Chapter 6

Emerging Trends in Healthcare Supply Chain Management — An Italian Experience

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Additional information is available at the end of the chapter

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1. Introduction

The aim of this study is to present the emerging trends in the *Pharmaceutical Supply Chain Management and Logistics flow* redesign. Logistics and Supply Chain innovation are becoming a highly topical issue in the international research agenda, as well as in practice. The reason is that economic and political factors are raising the attention to healthcare issues: the process of local health corporatization, which involves the introduction into the National Health System of control mechanisms similar to the competitive market models; the aging of population; the increasing demand for healthcare services; the rising cost of inpatient and outpatient care; new technologies and new drugs that will continue to drive up the total healthcare cost. Indeed, limited resources and a steady growth in spending, hence, the need of a public health rationalization, especially for meeting increasingly quality demands. All this requires a profound transformation that affects not only the processes of diagnosis and treatment, but also those of support, especially logistics, which is essential for the processes of service differentiation, efficiency, quality and safety processes improvement.

However, the logistics process of pharmaceutical products in the healthcare sector accuses a relevant gap compared to other sectors: hospital companies tend to behave like "individual agents" with their own purchasing offices, a pharmacy and an internal distribution system based on order-delivery process. Additionally, they have to manage very different kinds of goods, taking care of the impact in the process of patients care. Consequently, a large number of transactions sent to different vendors and purchases of large quantities of drugs from individual departments with the resulting generation of high inventory and storage costs. As a natural consequence of this diversity of assets to manage, the organizational responsibility

of the logistics function is often fragmented and dispersed across multiple organizational units, with clear coordination and integration problems.

In order to optimize the inventory control and reduce the material handling costs of pharmaceutical products, it is necessary to manage the Supply Chain following an integrated perspective, capable to overcome boundaries between professional specializations and organizations involved in the materials flow from warehouses to wards. This appears to be even more important for the Italian National Health Service, where all the discussions are concentrated in the fact that the hospitals' costs should be decreased, even if the materials managers' duties are still not defined. The state of the art shows that Italian hospital companies are in a condition of delay from the point of view of materials management, from which only recently they have been trying to get out, analyzing and rationalizing their Supply Chain processes [1].

Due to the critical role Supply Chain play in the healthcare sector, cost control and the optimization of material flows of drugs have been the subject of numerous studies, and different approaches and methods have been suggested in the literature [2-10]. They indicate that, starting from the traditional healthcare Supply Chain Management, some organizations are applying innovative transformations in the way of *centralization,* that is the aggregation under a single organizational unit of all the business functions involved in the overall process of pharmaceuticals purchasing and logistics. The application of these new models, capable of ensuring both the maximum efficiency and cost containment, has proven to allow the achievement of the objectives prescribed by the Italian's National Health Plan, which was developed in 1992 in order to find solutions that improve healthcare services and contain long-term costs increase.

According to these premises, in this chapter we explore the possibilities of Supply Chain and Logistics flows optimization and innovation in the Italian healthcare sector, through a process reengineering project. The literature review and an in-depth analysis of an Italian Local Healthcare Company help us to explain how changes in the pharmaceutical logistics flow can improve efficiency and reduce costs.

2. Healthcare supply chain: Definition and characteristics

The *Supply Chain* (SC) is a process that includes all the activities ranging from the identification of a customer need through product selection, negotiation with suppliers, payment, storage, distribution and redistribution. It is a set of three or more entities directly involved in the upstream and downstream flows of products, services, finances, and information from a source to a customer [11-13].

The *Supply Chain Management* (SCM) therefore, refers to upstream and downstream relationships with suppliers and customers and to solving problems of functional divisions that occur within and between organizations. In other words, it extends the concept of partnerships into a multi-firm effort to manage the total flow of goods from the supplier to the ultimate customer,

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to achieve greater benefits. SCM was developed initially in the context of manufacturing, but its introduction is beneficial to the healthcare sector, where it shows an important impact on hospital performance, in terms of reducing wastes, preventing medical errors, improving quality of care, service and operational efficiencies [14].

In particular, the healthcare SC in the Italian context generally consists of four main actors: 1) producers (pharmaceutical companies); 2) purchasers (dealers/depositaries and wholesalers); 3) providers (healthcare organizations and pharmacies); 4) patients (Figure 1).

