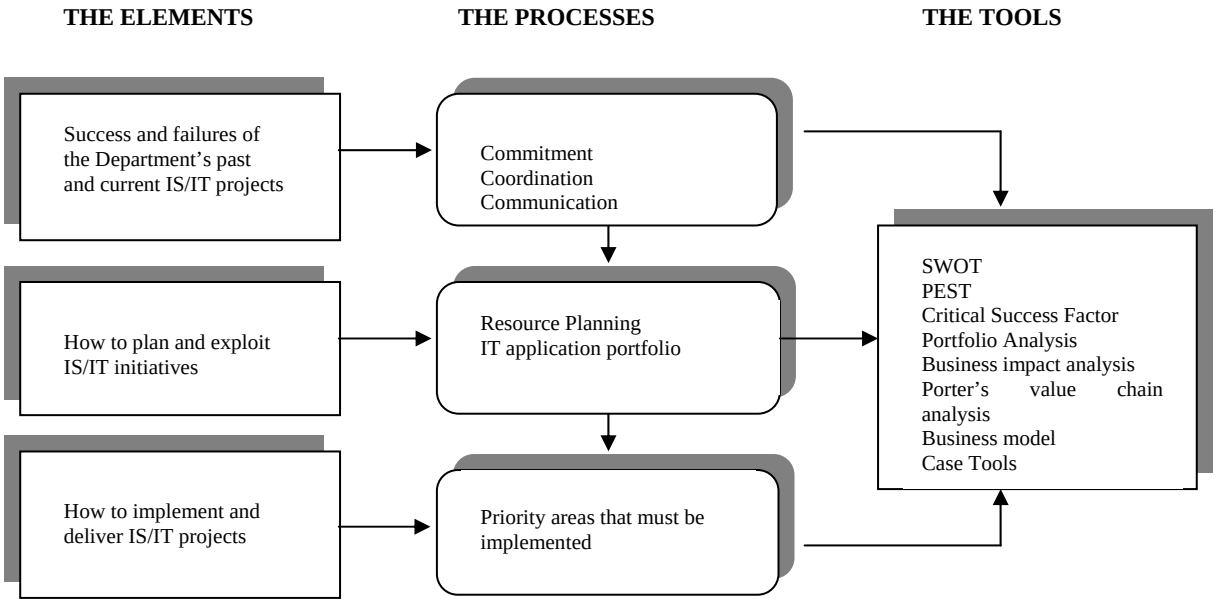


*Figure 1: Diagrammatical illustration of the Framework*

## 2.2 How to plan and exploit IS/IT initiatives

In order to achieve the above, the department will have to be proactive in the area of information systems development. Considerable resources are needed to develop priority areas. For instance training of staff and systems implementation. This (Yeo, 2005) should introduce an information systems culture within the department and further exploit advances in information and communication technology in order to improve the socio economic development of the department. The exploitation of information systems development will help staff at all levels with timely and accurate information to allow them perform their duties with maximum efficiency and effectiveness. A web-based application should be embraced that will enable medical staff and other departments' interact with RD electronically. The objectives of this will be to: establish RD in the exploitation of ICT as a driving economic and social development within the NHS. Provide RD staff and management with a comprehensive set of tools to support strategic and operational decision-making. The principal strategies to be pursued and the resources necessary to implement the system will be: Network and infrastructure development of system programme, establish intranet technologies, plan and disseminate resources.

### *2.1.1 Network and infrastructure*

The successful implementation of the RD's strategy as a recognised leader in the exploitation of ICT as a means of development within the NHS cannot be achieved without harnessing current information and communication technologies. The networking and communication infrastructure needs to assume critical importance. High-speed communication links has to be installed in order to provide fast reliable information systems to staff. These links should be multimedia applications such as voice, images in addition to data traffic over a closed high-speed network. A key role for information systems development staff within the RD will specify, procure, manage, implement and maintain the communication infrastructure. Ensure optimum utilisation and performance of this infrastructure. The data security of the RD's will have to be ensured to prevent intruders entering the system. The information systems development team will have a central role to play in coordinating the provision and management of information technology (IT) facilities for other departments. It is envisaged that the information system development department will have a key support role in enabling services to be delivered. The strategic plans for the RD's services require significant development and upgrading of facilities and services. For instance the x-ray services will require an enterprise PACS and a computerised library management system for patients records. The key role of the information systems development will be to continuously scan the horizon for emerging technologies and to identify potential opportunities to integrate these to the business plans of the RD.

