

# Role of Digitalization in the Hospital Supply Chain Performance Improvement: Digitalization of Hospital Pharmacy

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## Abstract

The hospital is a different supply chain made up of different structures and flows. Due to the Covid-19 pandemic, the hospital has overcome several major challenges in recent times, which have prompted it to accelerate the digitization of its supply chain to improve the quality of hospital care and services. This article looks at a specific point, that of performance in the hospital supply chain, and asks the following question: What is the role of digitalization in improving the performance of the hospital supply chain?

## Keywords

Hospital supply chain, Performance, Digitalization

## 1. Introduction

The management of the hospital environment poses several challenges, whether on the organizational or budgetary level. In any healthcare structure, the functional organization and rigorous management save time and optimize the work of staff and facilitate the management and continuous assessment of consumption. For this, the need to transform the hospital management system from paper mode to digital mode, ie replacing paperwork with an application, was essential. The proposed solution will help the health staff to optimize the financial flow, the flow of patients. Not to

mention securing the circulation of flows which aims to check and ensure that it is the right treatment before delivering the product. Our article proposes a solution to improve the performance of the hospital supply chain. All of the operations bring into play a set of interactions that help decision-making and assist the user. Thus, we will be able to gain in efficiency and speed during operations within the hospital while avoiding as much as possible the mistakes made by humans. Thus, our research question is structured as follows: What is the role of digitalization in improving the performance of the hospital supply chain?

The article is organized as follows. The next section reviews the literature on hospital and healthcare supply chain. It is followed by the performance and digitalization, then, the role of digitalization in performance improvement. In the fourth section, we will deal with the automation of the hospital supply chain before ending with a conclusion.

## 2. Hospital and healthcare supply chain

### 2.1 Healthcare supply chain

The multiplicity of logistics activities within a healthcare establishment reveals the presence of two logistics chains to transport the various products from suppliers to points of use, an external chain and an internal chain at the healthcare establishment (the Internal Regulations of Hospitals 2010).

Hospital logistics is the process of managing the flow of patients, products and materials, services and related information, from supplier to beneficiary, at a defined level of performance, in the service of quality and the safety of patient care (SNFS VD April 2021 report). In terms of service, figure 1 illustrates all of the components of the hospital logistics process.

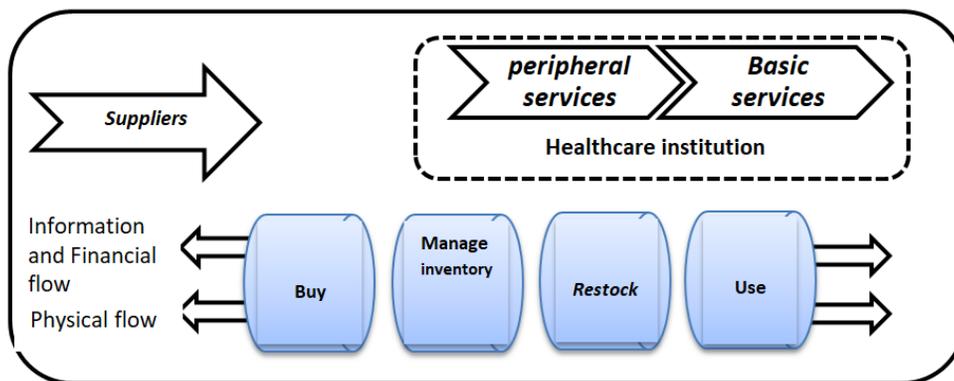


Figure 1. Components of the hospital logistics process.