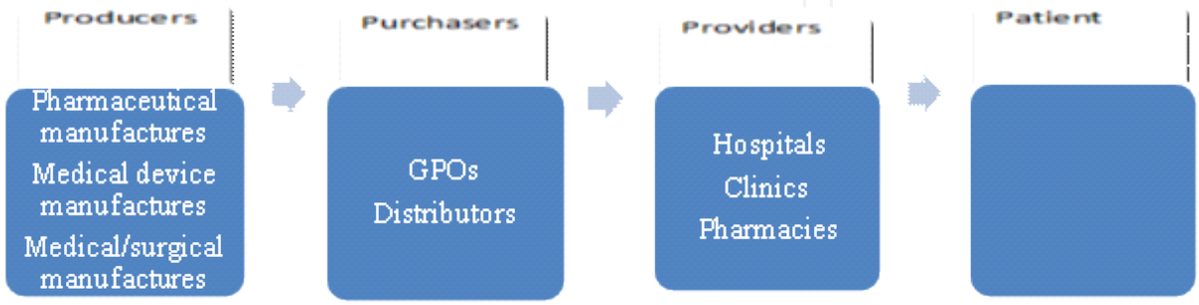

Figure 1. Healthcare Supply Chain

Producers produce goods such as pharmaceuticals, medical devices and implants, and medical/surgical supplies that are necessary in the delivery of healthcare. *Purchasers* consist of group purchasing organizations (GPO) and distributors who facilitate the payment for and the shipment of goods from producers to providers. Among them, the main actors are depositaries and wholesalers. The difference between these two subjects is fundamentally linked to the acquisition of the goods ownership: depositaries work in deposit account and they are paid on the basis of a fee-for-service; they carry out temporary storage of products and send them to providers. Wholesalers acquire the ownership of pharmaceuticals and the related business risk, buying the availability of pharmaceuticals from the industry or by depositories. They must satisfy the demand of providers quickly, with a widespread distribution and through the management of a large number of references. To the actors of healthcare SC described above we must add *providers*, who may purchase goods from purchasers or directly from the producers. They use pharmaceuticals to administer healthcare services to patients. In particular, pharmacies can distribute pharmaceuticals to dismissed patients or to patients who, due to debilitating diseases, cannot get to the hospital to access the necessary pharmaceuticals to their treatment assigned. *Patients* (both hospitalized and dismissed) are the final customers of the healthcare process.

Healthcare SCM includes *business activities* and *operations* that integrate a continuous, seamless flow of materials and services for healthcare delivery [15]. One of the biggest challenges facing healthcare SCM operationally is maintaining sufficient inventory levels to sustain quality and timely patient care reducing wastages, and for this reason, it is designed to assure a high service

level by maximizing the resource allocation, in order to respond effectively and promptly to the patient care needs. Healthcare SCM processes have three types of flows: *physical, information and financial* flows. The physical flows includes the supply of pharmaceuticals, medicals, surgical consumables, medical devices, hygiene consumables, food supplies, equipment and other supplementary products necessaries to support doctors, nurses and of course patients. Information and financial flows are related to SC decisions for effective product flow and organizational performance improvement. A successful SCM requires planning, managing and controlling these flows through the integration of key processes [15-19].

Due to the growing influence of patient-associations and to the necessity to deliver health services in a more efficient and effective way, many healthcare organisations have started projects in the area of patient logistics, clinical pathways, data interchange [20]. Moreover, the redesign of hospital services and the implementation of integrated care programmes are frequently addressed as being critical strategies to decrease resource utilization and improve healthcare quality. During the last ten years an impressive number of studies, originated in different disciplines like economics, organisational behaviour and logistics, have drastically enlarged our knowledge regarding the healthcare sector [16, 21-23].

Although many healthcare organizations have recognized the importance of adopting SCM practices, the application of techniques, methods and best practices originally developed in the industrial setting is often problematic. Their implementation has proven to be more complex primarily because it handles a diversity of items in widely varying quantities, in response to the large number of diagnosis types and procedures. Secondly, it requires the participation of many *different stakeholders* and it is highly influenced by *legislations* and *healthcare professionals* [14, 24, 25]. Furthermore, healthcare is a *customer driven service*, which means that customers are an effective part of the process [26, 27]. However, literature and practice suggest that numerous opportunities exist to reduce costs and improve delivery of healthcare by improving the efficiency and quality of healthcare SC operations. The key drivers of these opportunities are cost and quality of healthcare, and this is the reason why they are two of the most discussed and debated issues of our time. Healthcare SC innovation has been regarded as a critical success factor for organisational performance: it refers to tools that can improve organisational processes needed for effective SCM through seamless interactions with suppliers, manufacturers, distributors and customers. Thus, it allows reductions in cost and lead time, creation of new operational strategies, provision of quality and development of flexibility for dealing with rapid changes in the socio-economic context.

3. The pharmaceuticals logistic management

In healthcare the term logistics encompasses the set of techniques, methodologies, tools and infrastructure used in the management of the physicals flows (such as drugs and surgical medical products) and the associated information flows, from the acquisition in the market to the distribution to wards (Figure 2). The proposed definition allows us to make some important specifications as regards to *purposes* and *contents*.

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With reference to the first aspect, the *pharmaceutical logistics* is the task of placing the *right* drugs and medical supplies, in the *right* quantities, in the *right* conditions, at the *right* health service delivery points, at the *right* time, for the *right* patients/users and for the *right* cost [28]. In other words, logistics seeks to pursue simultaneously *efficiency* – economical use of resources –, *effectiveness* – service level maximization – and *cost-effectiveness* – long term capacity to achieve the economic equilibrium. Referring to the content on the other hand, the logistics system is a set of activities (procurement, storage, physical distribution) that must be managed in an integrated manner.

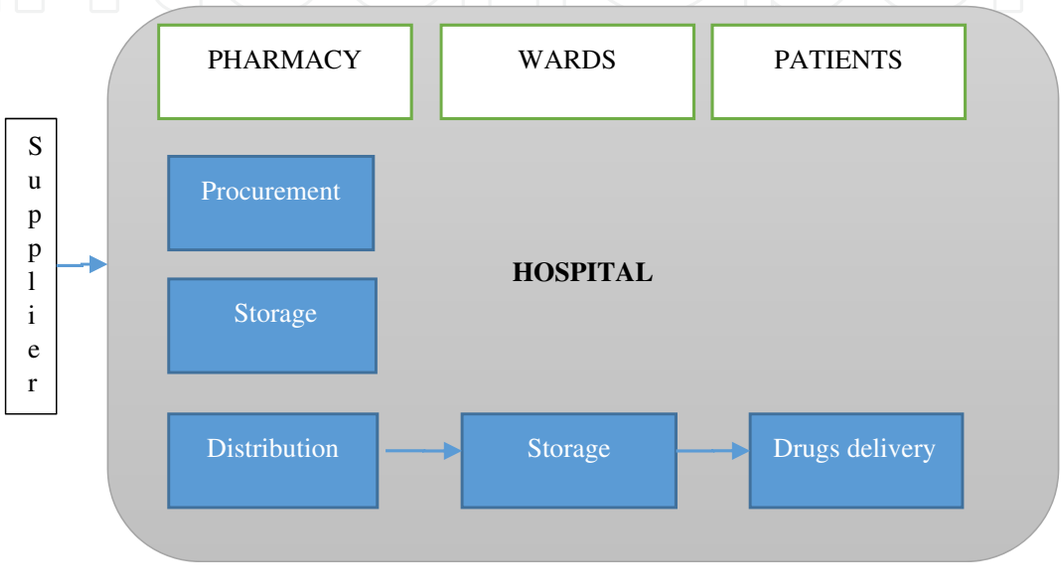

Figure 2. The pharmaceutical logistics process

As some authors point out [28], the mains objectives of a good logistics include:

- improve information systems for accurate collects and reports data when and where needed;
- improve forecasting/procurement;
- improve distribution activities;
- obtain clean, secure, organized storage;
- implement a good transportation system.

The increased complexity that characterizes the management of logistics flows within the healthcare companies is linked to different aspects (Figure 3):

1. Healthcare companies manage at least *three broad categories of goods* characterized by markedly different physical, logical and managerial requirements, with important problems of storage space;
2. *Logistics organizational responsibility* is often fragmented and dispersed among several organizational units with obvious problems of coordination and integration;

3. Healthcare companies treat *patients*, and this introduces elements of natural variability.

4. Last but not less important point, logistics has an important impact on the processes of care, that is on the quality and safety of care provided to patients. When healthcare actors communicate and share information, they are more likely to improve the quality in terms of patient safety, cycle time reduction and operational efficiency [29-32]. The safety of patients is the top priority in healthcare, and pharmaceutical managers play a crucial role in protecting their interest: their biggest responsibility is to ensure that the products purchased for clinical use are good quality ones. This can be achieved by developing a product evaluation system, consisting of well-defined parameters, to guarantee that only approved products can enter a hospital's stockroom. Additionally, timely placement factor is probably not as crucial in any other field as it is in healthcare delivery, where delay of a few seconds can cost a life.

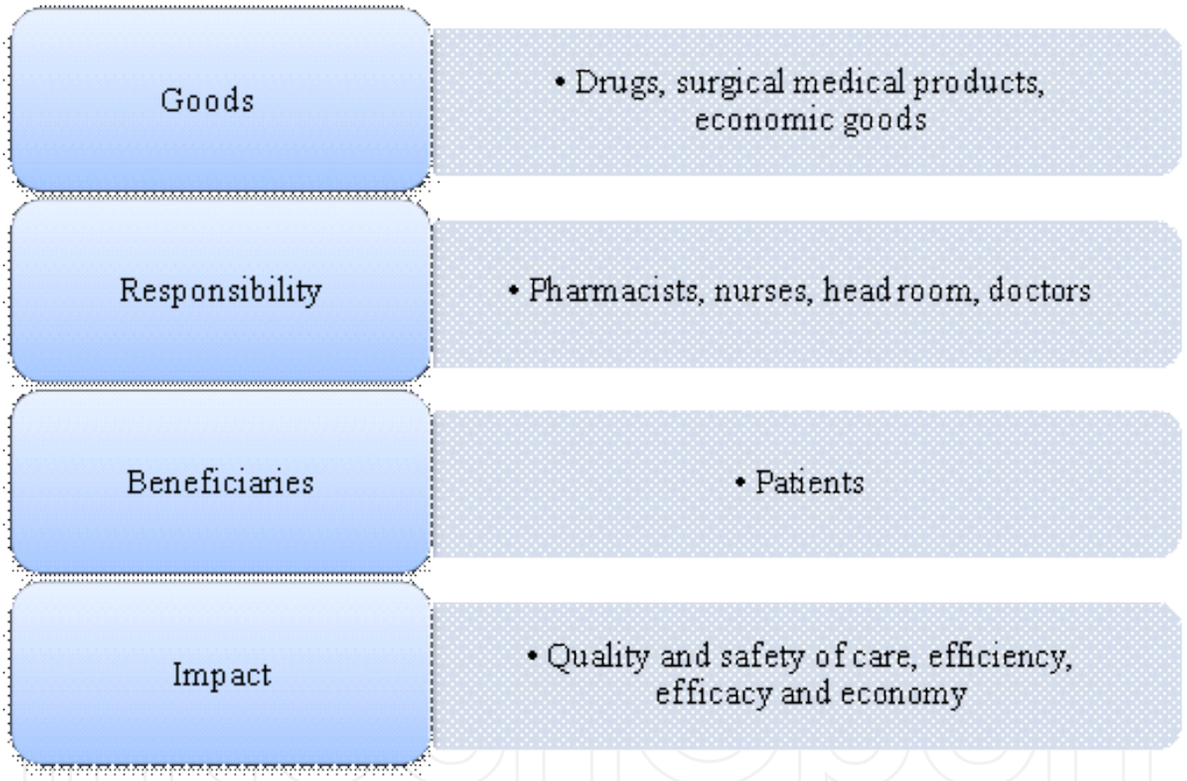

Figure 3. Factors of complexity in the pharmaceutical logistics process.

3.1. Pharmaceutical logistics and information systems

Managers operating in the pharmaceutical logistics process face many problems related to *data quality*: *products* are various and constantly changing, and this results in product data that is often inaccurate and obsolete; furthermore, *product identification codes* may not be consistent between hospitals in the same network or even between floors of the same hospital. The effects of poor data quality are widespread throughout the healthcare SC: incorrect product data leads

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to increased costs due to pricing errors, and this results in wasted time and rework for managers trying to resolve rebate, return, and credit issues with suppliers. In addition, the quality of healthcare can be adversely impacted, because data problems can result in healthcare procedure delays due to necessary products not being on hand [33].

