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Conceptual approach for a hospital information system based on the quality improvement aspect

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Short Paper

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Abstract

The diffusion of the process approach led to the introduction of a process concept into the information system definition ; it has a positive influence on both the management and behaviour of these systems within any organisation. The Hospital Information System is inserted in the "hospital" in continual evolution; it is able, per rules and procedures, to gather data, evaluate, treat and to distribute information containing a strong added value to all the internal/external partners of the establishment, collaborating in a common work directed towards a specific goal which is related to the treatment of a patient case, our project aim to relate the first aspect which is the process approach to the second one which is the hospital information system under the objective of having a system which communicate to the continuous improvement. Quality improvement consists of systematic and continuous actions that lead to measurable improvement in health care services and the health status of targeted patient groups. Through this paper we are aiming to present the methodology we have defined and the work steps that we have taken to reach the main objectives of our project, then we will present the conceptual approach allowing to apply the principles of quality improvement in hospitals in a continuous way.

Keywords: process approach, conceptual approach, hospital information systems, continuous improvement, quality improvement.

Introduction

More than 40 years ago, Donabedian proposed measuring the quality of health care by observing its structure, processes, and outcomes (Donabedian 1966). In the past 20 years, quality improvement methods have "generally emphasised the importance of identifying a process with less-than-ideal outcomes, measuring the key performance attributes, using careful analysis to devise a new approach, integrating the redesigned approach with the process, and reassessing performance to determine if the change in process is successful" (Shojania 2004). In addition, over the last years there has been an International Medical Device Regulators Forum proposing documents to help medical institutions provide guidance on the application of existing standardised and generally accepted Quality Management Systems (QMS) practices to software as a medical device (SaMD) (IMDRF 2015).

As for similar approaches, such as the use of IS (Cherfi 2007), at the international level, the conduct of change generates resistances that must be managed; this is the case for the QI/quality improvement as a new tool in such context, it faces resistance from the health professionals (Mohssine 2012) (Guetibi 2015b) & (Claveranne 2003).

Because of the problem of resistance and the multitude of quality perception in the hospital context, it is necessary to propose reasons to adhere to this quality process (Gardette 2010). It must be a continuous process in the long term, and not punctuated by the one-off obligations to ensure the participation and the mobilisation of participants in the project.

As part of this work, we bring our reflection to the problematic of information systems evolution by studying the use of the process approach under the objective of continuous improvement (Guetibi 2015b), and to achieve this goal we studied two hospital centres. This contribution is materialised by a mixed research methodology, focusing on the three aspects of research, use of the system, specifications of this latter and the quality approach applied by the care establishment (Guetibi 2017a), combining all the

essential elements to elaborate a mixed analysis (qualitative and quantitative), enabling to to draw out an evolving system and present the conceptual approach allowing to apply the principles of quality improvement in hospitals in a continuous way.

Materials and Methods

The plan defined to accomplish our research project, according to the bibliographic research and the determined objectives is presented under the following major steps:

- Define the specification of the HIS;
- Determine how this can communicate and respond to continuous improvement;
- Capture the process approach of this HIS ?
- Propose a general modelling approach using the process approach and based on the principles of continuous improvement, on the information collected, observation and experience of the cases studied;
- Use the proposed approach to model a HIS;
- Simulate our proposed HIS;
- Extract limitations and propose a new line of research that can be completed by other researchers in future works.

From the research keywords and the state of art (Guetibi 2015a), we have got the following items that allowed us to think of an hypotheses model:

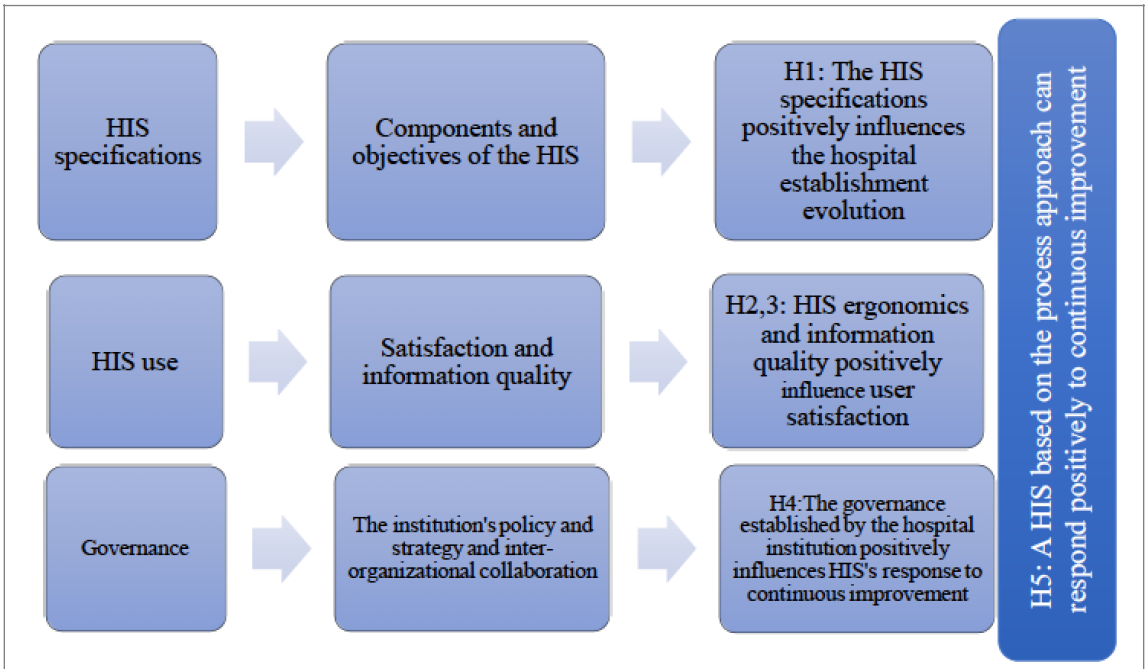

Figure 1. Hypotheses Model

- H1: The HIS specifications positively influences the hospital establishment evolution
- H2,3: HIS ergonomics and information quality positively influence user satisfaction
- H4: The governance established by the hospital institution positively influences HIS's response to continuous improvement
- H5: A HIS based on the process approach can respond positively to continuous improvement

Many authors had already worked on some of the existing hypotheses, the difference here is in terms of methodology.

To validate the four hypotheses (Guetibi., 2017a, 2017b), we conducted several surveys, to study the two different cases of HIS, so we had the opportunity to make our own observations and discuss with the staff the various problems encountered using the HIS (Guetibi 2017a).

The HIS is inserted in the "hospital" in perpetual evolution, where medical information is more and more of a major importance in a world where the increase in population imposes the existence of a performing information system (Thera 2014). IS require high cost for their maintenance activities. The relative cost for maintaining software and managing its evolution represents more than 90% of the total project cost (Erlikh 2000).

To face these problems and to solve the main issues faced by HIS users, known from the cases studied, and to help managers and quality managers maintain/improve the quality level of their functions, it is intended to present a quality management system (QMS) in a new computerised form integrated in the HIS, to analyse information and through real time quality measurements to help to improve the overall health care quality.

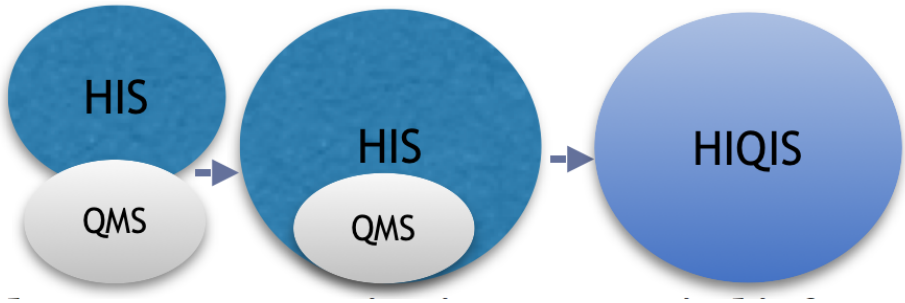

Figure 2. QM and HI systems meeting in one Hospital information and quality improvement system

This system is able to provide a better information quality (using several indicators), to contribute to real-time information sharing among professionals, to approve documents (electronic signature), and to eliminate documentation according to the information provided by the staff (life cycle), this subsystem must help to bring back experience and knowledge sharing between professionals (saving time for already seen cases and dealt with problems). Per our first vision the QMS will present the following interfaces: Complaint, Program and project record training, Reports, Tools, Dashboard, Internal documents control, Internal corrective actions or preventive management.

