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Applying the theory of constraints to the logistics service of medical records of a hospital

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ABSTRACT

Management of patient records in a hospital is of major importance, for its impact both on the quality of care and on the associated costs. Since this process is circular, the prevention of the building up of bottlenecks is especially important. Thus, the objective of this paper was to analyze whether the Theory of Constraints (TOC) can be useful to the logistics of medical records in hospitals. The paper is based on a case study conducted about the 2007-2011 period in the Medical Records Logistics Service at the Hospital Universitario Virgen Macarena in Seville (Spain). From April 2008, a set of actions in the clinical record logistics system were implemented based on the application of TOC principles. The results obtained show a significant increase in the level of service and employee productivity, as well as a reduction of cost and the number of patients' complaints.

1. Introduction

In this section, we describe the process of logistics of medical records and the management tool that was used to improve it: the Theory of Constraints.

1.1. Medical records

In spite of the fact that medical records (MR) are involved in several roles (Tejero Álvarez, 2004), such as research, teaching, and planning, priority lies with the healthcare purpose, for which it is important to efficiently manage records in order to guarantee case follow-up and, therefore, proper medical care of patients. Although the trend in this field is the replacement of the physical files by electronic patient records systems (Waterson, Glenn, & Eason, 2012), physical support records are still common, implying a logistics management of material flows. In such cases, a key element for this objective is to maintain efficient logistics of clinical documents that ensure the presence of medical records right where and when they are needed in the most effective and efficient way. In fact, is the same logistic problem that has the materials management service (Aguilar-Escobar, Bourque, & Godino-Gallego, 2015)

In MR management, the goal is to maximize the number of MR delivered to the clients in time (doctors are the internal customers in this process). As can be seen in Fig. 1, MR logistics involve lending out the MR to medical services and then taking these MR back to the storage area. This can be divided into four processes: *preparation* for MR to be lent out for consultations, MR *delivery* to medical services, its *collection*, and *storage*. It is, therefore, a process of a circular nature because, to make it possible to prepare new consultations, MR must be taken back by the medical services and properly stored. Circular processes are common in lending activities, such as libraries, rent-a-car, video-clubs, and even include certain financial activities. In healthcare, it is also the case of the central sterile services department. In these cases, the prevention of bottlenecks is especially important because, once one is formed, other parts of the process then suffer from that constraint.

Another singularity of the MR process is that the agents of the process could react to the constraint by making their own decisions, which usually exacerbate the problem, thereby creating a vicious circle. This situation is possible since certain agents (middle managers, i. e. doctors) have the authority to make decisions that affect the system as a whole.

The presence of these two characteristics together renders bottleneck management as a critical issue.

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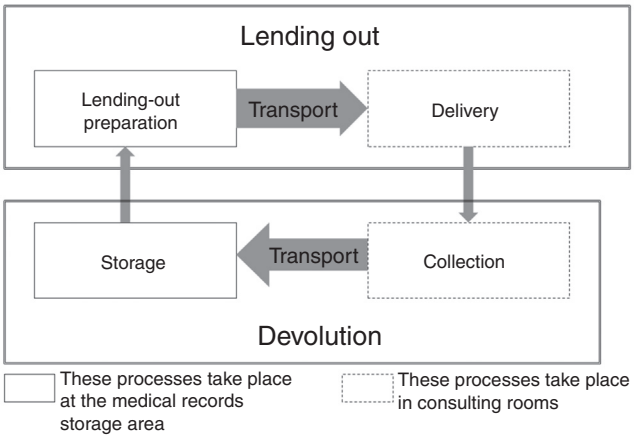

Figure 1. Medical records management circular process.

1.2. The Theory of Constraints (TOC)

From the perspective of logistics, the challenge to be faced is similar to that in any economic activity and the goals are also the same: the improvement of service, the reduction of costs, and the increase of client satisfaction (Aguilar-Escobar & Garrido-Vega, 2013). In order to meet such a challenge, several methodologies have been applied (Simón Martín, Flores Varela, & Arias Coello, 2010; Moro Cabero, 2011). In the business management field, various approaches have been developed for the improvement of management, such as MRP, Lean, and Theory of Constraints (TOC), among others (for a comparative analysis of these three approaches, see Gupta & Snyder, 2009). The Theory of Constraints (TOC) is based on eliminating the restrictions of the system (or bottlenecks), which prevent the productive flow from being able to satisfy the demand. TOC philosophy appeared in the 1980s from the evolution of a previous version in the production/operation area, called Optimized Production Technology (OPT). OPT was initially created as a scheduling software program (with a secret algorithm) in 1980 by Eliyahu Goldratt and was quickly applied in western companies (Goldratt & Cox, 1992). A few years later, the nine OPT rules upon which this program was based was released (Goldratt & Fox, 1986). Since then, this technique has evolved from a production programming method to a management philosophy (TOC), which can be useful for ascertaining and improving the performance of complex systems (Gupta, 2003; Watson, Blackstone, & Gardiner, 2007; Naor, Bernardes, & Coman, 2013). TOC can be analyzed from two different perspectives: organizational system management and ongoing quality improvement (Siha, 1999; Gupta, 2003).