Optimization of information storage and use requires that the organization and storage of data throughout the SC is consistent, so that all the data are accessible to multiple entities at different levels. The results are well coordinated movements of inventories, products that are delivered quickly and reliably when and where they are needed, as well as high responsiveness to short lead times [34]. A solution is given by implementing a *Logistics Management Information System (LMIS)*: managers gather information about each activity in the system and analyse that information to coordinate future actions [28]. The LMIS provides method feedback for [35]:

- tracking the storage and movement of goods at every level within the supply system in order to obtain stocks ready for use in healthcare structures;
- ensuring proper stock rotation so that items of earliest expiry dates are used first;
- enabling managers to know the total amounts of commodities that are within the supply and where they are located.

The purpose of LMIS is to collect, organise, and report the logistics data in order to improve the customer service by improving the quality of management decisions. A well-functioning LMIS provides decision makers with *accurate*, *timely*, and *appropriate* data for managing and monitoring the flow of supplies, accounting for products, reducing supply imbalances, and improve costeffectiveness.

There are four essential *data items* in any LMIS (Table 1):

Stock on hand	**Quantities of usable stock available at all levels of the system.**
Rate of consumption	An average of stock dispensed to users during a particular period of time.
Losses	Include the quantity of stock removed for any reason other than consumption.
Adjustments	They are created when quantities are issued to or received from other facilities at the same level.

Table 1. Types of LMIS data items.

These data must be available for every product, at every level, and in all times. The additional data item is known as *service statistics* and it may be added depending on the needs of the users. It helps logistics managers to evaluate the success of health programs. Essential data can be recorded through three different *recording systems*:

1. *the stock keeping records* keep quantity of stock on hand and quantity of losses information about products, and they are completed by anyone who receives or issues stocks from storage, or who takes a physical inventory of stock;

2. *the transaction records* keep information about the movement of stock from one storage facility to another and are prepared by the warehouse personnel or nurses at both issuing and receiving facilities when a facility issues or requests supplies;

3. *the consumption records* keep information about quantity of each item dispensed to the customer (dispensed-to-user data) and they are completed by the service personnel at the service delivery point whenever supplies are dispensed to the customers. Only the transaction records move from one facility level to another with the product, while both stock keeping and consumption records remain where they are prepared.

At the end of a certain period, particularly monthly or quarterly, reports should be prepared and sent to the higher levels in the logistics systems for decision making, policy making, and planning. Reports are used to move the essential data to the logistics decision makers and the data should be available to the managers in a form suitable for decision making. For this reason, literature suggests six "rights" for LMIS data: the managers must receive the *right* data (essential data), in the *right* time (in time to take action), at the *right* place (where decisions are made), in the *right* quantity (having all essential data from all facilities), in the *right* quality (correct or accurate), and for the *right* cost (not spend more to collect information than spend on supplies) [28].

Additionally, the *summary report* contains all essential data items for a specific facility and for a specific time period (usually monthly or quarterly) in the form of simple report, aggregate summary report, or report and request report. The *feedback report* informs the lower levels about their performance and even inform higher level managers about how the system is performing.

4. The Italian National Health Service: Mains trends and change forces

The Italian National Health Service (NHS) is the institution through which the State guarantees its citizens the constitutional right to health (article 32 of the Italian Constitution), in conditions of equality throughout the national territory. The NHS is a public system with universal nature, that is to say that it guarantees healthcare to all citizens (all citizens are equal and enjoy equal rights); it is funded through general taxation, direct incomes (health tickets) and fees. The NHS is organized according to the *National Health Plan*, from which the *Regional Health Plans* are derived, and it includes the *primary* healthcare (services to which citizens have direct access) and *secondary* and *tertiary* healthcare (services to which citizens access via the General Practitioner).

The public healthcare service considers different levels of responsibility and government at central, and regional level. In particular, at the *national level*, the Ministry of Health has the responsibility to guarantee all citizens the right to health, ensure equity, quality and efficiency of healthcare and promote actions of improvement, innovation and change. The *middle level* has the task of setting the basic level of benefits that the health service is required to provide to all citizens, for free or with a cost-sharing. In addition, it allocates resources devoted to healthcare. The *regional level* has legislative, administrative, planning, funding and monitoring

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responsibilities for the essential levels of assistance, and functions are established by the Regional Health Plans for three years. Services are operationally delivered from ASL through internal structures, according to agreements with other public health institutions (Hospitals Companies, Hospitalization and Healthcare Institutes, University Polyclinics) or with accredited private structures and healthcare providers.

The need for change the management of public healthcare structures is due to some fundamental reasons: 1) the process of *local health corporatization*, which involves the introduction of control mechanisms into the national healthcare system. Hospitals assume managerial and economic-financial autonomy, and they must set their own goals for quality of service and cost management in order to ensure the survival over time; 2) limited resources and a steady growth in spending, hence, the need for a *public health rationalization*, especially for meeting increasingly quality demands. All this requires a profound transformation that affects not only the processes of diagnosis and treatment, but also those of support, especially logistics, which is essential for the processes of service differentiation and quality improvement [36]. As some researchers point out [37-40] a significant portion of healthcare costs can be reduced by implementing effective pharmaceutical SC through the redesign and reorganization of the materials and information flows with the aim to optimize inventory control and reduce material handling costs. Actually, the pharmaceutical logistics in most of the Italian Hospitals is characterized by dispersion and fragmentation, which does not allow efficiency and patient safety. In particular, the current organization is expressed by a multiplication of warehouses, diversified by product type and destination end-users; the growth of managed products types; the absence of economies of scale in the procedures for storage, with a duplication of used resources; a high number of transactions addressed to a multitude of suppliers.