The following n presents the HIQIS model showing the different applications and functions of the proposed system.

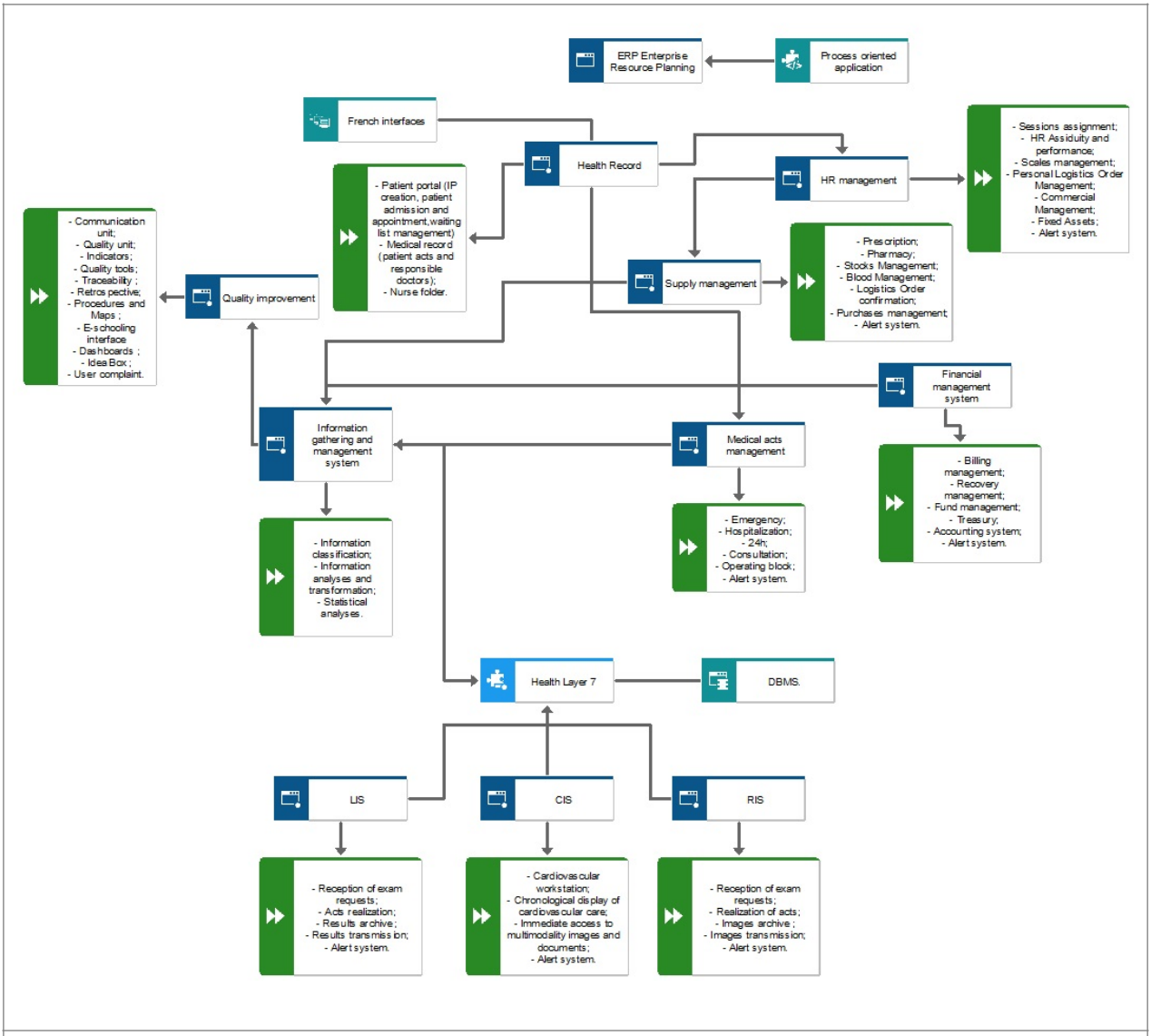

Figure 3. The proposed HIQIS model: Hospital information and quality improvement system.