### *2.1.2. Develop system programme*

In parallel with the implementation of the networking and communication infrastructure, a major systems development programme must be implemented. These are: (i) integrated planning project that will provide a complete information systems solution to cover all aspects of recording and process planning applications. There are three components in integrated planning system that will be linked together to form integrated system; these are records management system, database and imaging system. The database will be used to record patient's information. The imaging system stores all x-ray photographs and reports on optical disks. The integrated planning system allows staff to record and process patients information using modern technology. It allows information to be accessed from computer workstations. The introduction of this system will demonstrate the potential of technology to streamline business processes within the RD and to provide a more user-friendly service for patients. The experience of developing and implementing this project will provide an insight to the potential for similar systems to be applied to other departments within the NHS. The IS department will work with relevant service managers to identify such opportunities to create other strategies for their implementation.

*2.1.2 Establish intranet technologies*

A corporate intranet will be established that will serve as a central accessible holding area for all the sub departments within RD, where files and messages can be accessed and exchanged at the touch of a button. This intranet initiative will link all information databases together and facilitate the development of comprehensive project management processes. This will become a key information tool in assisting the RD staff manage their programmes of work and assist in the overall strategic decision-making.

*2.1.4 Plan and disseminate resources*

It is evident that the existence and continued growth of this initiative, together with other technology related areas enabling the department to take a leadership role require the IS department to be adequately resourced. It is therefore necessary for staff training to handle such projects.

## 3. IMPLEMENT AND DELIVER IS/IT THE PROJECTS

During the implementation stage there are three significant issues that needs to be considered. These are: The range of activities they will have to be completed before the system "can go live"; Draw up a schedule of activities using project management tool like the Gantt chart; Finally recommend a changeover approach to the new system. This stage examines issues such as resource planning for implementing the system and the overall schedule of the project.

## 4. TOOLS AND TECHNIQUES

To enable these processes to be achieved a set of tools and techniques such as critical success factors and business model will have to be used (Sarosa and Zowghi, 2005; Irani and Love, 2005; Sipior et al, 2005). For this reason all business process functions of the department and the specific effect that these may have upon them was considered. This is to identify the minimum set of services that the department will require to continue operating and the performance measure that must be achieved if the department is to succeed in its environment. These may be related to objectives, mission or the program activities. Here, a business model comprising of business control model, business function model and business process model can be used.

## 5. VALIDATING THE FRAMEWORK

Employees of the radiology department tested the strategy adopted for evaluating the framework Ten users were selected to validate the framework and eight (8) responded. The table below are their responses.

The framework illustrates that RD and the Health Service as a whole should adopt IT by using cutting edge technologies to create, transfer and store their records efficiently. IS and IT consultants should be employed to oversee IT/IS projects in the NHS. Although the radiology department has the potential to be recognised as a leader in the exploitation of ICT for driving the economic and social development within the NHS, it is recommended that a new IT/IS department should be created with experts in these areas in the NHS as a whole. The framework however, should be a guide that when followed, the RD and NHS will be able to address business level strategies towards IT/IS implementation.

**Past Performance and Failures**

From information gathered it was revealed that the Radiology Department's past performance of Information Technology and Information System project failures has adversely affected the department and the NHS not to create, transfer and store their records efficiently. 62% of the respondents accepted this and 38% were not sure with none responding.

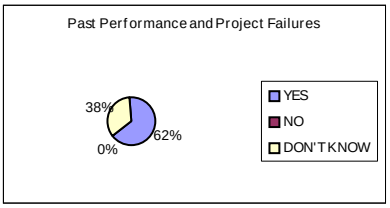


*Figure 2: Past Performance and Failures*

**Radiology Department (RD) to be leader of ICT**

The result shows a fair distribution of the results. 25% are in favour, 37% are not in favour and 38% are not sure. It is therefore recommended that a review be carried out to ascertain whether the department meets the criteria to be a leader of ICT.

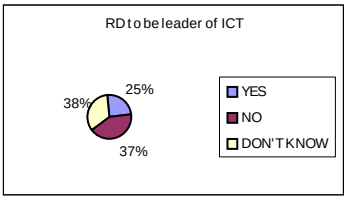


*Figure 4: RD to be leader of ICT*

**Flexibility of Framework**

The results show that 75% are in favour of the framework 's flexibility. None disagreed while 25% were not sure. This shows that the framework is flexible enough for use. With further explanation in collaboration with an RD that are attempting to implement similar projects.

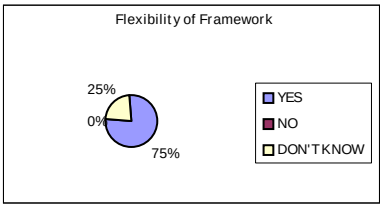


*Figure 6 Flexibility of Framework*

**Lack of IS/IT Consultants**

The results shows that 87% of the respondents agreed that consultants are not in place to coordinate IS/IT issues when communicating and transferring information to various participants, 13% were not sure with none disagreeing. It is therefore recommended that there is a need for employing consultants to oversee the IS/IT projects either through outsourcing or in-house.