All these has contributed to the continuous improvement of the healthcare organizational and management *complexity* and to the increase in transactions put into place within them. Hence, the need to make radical changes in the way healthcare companies operate and to provide clear logistics objectives. In particular, they must ensure a *multi-dimensional decision making process* that involves more figures and professional skills, in order to analyze the operational needs across the board (technical, health, economic and organizational aspects), together with a *graduated scale of intervention*, of increasing complexity and directed to the realization of an operational model based on pre-assessments of opportunities.

In the healthcare sector there is a growing awareness of the significant weight that investment in consumables and the cost of managing them have on the corporate balance sheet. Therefore, in order to increase the efficiency it is necessary to operate in the direction of simplifying the flows of materials and replace the current high level of stocks with a greater amount of accurate information available in real time about the various stages of the SC.

Unlike what happened in manufacturing companies, in which the SCM is a strategic element of management, in the world of healthcare it is still anchored, in most cases, to a distribution with the *traditional system* (Figure 4)*:* a distribution source – pharmacy – in every hospital decides what and how to buy according to requests, and delivers medications to the wards (Cost Centers – CC), where a standard stock of frequently prescribed drugs is always available.

As a consequence, this system produce highs inventory costs, and deals with different problems related to:

- the high value of departments fixed deposits;
- the difficult drug consume control at the ward level;
- the high risk of product obsolescence;
- the staff time devoted to administrative and medical medication management;
- the wards stocks location;
- unpredictability of requests for wards and frequency of urgent requests;
- the risk of failure in the early stages of association and patient care, preparation, administration and manual transcription of prescriptions from paper medical records to the nursing register paper.

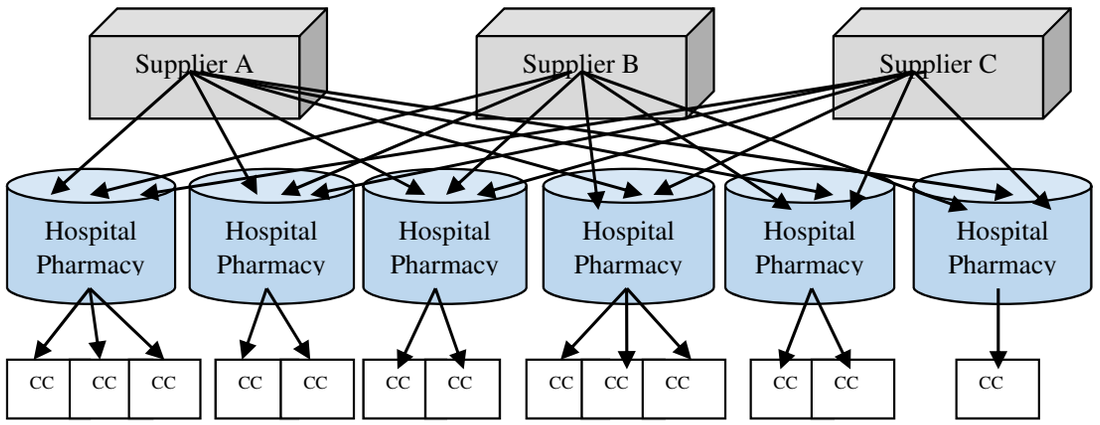

Figure 4. Traditional system of drugs management.

However, starting from this traditional healthcare SCM [7-9], some healthcare realities are testing the *centralized managing*: a unique district or regional center among multiple hospitals recognizes needs, contacts the supplier and deals with pharmaceutical management. Therefore, the general future trend seems to be the aggregation under a single organizational unit of all business functions involved in the overall process of purchasing and logistics.

5. The healthcare supply chain redesign: An Italian experience

The *Local Healthcare Company n. 8 of Cagliari* – Sardinia, Italy – (hereinafter *ASL*) [41] was formed in 1995 from the merger of former Local Health Units. It has authority in 71 municipalities, with an area of approximately 4,569 square kilometers (equal to 19% of the total regional area of Sardinia) and for a population of about 550.000 inhabitants. It occupies a number of approximately 6,000 employees distributed among 7 hospitals units, 20 clinics and 10 accred-

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ited nursing homes. For dimensions, characteristics, geographical distribution and organization it is considered as one of the most complex healthcare companies currently operating in Italy. The extent of the territory, the population served, services and resources managed place it among the top five national healthcare companies.

In order to complete the process of SC redesign and pharmaceutical logistics reorganization, among the ASL has been set up the experimentation of the *Pharmaceutical Department*, with the aim to coordinate all the activities in the drugs area, in order to ensure uniform and centralized processes and procedures (Table 2).

Ensure the organization and operation of activities and processes aimed at the government of pharmaceutical care;
Ensure the quality of service delivery, at both hospital and community level;
Promote the development of integrated actions for the clinical management of drugs and medical devices;
Support the human resources training process for the improvement of professional qualification;
Identify guidelines for carrying out the activities of clinical pharmacy and patient care at hospital, outpatient, home and residential level;
Act within the criteria of effectiveness, efficiency, appropriateness and transparency.

Table 2. Pharmaceutical Department functions.

The organizational structure has been defined according to the functions of pharmaceutical care, attributing coordination and management specialist of the main tasks to specific operating units. This reorganization also took into account the problems related to the government of pharmaceuticals expenditure and the information derived from the ministerial projects relating to drugs policies. For this reason, in order to facilitate the reorganization and rationalization of processes, the Department consists of six operational units (Table 3):

Operational Units:
Pharmaceutical Assistance in Agreement
Hospital Parmaceutical Assistance
Direct Distribution
Pharmacovigilance and Pharmacoeconomics
Pharmaceutical Warehouse
Central Pharmaceutical Unit

Table 3. The Pharmaceutical Department structure.