The system above merges between the positive points of the studied cases and is based on solutions transformed into applications and functions, to be able to solve the various problems presented by the HIS studied, it is noted that after the results of the comparative study, we can say that there is a great possibility that the encoded problems can be presented by most HIS used in most hospitals.

Discussion

According to Staccini the links between the operating system (referring to the activities and function of the organisation) and the strategy pole are handled by the IS (Staccini 2003), which ultimately plays 3 roles: a strategic role, an organisational role and a social role. For our conceptual approach, we add the role of continuous improvement and sustainable development (Figure 4):

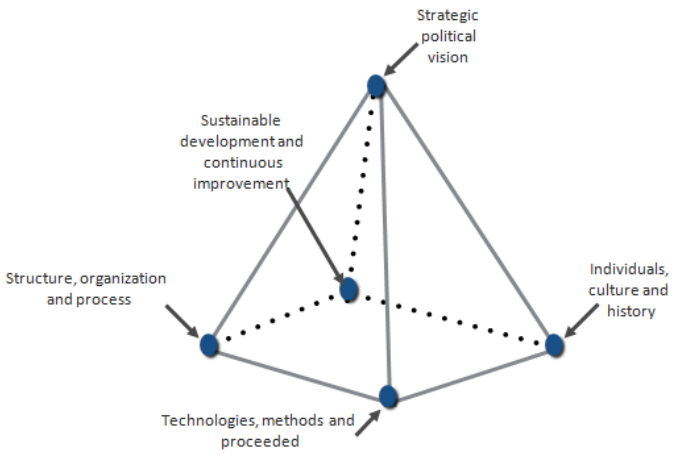

Figure.4 Relationship between the operating system (base of the pyramid) and the information system (faces). (Adapted from (Staccini 2003))

Looking at the pyramid from a strategic point of view, the IS help organisations alter their business strategies, plans or structure. They are also used to hasten the reaction time of the environmental changes and aid the organisation to achieve a competitive advantage over its competitors.

Any organisation needs records of its activities for financial and regulatory purposes as well as for finding the causes of problems and taking corrective action. The information system stores documents and revision histories, communication records and operational data, which proves the organisational role

The organisation staff must have full commitment during all implementation stages and ensure the smooth running of the whole process (Costa, Ferreira, Bento, Aparicio, 2016). It was pointed that if the top management delegates its responsibilities to the technical experts, this may hinder the full implantation of the system or lead to the abandonment of the project before its full implementation or after the system becomes operational (Ewusi-Mensah & Przasnyski, 1991; Somers & Nelson, 2001), which bring as to the ultimate social role indicated in our pyramid.

For the sustainable development, by making clear and explicit the relationship between information and reality, the information system will be able to respond to a movement of sustainability for the organisation functions and activities and the information system processes as well, using the process approach which is one of the keys enabling sustainability and agility of the information system and the organisation functions.

Continuous improvement, sometimes called continual improvement, is the ongoing improvement of products, services or processes through incremental and breakthrough improvements, The quality management system functions of the information system are enabling the continuous improvement role of the information system by bringing about improvements in all business processes, thereby leading to better outcome/results by monitoring and analysing crucial data.

By ensuring the management of the acts mentioned in the previous section, this new system will be able to respond to the roles indicted in the pyramid, by maintaining a continuous improvement of the quality and the healthcare system and consequently of the whole establishment. This new system has a capacity to evaluate and optimise quality and will be able to guarantee a better quality of the HIS, monitoring the latter as one of the processes of the hospital.

We can group the under objectives as follows:

- Auto-training and self-assessment of professionals;
- Management of traceability;
- Informatisation of quality improvement acts;

- Following and evaluating processes using indicators forming a dashboard, in order to optimise the three factors, cost (processing time and cost of the latter), quality (quality of treatments), volume (number of patients), which implies the optimisation of the patient path.

Conclusion

The proposed Hospital Information and Quality Improvement System (HIQIS) is able to meet the following criteria:

- A system based on the process approach and the new technologies (Health level 7) allowing the synchronisation of information between the different subsystems.
- A system communicating and responding to continuous improvement.