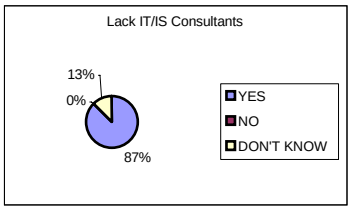


*Figure 3 Lack of IS/IT Consultants*

**Radiology Department (RD) to be Responsible for IT/IS Delivery**

The information shows that 74% are not sure whether the department should be responsible for the IT/IS delivery.13% are in favour of the department carrying out the delivery whiles another 13% are not in favour. This shows the need to find out if the department has the expertise or consultants employed full time to carry out the tasks.

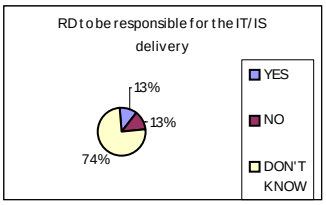


*Figure 5 RD to be responsible for IT/IS delivery*

**Tools and Techniques for the RD Processes**

The results for the question shows 75% in favour of the fact that the tools and techniques used in the framework helped model the business processes of the department. 25% are not sure.

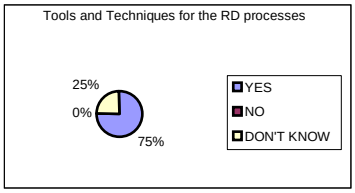


*Figure 7: Tools and Techniques for the RD processes*

**Overall Comments**

The overall comment from the respondents shows that the framework is acceptable. 43% think the framework is good although it may need enhancement in the area of technology and 57% think the framework is very good. There were no other comments.

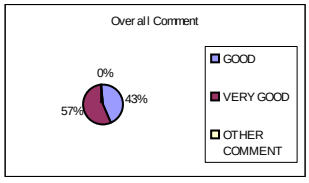


*Figure 8: Overall Comment*

*Table 1. Responses from the Framework validation*

## 6. SUMMARY, RECOMMENDATION AND CONCLUSION

This research has developed a framework for guiding RD when attempting to implement information systems and technology development projects. The framework was based on literature review, case study and analysis (Ogoe *et al*, 2005). Recommendation is therefore needed in the following areas namely: improving guidelines for clinical coding; information security and networks; development of the framework further to incorporate legal and ethical issues. The case study material should be enhanced and used for future training.

### 6.1 Improve Guidelines for Clinical Coding

It is therefore recommended that hospitals have to consider whether the source documentation used for abstraction of clinical information provides complete and accurate information. Conventions and national standards need to be applied in the information systems development stages. The staff fully trained should complete this function and likewise any clinicians performing this function should also be aware of the coding requirements. A good communication between clinicians and coders should be encouraged to establish a cycle of quality assurance. This will help correct fundamental error to clinical coding and coding processes thus encouraging best practice. The involvement of clinicians directly recording and using information is anticipated to have positive benefits on the timeliness and accuracy of electronic patient records. To achieve good quality records investment is required in training and quality management. There should be constant monitoring for quality, by those individuals conversant with the rules of classification.

### 6.2 Information Security and Networks

A need for faster and better system to minimise the risk of unauthorised access. Linking patient information held on databases to different organisations or departments within the NHS require a unique identifier common to all the databases. Review the old networks to reflect on the changing trend of advancement in network technology. An internet-based network that conforms to the national information strategy. This will allow departments within the NHS and approved suppliers to be linked seamlessly using this technology. In order to improve the current problems with communication within the NHS, patient management may have to be assisted by a technology to provide clinical decision support tools, such for information systems and also take advantage of a constantly updated centralised resource of medical opinion from all users and edited by experts. The installation of a local area networks or mobile networks will allow many computers to be linked up. Grouping bounding hosts and network applications into functional or architectural boundaries to achieve the maximum effectiveness to network based-security. A unified modelling approach, for the implementation of the mobile networking within the radiology department. The network should improve the dissemination of information to ensure large savings in cost.

### 6.3 Consideration of legal and ethical issues

Ethical issues regarding the use of information should be considered by retaining data in the form that identifies the subject only as long as it is necessary for that purpose. Legal issues of Information processes should be considered when the RD attempts to automate their records management systems.

In conclusion this framework will allow the RD achieve its objectives. It provides a flexible and adaptable way of relating the objectives to the business process. This will enable the RD to be capable of developing the necessary deliverable and be consistent with management information system. The framework is made up of elements, processes and tools. The elements are the expected deliverables; the processes are the activities that go on within the radiology department whereas the tools will help implement the model.

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