

# Proposed an Approach for Measuring the Performance of Hospital Logistics Systems by Integrating Quality, Safety and Environment

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**Abstract**— Hospital activities have become more and more complex following the multiplicity of care offered and the variety of factors that come into play during operation: safety, quality, cost. Hospital supply chain is an important part of the budget of a hospital. The evaluation and improvement of hospital performance are needed to manage the process of its supply chain. The problem we will address in this paper is to propose a methodology for analyzing the supply chain of the hospital including safety, quality and environment.

In this article, we begin by presenting the interests of hospital management in the operation of a hospital, then we explain the methodology and its impact on the performance of the hospital supply chain and we conclude by applying the methodology to a case study of the hospital public Morocco.

**Keywords:** QSE, Management, Hospital, Security, Cost, ISO, Performance.

## I. Introduction

Health facilities are now facing the same constraints of economic efficiency and industrial companies. They discover the importance of the logistics process as a new approach for efficient management of all the activities of other organizations. Hospital reforms in recent years have prompted hospitals to make efforts and implement new management tools such as logistics and information system.

Thus, the measurement of hospital performance is now considered an indispensable part of the process of improving the quality of care (Barney 1986; National Health Service 2003; Groene, Klazinga et al. 2008).

Currently, policymakers are driving hospitals having constantly MIND, the satisfaction of all the performance, cost, time and also quality, the security and Environment (QSE).

For this we see that the hospital management did limit to ensure the smooth operation of the property in question. The hospital logistics is also an efficiency factor to ensure quality of care, patient safety and the protection of the environment.

To answer to our problem, it is necessary to rely on an integrated management methodology in which we will integrate the Quality, Safety and Environment areas. Initially and after explaining the interest of integrated approach, we present our methodology and are scientific contribution with its impact on the performance of the hospital Finally, the results obtained by this scientific methodology through a study of case in a public hospital in Morocco.

We aim through this work to demonstrate continuous improvement offered to managers in this area.

## II. Context of the study

The health sector in Morocco is a project of mobilizing change commitments, partnerships and resources. Hospital reform

considered cumbersome and expensive coaching helped hospitals in the spirit of improving the provision of care and that the public image of the hospital from the population. The extension of the basic medical coverage through <sup>1</sup>RAMED, AMO and INAYA project is an example of this reform.

So we chose the public hospital instead of a private hospital because the public nature is the social dimension which offers a large research potential and the dimensions are not the same (resources, budgets ...).

## III. Interest in the study

### 1. Definition of hospital logistics

Logistics hospital (Figure 1) has been the subject of several definitions. Chow and Heaver, 1994, described the hospital supply chain based on three main logistics activities:

-**The supply:** Includes purchasing and inventory management of various products.

-**The production:** Manages the various processing activities such as laundry, kitchen, sterilization, etc.

-**The Distribution:** ensure the delivery of various products from storage areas to the various points of use, or transportation of waste to shipping areas

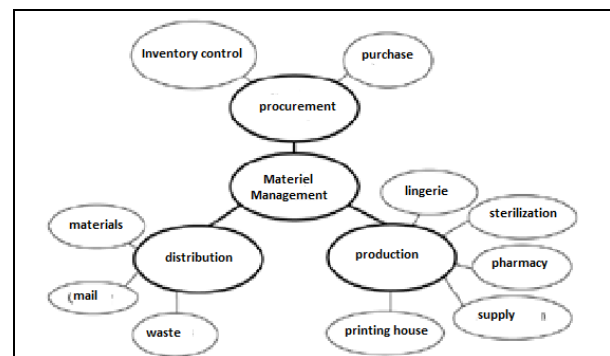


Figure 1: Hospital Logistics CHOW and heaver 1994

According <sup>2</sup>ASLOG "the logistics of the hospital is to direct the patient, products, services and information from the provider to the recipient." In our article, we use the definition of logistics as "meeting the needs patients (products or services) through an optimization of the various functions of the hospital"

<sup>1</sup> RAMED: medical assistance scheme

AMO: mandatory medical coverage

INAYA: compulsory health insurance in favor of self-employed persons engaged profession and helps artisans.