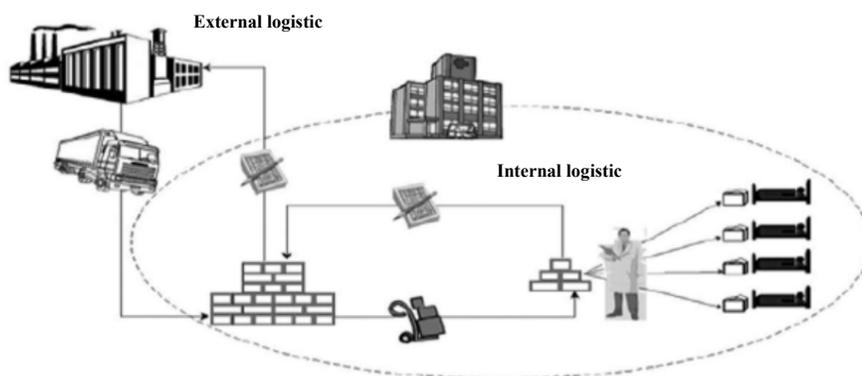


Figure2. The hospital logistics chain

Another illustration of the hospital logistics from two angles will be schematized by figure 2. It is about the external chain and the internal chain. The external logistics chain linking the supplier to the store (s) of the health establishment through which passes the information flow (product number, quantity, price, etc.), material and cash flows. Internally, a logistics chain replenishes care units from stores or from a distribution center, depending on the structure put in place. In the care unit, there is usually a main reserve where medical supplies are stored. This reserve rarely constitutes the last point of storage; there are also secondary reserves that meet the specific needs of nursing staff (The Morocco hospital network report 2011).

## 2.2 Main issues related to hospital logistics

According to the [Afnor-nf-X50-150] standard, cost is any expense incurred or attributable to a given product. Several experts have estimated the importance of logistics costs in health facilities; the evaluations arrive at an estimate of 46% for North American hospitals (JELLOULI 2016). By taking a similar approach, evaluating that hospital logistics represents 42% of the total expenses of a hospital center (Lefebvre 2020). These estimates present a large share of logistics costs and show that logistics procedures within hospitals have become one of the important vectors in the process of reducing health expenditure. This data can support decision making for improvement of this function in the hospital.

A group of pharmacists from CHUs in France have identified 22 critical elements related to drug logistics (Beretz and Petit 2002). On the basis of these data, the group notes that the logistics services are subdivided into three areas: organizational, human and technical and represent successively 12%, 11% and 77% of the total critical points. Figure 3 shows all of these results.

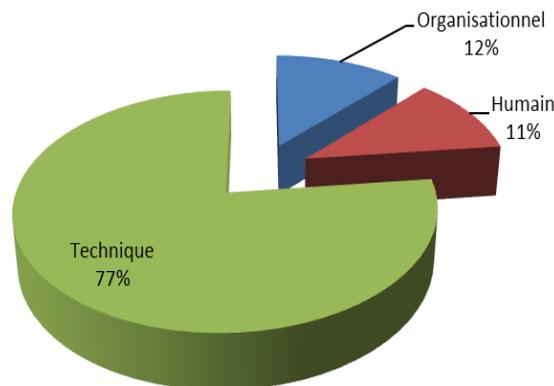


Figure 3. Main critical points of logistics management in the hospital

By dissecting the technical pole, we find that the main critical points are the locals (15%), quality management (18.45%), preparation and delivery (12.62%) and storage and inventory management (10.68 %). Other research work has been proposed to deal with this problem, we cite for this purpose the studies carried out by (Taher 2006), (Baboli et al. 2008), (Huet et al. 2010), (Aloui 2007), (Sienou 2009) and (Huet 2011). The work of Taher H. (2006) focused on the downstream pharmaceutical chain of consumable products. The author has modeled the strategic and tactical levels by the SCOR model and the simulation of the operational level by the ARIS tool. The aim is to compare the structure and centralized and decentralized decision-making of the downstream pharmaceutical supply chain. The results retained by the simulation of the models demonstrate that the centralized approach is more efficient from a global point of view but that a distribution mechanism of the gains is necessary.