We propose to design and develop a prototype implementing the proposed approach. This implementation has two core objectives, it will first help in demonstrating the feasibility of the approach. The second objective is related to the validation of the approach as we plan to make the prototype available to practitioners to collect their feedback.

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References

Cherfi S., & al, "Perceived vs. Measured Quality of Conceptual Schemas: An Experimental Comparison", Australian Computer Society, Inc. This paper appeared at the Twenty-Sixth International Conference on Conceptual Modeling – ER, 2007.

Claveranne J-P & al., "Perceptions of quality among professionals in health care institutions, Report for the Directorate of Hospitalization and the Organization of Care", 2003.

Costa, C., Ferreira, E., Bento, F., & Aparicio, M. (2016). Enterprise resource planning adoption and satisfaction determinants. Computers in Human Behavior, 63, 659-671. https://doi.org/10.1016/j.chb.2016.05.090

Donabedian A., "Evaluating quality of medical care". Milbank Q.; 44: pp. 166-206, 1966.

Erlikh, L.: "Leveraging legacy system dollars for E-business". IEEE IT Pro, May/June 2000, pp. 17-23, 2000.

Ewusi-Mensah, K., & Przasnyski, Z. H. (1991). On information systems project abandonment: An exploratory study of organizational practices. MIS Quarterly, 15(1), 67-86. https://doi.org/10.2307/249437

Gardette V., "Principles of a quality assurance approach, evaluation of professional practices", April 2010. http://www.medecine.ups-tlse.fr/index.php

Guetibi S., El Hammoumi M., (2015a), « Développement du système d'information hospitalier par l'un des huit principes du management qualité », the 1st Edition of the multidisciplinary International Colloquium "Becoming a Good Researcher", March 26, 27 & 28, 2015, Tetouan_Morocco. https://www.researchgate.net/publication/281777348

Guetibi S., El Hammoumi M., (2015b), "Application of Self-Assessment Tool for the Measurement of the Maturity Level of a Moroccan Health Institution by Report to the Quality Approach", International Journal of Engineering &Technology IJET-IJENS, Vol: 15 No: 05, October 2015. http://ijens.org/Vol_15_I_05/154005-2929-IJET-IJENS.pdf

Guetibi S., El Hammoumi M., (2017a), "Utilisation des systèmes d'information dans les établissements de santé: Contribution à l'amélioration en termes de sécurité, de temps et de qualité des soins ", the 12th edition of the International Congress of Industrial Engineering: Digital and organisationnel innovations for meet the challenges of the industry of the future, Compiègne University of Technology, 3-5 May 2017, Compiègne_France. https://www.researchgate.net/publication/323999388

Guetibi S., El Hammoumi M., Brito A.C., (2017b), « Process approach use to implement and define the specifications of an open hospital information system responding to the continuous improvement:

Methodology and work steps», DEGI club sessions- Department of Industrial Engineering and Management of Faculty of Engineering of University of Porto- FEUP, 2 June 2017, Porto_Portugal. https://www.researchgate.net/publication/323999404

IMDRF, International Medical Device Regulators Forum "Software as a Medical Device (SaMD): Application of Quality Management System", IMDRF/SaMD WG/N23 FINAL: 2015.

Mohssine N., Rajiet I. & Chaouch A.,"Establishment of the program of hospital accreditation". Hospital management, N° 518, pp. 371-376, 2012.

Shojania KG, McDonald KM, Wachter RM, et al. "Closing the quality gap: a critical analysis of quality improvement strategies", Volume 1–Series Overview and Methodology. Technical Review 9, August 2004.

Somers, T. M., & Nelson, K. (2001). The impact of critical success factors across the stages of enterprise resource planning implementations. Proceedings of the 34th Hawaii International Conference on System Sciences (HICSS-34). https://doi.org/10.1109/HICSS.2001.927129

Staccini P. & al., "How the information system can contribute to the implementation of a risk management program in a hospital?", Transfusion Clinique et Biologique 10, pp. 311–317, 2003.

Thera K. E., "Study of the use of applications HIS (hospaital information system) of health institutions in Bamako district and KATI", "thesis", University of Science, Techniques and Technology BAMAKO, 2014.