<sup>2</sup> French Logistics Association

## 2. Importance of hospital logistics

In general the supply chain to the hospital consists of the following processes:

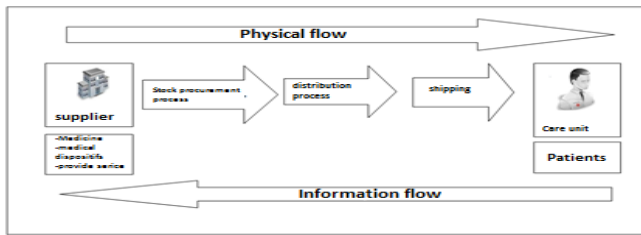


Figure 2: Supply chain hospital

Several experts to estimate the importance of logistics costs in health care facilities, assessments Housley (1978) arrive at an estimate of 46% for North Americans. Hospitals Henning (1980) considers by taking a similar approach estimated that hospital logistics accounts for 42% of total expenses of a hospital. The figure below Chow and Heaver (1994) confirm similar results.

## 3. Interest of performance measurement in the hospital

Two trends have involved hospitals use to measure performance. First, the enormous development of the Moroccan law in governance management budgets available to public hospitals; so that the state requires information on hospital performance. (MAGNUSSEN 1996) reported that the measure can be an aid to resource allocation. Second, patients have become more emancipated. They granted the right to choose between hospitals based on the information they receive from the assessment thereof.

(MARTY and Merlin 2007), (De Toni and Montagner 2009).

The two constraints are forcing the hospital to measure. Although this search address in the internal management of the hospital the first place, the measurement tool could be extended in the future to meet even for patients or governmental organizations.

## IV. The hospital logistics and integration of Quality, Safety and Environment

-The ISO 9000 defined quality as "fitness of a set of inherent characteristics fulfills requirements" (ISO 9000).

-The ISO 14001 Environmental defined as an environment in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelations (ISO 14001).

-According To the AFNOR 06-010-X, security is "the ability of a device to avoid appearing critical or catastrophic events" (AFNOR, 2002). Yet, according to a survey (Figure 4) carried out in seven Moroccan hospitals we found that there are significant differences between the performance levels of quality systems, security and privacy reasons environment. We mean by these hospitals letters: 1, 2..

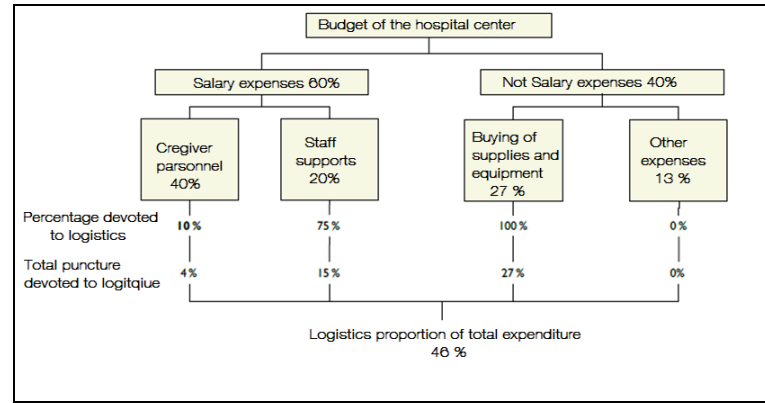


Figure 3: Costs of logistics activities in hospitals and CHOW Heaver 1994

This very important part of logistics costs shows that logistics processes within hospitals have become one of the major vectors of the process of reducing health care spending. These data may support the decision making of improving this function in the hospital.

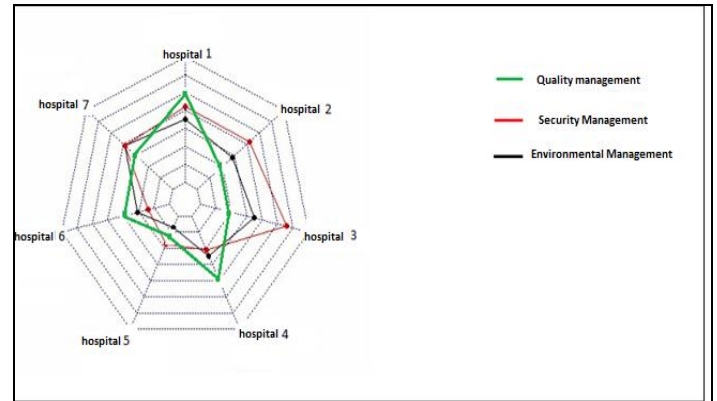


Figure 4: Level of axes QSE hospital

## 1. The hospital logistics and Quality

The quality management is an element management system of the organization that focuses on achieving results, based on objective qualities to meet the patients' needs as appropriate, expectations or requirements stakeholders (ISO 9001). To do this, the hospital undertakes a variety of means, techniques and methods to achieve the objectives of patient satisfaction.