With this configuration, skills are reconfigured and redistributed in order to provide greater support to corporate governance to all the units of the network. In particular:

1. The *Pharmaceutical Assistance in Agreement Unit* develops activities and processes related to the pharmaceutical assistance organization in the territorial field and to the administrative control of the prescribing activities carried out by the healthcare personnel.
2. The *Hospital Parmaceutical Assistance Unit* guarantees the supply and distribution of medicines, medical supplies and medical surgical devices to hospitalized and discharged patients.
3. The *Direct Distribution Unit* ensures the direct delivery of drugs to patients in their own home, or the dispensing to the patient via pharmacies affiliated with the ASL, in accordance with specific agreements.
4. The *Pharmacovigilance and Pharmacoeconomics Unit* develops activities and processes to facilitate the proper use of medications, guide treatment decisions and formulate strategies and programs aimed at the appropriateness and containment of pharmaceutical expenditure.
5. The *Pharmaceutical Warehouse Unit* manages the inventory of drugs through the distribution to the hospitals and the supply requests for the Central Pharmaceutical Unit. Additionally, it ensures, through the consumption analysis, rationalizing processes, avoiding the accumulation of stocks not justified by current usage or predictable, at the central level, in peripheral storages and wards. It also optimizes the inventory through the definition of procedures, distribution processes and balanced choices in terms of frequency distribution and minimization of inventories at the peripheral level. Finally, it prepares detailed perspective programs for the supply, in order to rationalize the timing for the execution of supply contracts and the preparation of new contracts.
6. The *Central Pharmaceutical Unit* governs the centralized purchasing process of drugs and medical surgical devices at the company level. It operates with the Pharmaceutical Warehouse Unit for the management of supply contracts and whit the Purchases Service for the preparation of new contracts. It also operates with the Pharmacovigilance and Pharmacoeconomics units for the technical evaluation of drugs to be purchased, and for the choice of substitutes and new products. Additionally, it prepares needs programs to fit the timing of supplies, preventing stock breakages or increased costs for the company due to urgent situations. It contributes for the implementation of regional guidelines for the realization of the regional program about rationalization and containment of pharmaceutical expenditure and strategic planning in the field of corporate purchases. Hence, it operates in order to constantly ensure the availability of drugs and medical devices.

5.1. Pharmaceutical Logistics Hub Project

The current logistics organization of the ASL presents strengths but especially criticalities. In particular, the presence of six pharmaceutical warehouses located in six different hospitals guarantees some *advantages* when compared to a possible centralized management of warehouses:

a. a reduction of the time for the procurement of health goods by Cost Centers;

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b. the optimization of emergencies management;

c. a cost reduction for the transport of goods from the pharmacy to the user centers.

Conversely, *weaknesses* resulting from the presence of six pharmaceutical warehouses are the following:

a. the replication of the same activities in the six hospitals, such as order management, receiving and distribution to Cost Centers;

b. inefficient management of stocks, as each pharmacy define their own needs independently from the others, with a resulting disproportionate total data compared to the real needs of the company;

c. ineffective management of stocks, because each pharmacy is completely independent from the other, whereby in case of drug stock breaking in a pharmaceutical warehouse the pharmacy purchase it even if it is present in sufficient quantity. In fact, the exchange from one warehouse to another is activated only in case of emergency;

d. the need for a large number of operators resulting from the localization of stocks in the different six warehouses and from the replication of the same activities;

e. a difficult inventory management with the multiplication of activities and different timings for each pharmaceutical warehouse;

f. inadequate places with inappropriate surfaces and volumes, architectural barriers that make it inadequate the storage and handling of goods;

g. high risk of consistent stocks in the wards.

The aim of the project is the outsourcing of logistics services and the unification and standardization of all the logistics procedures related to the supply, storage and distribution of health and non-health goods in the ASL, by improving the effectiveness, efficiency and safety of all logistics processes. The main objective is the rationalization of pharmaceuticals management, in order to contain risks associated with clinical processes for medication management, and to improve efficiency and effectiveness of supply logistics management, storage and distribution/administration of pharmaceuticals and medical devices. The overall project involves the concentration of existing warehouses in one site, and the structuring of stocking points of proximity, coinciding with the current hospital pharmacies and local pharmaceutical services, together with the centralized management and unified inventory of materials through an integrated information system (Figure 5).

The project involves the reengineering of the main logistics processes (order management, procurement, inventory management, distribution) through the centralization of the commons activities, in order to contain the pharmaceutical expenditure.