Baboli et al. (2008) propose mathematical optimization models combining storage and transport costs for the replenishment system within a downstream pharmaceutical supply chain. These models are specifically intended for products with deterministic demand and allow the calculation of total costs of the central hospital pharmacy in centralized or decentralized multi-level replenishment. The work proposed by (Huet et al. 2010) aims to automate the

dispensing of drugs. For this reason, the authors have developed a knowledge model combining the Holon-Manufacturing System and UML language constituting a decision support tool for the organization of the drug circuit. Aloui (2007) proposes for its part a methodology framework for the management of risky organizations such as hospitals. The objective of his work is to develop an approach focusing on systems engineering and making it possible to represent and analyze complex socio-technical systems such as the drug circuit. Sienou (2009) presents a methodological framework for the integrated management of risks and business processes. The author offers meta-models produced by the ARIS tool, the objective of which is to design a process engineering method that unites business and risk processes by applying this approach to the drug circuit.

Huet (2011) proposes a reengineering methodology for the control by the product of manufacturing systems by applying this approach to the hospital drug circuit. The author has developed models of the named dispensing mode using the AUTOMOD tool, which is considered a flexible manufacturing system (SMF) to simulate and deploy a reorganization of the medication circuit at the Clermont Ferrand University Hospital Center (UHC). Ibn El Farouk I. et al. (2012) studied the issue of the performance of the logistics processes of public hospitals by proposing indicators for the management of supplies for the pharmacy of a Moroccan hospital. Based on all of this work, we can see that the majority of solutions ultimately focus on improving performance.

### 3 Performance and digitalization

#### 3.1 Performance in hospital supply chain: Literature review

Performance analysis is an essential task for monitoring a strategy or monitoring the effectiveness of a system. As a result, the health system as a whole finds itself in the need to review its performance periodically in order to strengthen its resilience towards any internal or external change. In this context, (Tahon and Frein 1999) discuss two methods of analyzing performance depending on the time of intervention:

- A priori approach: create a model and carry out analyzes to achieve its performance. These analyzes will be compared subsequently with the objectives assigned to propose modifications on the action variables of the model.
- A posteriori approach: Consists of measuring the different performances relating to an existing real system. Then, it is a matter of comparing these measures with the assigned objectives, proposing and implementing actions to improve the system (see figure 4).

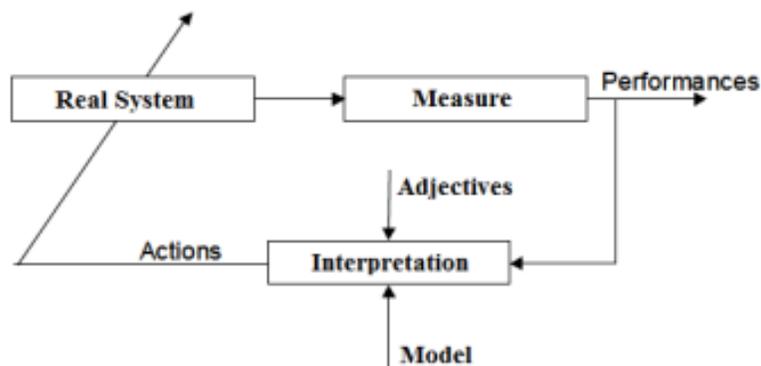


Figure 4: A posteriori performance evaluation.

The literature presents various research works that deal with the concept of performance analysis in the hospital sector (posterior approach) and several tools have been proposed and developed for this purpose. According to (Vernadat 1999), these tools and methods make it possible to analyze or improve the performance of the system in order to describe the organization of processes both to simulate it subsequently and compare the different scenarios as well as to analyze and restructure them.

In the field of the hospital supply chain, a large part of the work focuses on the main production flow, namely that of patients and those dependent on them. The studies present in the literature (Villa et al. 2014) are distinguished into two different types: studies that are based on the planning and optimization of singular care production units ((Bhattacharjee and Ray 2014); (Caunhye et al. 2012)) and operations management studies relating to flows which

propose models and theories in relation to the problems present in the context of the patient circuit at the hospital ((Jacquemin 2011); (Marshall et al. 2015); (Jlassi 2011); (Hassan 2006); (Gourgand et al. 2007)).