## 2 The hospital logistics and Security

The mission of a hospital has evolved over time, it is increasingly characterized by a rich activities that zero risk does not exist environment. The hospital system has to control, manage and prevent risk, but the hospital security are very varied in nature, and risk management operates today as an essential component of the strategy of a hospital system.

Risk management in a health care facility seeks to identify and address the causes of risk, regardless of their nature, may affect patients, visitors, business and property of the institution.

### 3 Hospital logistics and Environment

The requirements for environmental performance, but provides a framework a hospital or organization can use to develop an ISO 14001 system effective

Implement ISO 14001: 2004 has several advantages, including:

- Reduced costs of waste management;
- Savings in consumption;
- Lower distribution costs;
- Better image of the hospital with regulatory authorities, contractors and the public

### V. Proposed Methodology

The performance analysis in the field of hospital management provides an interesting perspective; they can target the actions to take and optimize company resources (material, human ...).

It is not a particular methodology, but it is primarily a work around the problem QSE and research approaches, concepts and terminology can help to a better approximation of the quality areas safety and the environment, other than the simple superposition of the requirements of ISO (9001.14001 and OHSAS 18001) standards.

Therefore, based on the idea of the FMEA method (Analysis of Failure Modes Effects and Criticality their)

A quantitative assessment based three axes (Quality, Safety, Environment) and the calculation of a criticality index  $Ic = O \times D \times G$  (O case, gravity G and the probability of non-detection D).

- **Gravity**

-The Quality Gravity (QG): it reflects the impact of the failure of an activity or operation of the process on the quality of products and / or services of the process;

- Security gravity (SG): it reflects the impact of the failure of an activity or process operation on security at the process level;

- Environment Gravity (GE): it reflects the impact of the failure of an activity or operation of the process on the environment in the process.

- The frequency (F): it reflects the frequency of occurrence of a symptom affecting the criteria Q, S, E;

- The index of non-detection (D): This index gives the probability of detecting the influence of an activity or operation on the detection process which is not obvious

The following table shows the weights of each gravity coefficient:

severity	Coif	severity Quality	Security severity	gravity Environment
insignificant	1	Do not be influenced by the quality	Possibly no impact on safety patient	No significant environmental threat
marginal	2	"No quality" not seen by the customer	Possibly a person slightly injured / no impact on the property.	A significant environmental threat
critical	3	"No qualifications" perceived by the customer	One or more seriously injured / damage to one or more systems	Significant harm to the environment
catastrophic	4	"Quality" out standards	Permanent disability and / or death / major damage to one or more systems	Major damage to the environment

Figure 5: Definition of Gravity QSE

### VI. Case Study

The proposed methodology has been validated in a public hospital in Morocco that contains an activity for Delivery wide process that manages 10 hospitals the working group consists of three people: The Procurement Manager, Head of Quality and Service 4 technicians for Delivery .The study period is 3 months.

#### 1.Overview of the process to supply the studied hospital.

The procurement process at the direction of the hospital ensures the supply of 10 hospitals, the process is complex because it consists of three components which are linked and inseparable.

This complexity is compounded by the diversity of the system components to Ibn Sina hospital in effects of multiple stakeholders are involved in the procurement process (Figure 6).

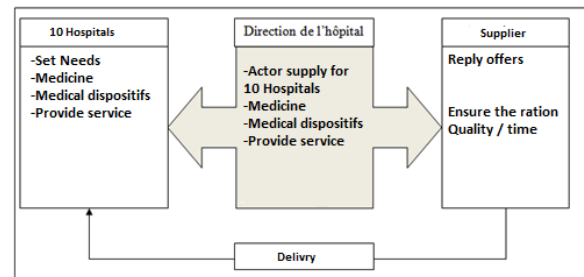


Figure 6: Components of sourcing studied hospital

#### 2 Steps in the implementation of the methodology QSE

##### Step 1: Modeling IDEF 3 of procurement process

The procurement process involves many actors. Before analyzing and optimizing a complex organization, it is first necessary to understand its mechanisms. For this, the modeling approach is well suited IDEF 3 and also serves as a tool for advocacy, communication, and analysis. This will allow us to better understand how the process real system, the nature and logic of interactions between the different actors involved in the process. Our objective is to identify problems majors process through QSE that have a direct impact on the supply performance. To model this process, we have chosen in the IDEF3 process modeling father is the supply at the direction (Figure 7).