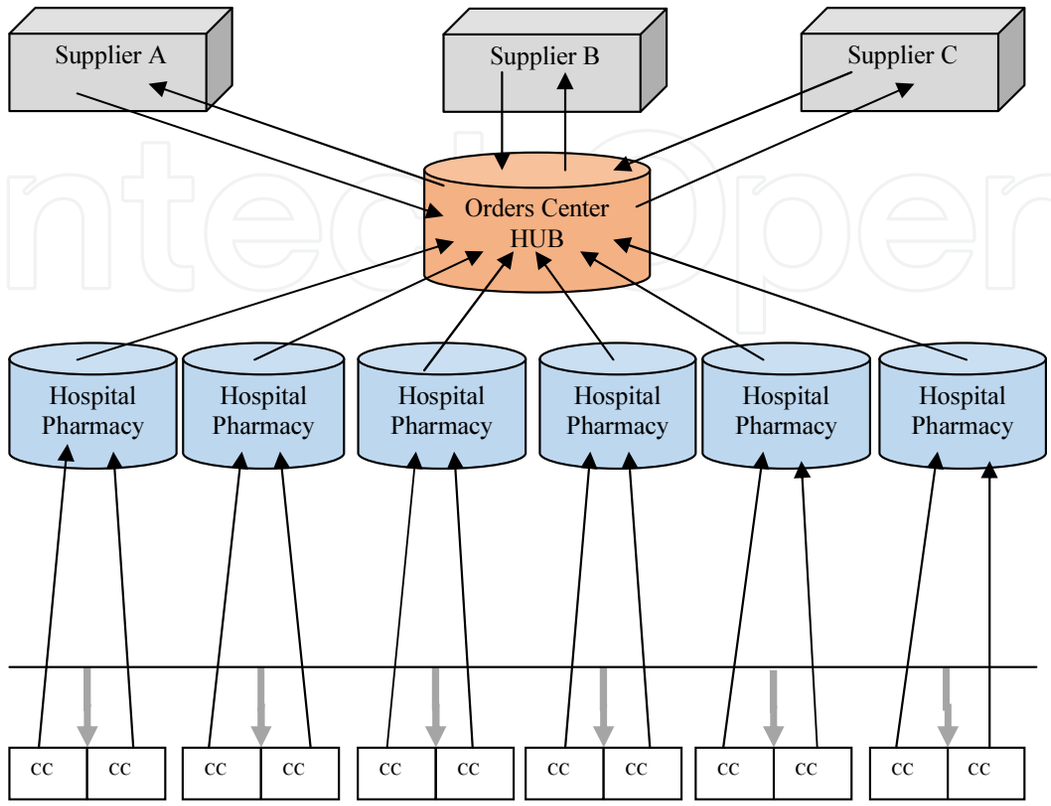

Figure 5. The reorganized pharmaceutical management with the Centralized Warehouse.

This centralization will cause an effect even in the organization of the drugs and medical devices procurement requests process to Cost Centers, which will be managed exclusively by computerized means (Figure 6).

As already pointed out, the reengineering includes the transition from an empirical management of inventories to a *computerized management* (Figure 6). Therefore, it becomes essential to implement an information system with the indication of under-stock and reorder point for drugs and medical devices in stock in pharmacies, in order to create a virtuous circle that will eliminate the empirical management, which in the past has led to frequent stock-outs, with obvious negative consequences. The redesign provides, firstly, the analysis of historical consumption data, the definition of under-stocks and reorder point by the pharmacist and, in the next phase, the weekly print execution of under-stocks by administrative operators. At this point pharmacists validate the under-stocks for the order execution, the administrative operators predispose the supply orders and pharmacist validates orders. Finally, the administrative operators send orders to the economic operators. The pharmacist then will provide for the periodic revaluation of under-stocks and reorder point of pharmaceuticals and medical devices in stock.

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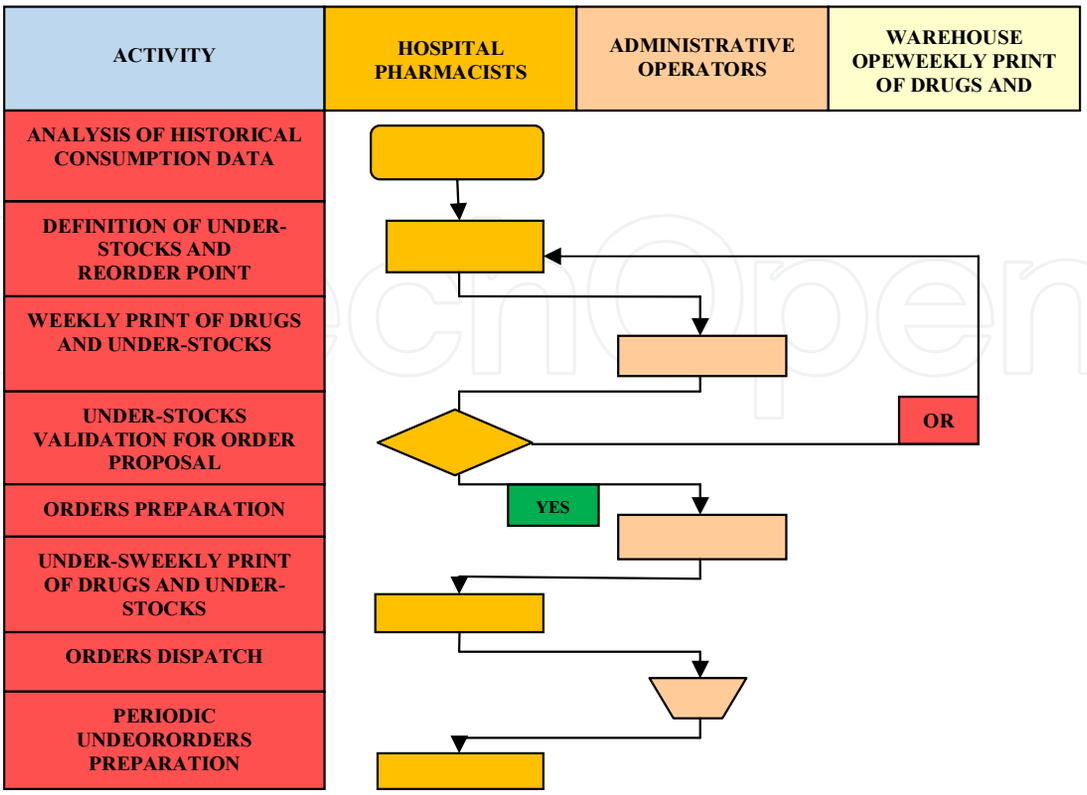

Figure 6. Inventory management in case of centralized warehouse

5.2. The rationalization of pharmaceuticals flows

Actually, the predominant activity of the pharmacists is represented by the orders issuance, which requires the 20% of their time/work; the control of healthcare goods entering and leaving the ASL requires approximately the 60% of the time/work available; the remaining 10% of the workload is dedicated to procurement practices, and only the 10% of the time is dedicated to give information in the wards. Therefore, it is clear that the management processes related to logistics absorb almost all the work of the pharmacist, which is mainly spent in *non-strategic activities* and that may be delegated to non-management figures.