Various studies have tried to deal with performance and its determinants in the hospital logistics chain. For example, a system of performance indicators based on the determinants of performance and the following perspectives: Efficiency, Effectiveness and Relevance (DEEP) was developed by (Matthieu 2004) according to six main stages. It is based on a set of modeling methods (ABC / ABM, SADT / IDEF0, GRAI, SCOR, ...) which are known by their ability to generate action variables (performance indicators).

In striving for leaps in productivity, technology will play a key role, as it does in the manufacturing industry. Automating logistics is a way to improve efficiency and support core value-added processes. Also, for the healthcare supply chain automation is an effective support tool, allowing staff to focus on activities that add value to the patient and improve the performance in hospital.

### **3.2 Role of digitalization in performance improvement**

According to (Carino et al. 2020), the digital company is the one that has introduced into its daily operation the use of innovative digital tools, such as Big Data, artificial intelligence, dematerialized computer systems, social networks and the Internet of Things. Digitalization therefore means first of all having succeeded in setting up such tools and using them. The use of these new tools immediately raises the question of their usefulness. For digitization to be complete, the company must transform. In particular, successful digital transformation enables companies to identify and respond more quickly to consumer needs and preferences as well as to develop more innovative products and services than competitors (Nobre 1998).

For (Dohan et al. 2020), organizations still do not understand what digital means: Some still consider it as a simple extension of IT or marketing, moreover organizations rarely adopt the holistic approach necessary for digital success. The fundamental misunderstanding of digital prevents many companies from connecting their digital strategies to their core business. Before examining the digital transformation of hospitals, it is important to understand exactly what "digital" means. There are several definitions, but we are based on that of McKinsey which states that digital is less about a process and more about the way companies run their business (Koetz 2020).

Digitization has had the impact of the emergence of new managerial methods and practices, incumbent on managers to learn new skills, and sometimes even radically change the way they work. As highlighted by (Corniou 2010), the massive deployment of digital technologies was perceived more as a complication of the work than as a simplification, citing the example of digital office automation tools and management software (ERP), which fixes the 'individual to his computer' (Ferhane and Salah 2019). Digitization today is therefore a source of innovation. However, the main challenges of innovation were related to its acceptance by individuals and therefore to the management of change in general (Lefebvre 2020).

For example, during the introduction of the Computerized Patient Record (CPR), a real resistance to change in the health care provider was felt (Gapenne 2020). Another difficulty regarding the digitization of the medical sector is the question of the use of technologies. Obviously, the related constraints such as respect for private life. For Dohan et al. (2020), digital transformation is a collective term used to describe the changes affecting the activities, processes and skills of the company by digital technologies. Furthermore, according to (Retmi et al. 2021), improving healthcare delivery through digitalization entails providing product quality for patient well-being, in respect to hygiene and safety rules.

The digital transformation of a company means the transformation of its businesses using products and services from the digital industry. The structures and their interactions within the company and in its ecosystem can be profoundly impacted by the Internet and the Internet of Things (IoT) (Dorner 2015). The challenge of digital transformation in Africa is largely based on human resources as well as on the centrality of the end user (citizen and user) in the implementation of all projects. Starting from there, supporting digital transformation in Africa means investing in a structured, coordinated way, at an accelerated and sustained pace in plural and multidisciplinary actions (Dorner 2015).

Digital transformation refers to the changes brought about by the development of digital technologies that are occurring at a breakneck pace, disrupting the way value is created, social interactions, the conduct of business and, more generally, our way of thinking (Khanboubi and Boulmakoul 2018). According to Ben Gilchrist (2013) digital transformation is seen as changes that digital technology brings about or influences in all aspects of human life. It leads to a world that is increasingly experienced with, through and through information technology.