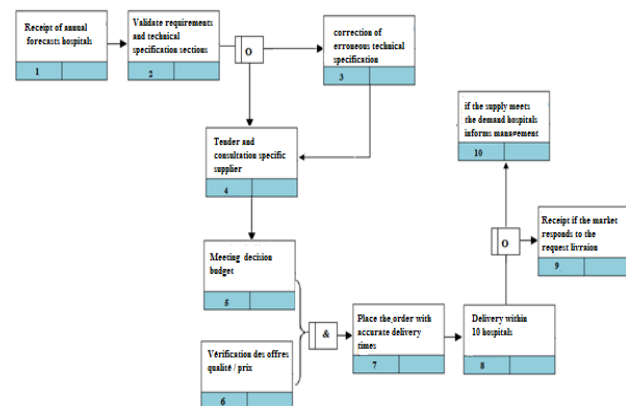


Figure 7: Modeling IDEF 3 Process hospital studied

This representation IDEF 3 clearly identifies the actors and the interactions between the different actions. We note that many actors involved in the procurement process.

**Step 2: Calculate criticality QSE per unit behavior IDEF3**

The calculation of the criticality allowed us to sketch the following curve (Figure 8) representing the criticality levels of compartment unit (the x-axis represents the number of unit behavior and the y-axis represents the associated levels of criticality).

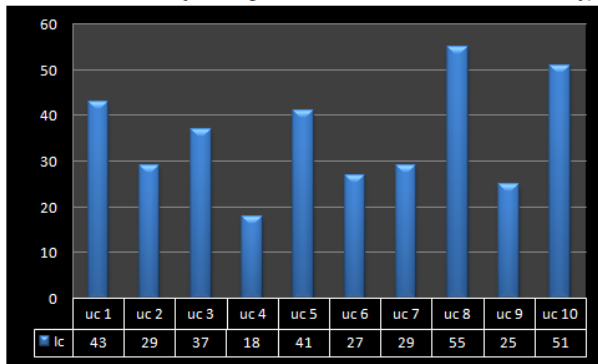


Figure 8: Presentation Ic per unit of process behavior for Delivery

**Step 3: Result Analysis and Discussion**

A sample is shown in Table 1, the process operations of the threshold exceeds 30 only (Ic = O x D x G).

The main issues that directly impact the time it is the link between the management and the Well supplied 10 hospitals:

N° behavior	unit	Problems	Impact on time	Preventive or corrective actions
1		Delay of preparing forecasts by 10 hospitals	Delay the application needs	Trigger the application before 3 months
3		Problems with the technical specifications	Correction time of application influence on the time of application	Add documents contains all the items
5		Number of items processed influence on the efficiency of decision	Problem of quality / cost	Process requests by time of need
8		Delayed delivery in 10 hospitals	Late delivery provider	Choice of supplier efficiency
10		Delivery does not correspond to the application	Delay of the application (complaint reconciliation ...)	Establish an audit one month prior to the receipt

Table 1: Unit behavior with greater than 30 Ic

The results of this study allowed the time to identify and prioritize the defective elements in the procurement process affecting the QSE systems.

The proposed actions were immediately implemented to improve this process. As a first step, an evaluation by the team projected was proposed to identify the most effective and least costly action to reduce malfunctions especially for operations of more than 30 threshold.

**Conclusion:**

The mission health facilities is to ensure the quality of care delivery and patient safety. The stakes are human, health, organizational, economic, social, legal, sometimes political. The increasingly stringent constraints at these different levels is the result of evolution of these structures. The organization of these institutions now draws increasingly refocused on the principle of the client, the concept of organizational and process mapping skills industrial approaches.

The case presented in this article has helped to highlight the benefits of an approach to IDEF3 modeling and calculation by the QSE integration to validate the design and optimization of hospital logistics hospital.

This approach could also be applied to the reorganization of an existing service, integrating the constraints of the organization. Thus, it has allowed us to identify and prioritize the defective elements affecting the QSE systems.

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