From the first perspective, TOC remarks that every organization has a final objective, a *goal*, and it can be understood as a number of inter-dependent events subjected to fluctuations, in such a way that the system's global performance at any given moment is always constrained by a number of factors: *bottlenecks*.

As regards the second perspective, TOC proposes a number of tools for ongoing quality improvement of the system, from among which two are worth bearing in mind (Siha, 1999): effect-cause-effect (ECE) diagrams, and the five-focusing-steps (FFS) process. ECE diagrams form part of the "Thinking Processes" tools, introduced by Goldratt in 1994 in his book "It's Not Luck" (Watson et al., 2007), which are aimed at rigorously and systematically identifying unstructured problems related to management policies. Since ECE diagrams are not used in this case, this tool will not be discussed further.

The FFS technique is a methodology described by Goldratt in his book "The Goal" in 1984 (Watson et al., 2007) designed as an ongoing problem-solving process, and consists of: 1) identifying the constraints of the system; 2) deciding how to exploit those constraints; 3) subordinating all the other parts of the system to the previous decision; 4) elevating the constraints of the system; and 5) returning to step 1, while striving to prevent inertia. Each of these phases are briefly explained below.

Phase 1: TOC considers a constraint as any area, process, or specific element of a system which prevents its performance from being increased and its goal from being reached. Typically, the factors acting at any moment as a constraint number either only one or just a few. These constraints may be external (from suppliers or customers) or internal. The latter are of two types: physical, when they are due to a lack of resources; and political, when they are brought about by inefficient procedures or policies. To identify constraints, TOC starts by identifying a number of undesirable effects (UDEs).

Phase 2: The purpose in this phase is to maximize efficiency of the present constraint, by concentrating efforts on eliminating those activities involving waste or loss of time in the constraint. In this phase, actions are generally focused on making organizational changes in those procedures and policies that imply no economic outlay. The aim is to make the most of the bottleneck-factor potential, although this is usually insufficient to eliminate the constraint, as we will see later.

Phase 3: This phase implies synchronizing the operations in other non-bottleneck processes or elements of the system so that they will not provoke any setback in the use of the constraint. Like the previous step, this usually involves changes in policies and procedures without incurring additional significant expenses.

Phase 4: If steps 2 and 3 are insufficient to eliminate the constraint, then the solution is to increase the bottleneck potential, which was performed in this case. This action involves incurring expenses and making an investment.

Phase 5: If the constraint disappears as a result of the previous steps, it will be necessary to return to step 1, because there will be, without a doubt, another constraint emerging either inside or outside the system. Likewise, it is also necessary to pay attention and prevent the system from returning to the previous configuration due to inertia, which is extremely common in all systems.

One of TOC strengths, as opposed to other improvement approaches tending to optimize performance in each area of the system (such as TQM, *Six Sigma* and *Lean*), is that it is based on systemic thinking, by focusing improvement efforts on critical components of the system (Reid, 2007).

TOC has been successfully implemented in a number of organizations, mainly in manufacturing companies (Mabin & Balderstone, 2003; Chou, Lu, & Tang, 2012), its application remains much more reduced in services (Reid, 2007; Cox & Schleier, 2010; Nowakowska-Grunt & Moroz, 2013). In spite of this, services offer major room for improvement through applying TOC concepts and tools (Cox & Schleier, 2010). It is true that services present certain unique characteristics which must be taken into account when TOC is applied (in performance measures, in the nature of the constraints, etc.) and these characteristics depend to a great extent on the type of service (Siha, 1999). Although scant, among all service industries, it is in the healthcare sector where TOC applications have been more extensively developed (Ronen & Pass, 2010). Goldratt himself envisaged that TOC principles were perfectly applicable to healthcare (Goldratt & Fox, 1986). In this field, apart from some theoretical contributions (Motwani, Klein, & Harowitz, 1996; Breen, Burton-Houle, & Aron, 2002; Young, Brailsford, Connell, Davies, Harper, & Klein, 2004; Wright & King, 2006; Ronen, Pliskin, & Pass, 2006; Aoki, Ohta, Kikuchi, & Oishi, 2008; Sadat, Carter, & Golden, 2013), to the best of our knowledge, research has been mainly aimed at patient-flow management (Womack & Flowers, 1999; Rotstein, Wilf-Miron, Lavi, Seidman, Shahaf, Sharar, Gabay, & Noy, 2002; Umble & Umble, 2006; Stratton & Knight, 2010), although other studies have dealt with different areas, such