In the manufacturing industry, digitization is a well-known way to improve productivity and efficiency (Sampieri-Teissier 1999). Through standardization, automation and process control provide predictable and highly productive added value. Automation is however experiencing a transformation of scope and an increase in the range of requests. Healthcare logistics automation is a booming industry, but living case witnesses are poorly documented in scientific contexts. The healthcare industry is under constant pressure from politics and the public to increase service levels and reduce escalating costs. The demographic trend and the profile combined with increasing treatment possibilities, leads to a huge challenge to increase the productivity of healthcare. Faced with these challenges, many technologies and management strategies concerning process, organization, function and applications have been proposed and implemented. In striving for leaps in productivity, technology will play a key role, as it does in the manufacturing industry. Automating logistics is a way to improve efficiency and support core value-added processes. The automation of the logistics chain, and its activities concerning both information and materials handling. A well-functioning logistics system is essential for the overall functioning of healthcare operations, but the added value of patient care processes is often diminished by the many logistics activities required by hospital staff. Supply chain automation is an effective support tool, allowing staff to focus on activities that add value to the patient.

## **4 Automation of the hospital supply chain**

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With the supply chain being the second largest cost area for healthcare organizations, it is a natural target area for waste reduction and cost containment. But that leads to the question, "where do I start ?!" Let's start by looking at three areas where you can identify waste in your supply chain for greater efficiency, lower costs, and better bottom line.

### **4.2 Healthcare supply chain automation**

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Let's start by looking at three areas where you can identify waste in your supply chain for greater efficiency, lower costs, and better bottom line. Healthcare supply chain automation reduces waste in these 3 areas: work, expired or lost products, and load capture.

#### **4.2.1 Work**

Labor costs represent 60% of the average running costs of a hospital; therefore, increasing productivity and efficiency is the key to financial improvements. Healthcare organizations that still rely on manual supply chain management processes are throwing money out the door. When a clinician spends his time researching supplies or manually entering product data into multiple clinical documentation, supply chain and financial systems, he is wasting valuable

resources on administrative tasks, when those efforts could be applied. to patient care. Automating supply chain processes for better inventory management, availability of supplies and streamlined documentation eliminates this waste and allows clinicians to focus on patients.

#### 4.2.2 Expired or lost products

Healthcare organizations that lack visibility into their supply inventory cannot effectively manage product expiration dates, resulting in wastage or worse, the use of expired products on patients. Without an effective inventory management system in place, products are also lost within the walls of a facility, especially when clinicians choose to build their own inventory of supplies for fear of running out. To reduce waste in this area, implement a system that extends healthcare supply chain automation to all areas where inventory is stored, including clinical and procedural areas. The good news is that there are specialized supply chain solutions to help hospitals reduce waste and ensure the right products are available at the right time.

#### 4.2.3 Load capture

Failure to capture the products used in a procedure, especially expensive supplies used in the operating room (OR), results in waste by the inability to bill payers for these items and in turn receive a refund. When capturing the product at the point of use (POU) in the patient's electronic medical record (EMR) is complex and / or laborious, some clinicians skip this step because it is time consuming and distracted from the patient. While the main priority of any healthcare system or hospital is the care of the patient, the reality is that the organization has to earn money to provide care. In addition, failure to document the use of supplies in the patient chart hinders the reporting of adverse events and the management of recalls. The key is to enable clinicians to easily document product consumption (POU) with a healthcare supply chain automation process that uses digitization technology and system integration. Eliminating manual steps also reduces the risk of human error, thus improving the efficiency and accuracy of the invoicing process.

### 5 Conclusion

To address the research question - What is the role of digitalization in improving the performance of the hospital supply chain? - On the one hand, this article described what exists in the literature on hospital and healthcare supply chain. On the other hand, we treat, the performance and digitalization, then, the role of digitalization in performance improvement followed by the automation of the hospital supply chain. Regarding the latter, and to make the hospital supply chain more responsive and flexible, we started to develop a solid hospital information system, we continue collecting information of the domain to have a global view, identifying the problems, and push to finalize building a global IT project on the digitalization in this field.

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