With regard to the orders management, the phase of issuance actually entails that each hospital pharmacy produce supply orders for the same supplier, the same drug and the same day, with a useless *replication activity*. Additionally, inventories are not managed according to a computerized management with under-stocks and reorder point, but with a merely empirical verification. This generates the emission of orders for the same supplier at a distance of a few days, with obvious managerial repercussions.

Conversely, with the centralized warehouse, the under-stock and reorder point will be indicated and orders will be created on the basis of computerized data, assembling goods for the same supplier with a reduction in the number of orders: it will be generated only one order, and not six different orders for the same supplier. Additionally, the order will be prepared

on the basis of a date processed electronically and not according to an empirical verification. In the centralized warehouse there will be an area dedicated to the acceptance of drugs and medical devices in stock, followed by a qualitative and quantitative control, with the loading of transport documents in the computer system, followed by the print of the position in the central warehouse and the storage of medicines and medical devices.

As regards to medical devices in transit, after the qualitative and quantitative control and the loading of the document in the computer system, the delivery of the material will take place. The expected result is a significant reduction of supply orders and a consequent reduction in the number of bills that will affect positively the timing of their settlement. In addition, the replication of activities in the various hospital pharmacies by pharmacists will be avoided, allowing a reduction in the time/effort devoted to the orders issuance management, and consequently prescription appropriateness increase.

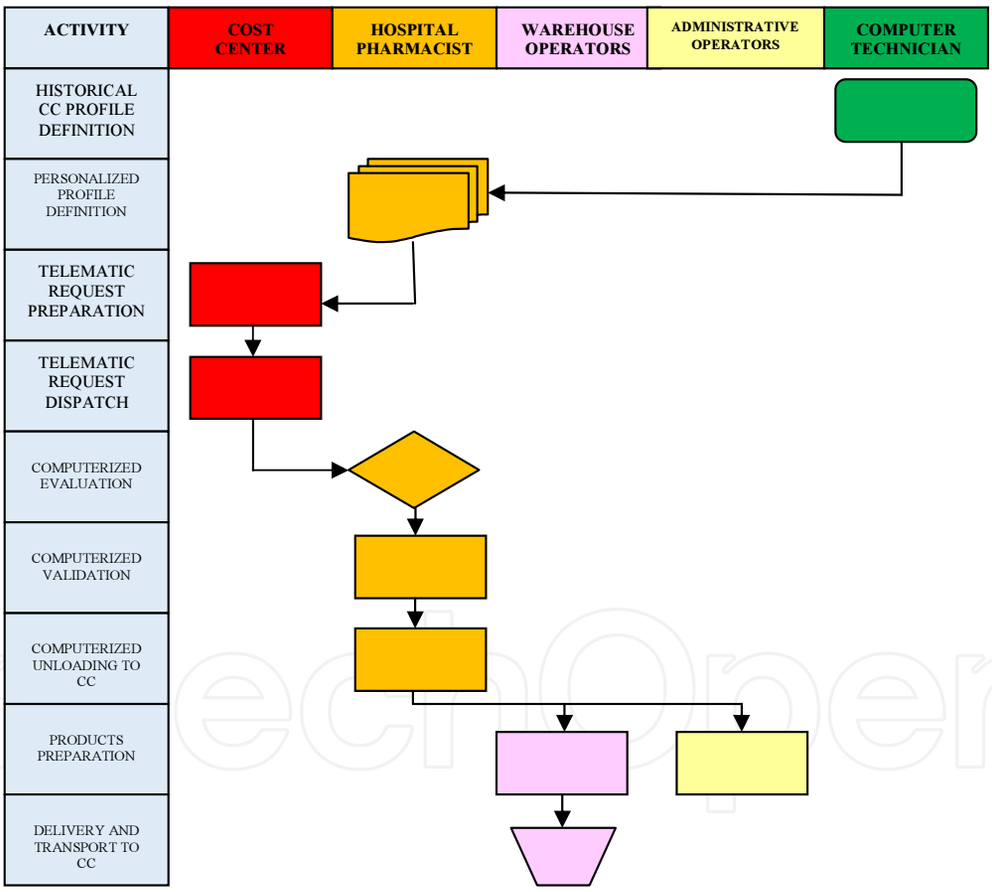

Figure 7. The reorganized procurement process to Cost Centers

As regards the procurement process managed, the Figure 7 shows how the process will change with the exclusive use of the computerized procedure. The figure describes the new drugs and medical devices procurement requests process to Cost Centers. It will start with the "coarse profile" preparation, on the basis of historical consumption by Cost Centers, to

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be followed by a custom profiling managed by the pharmacist. The next phase will involve the preparation of the computerized request of the Cost Center and the subsequent electronic transmission to the pharmacy. At this point, the pharmacist performs qualitative and quantitative computerized assessment of health goods required, and prints the request that is then delivered to warehouse personnel, who will provide for the preparation of pharmaceuticals and medical devices. If a discrepancy turns out during the preparation, it will be reported and the appropriate changes in the information technology will take place. At this point, the administrative operator closes the request, and the computerized unloading to Cost Centers will take place. The final demand of drugs and medical devices will be printed and delivered to Cost Centers. The expected result of this innovation is a constantly updated inventory and a full Cost Centers expenditure monitoring, as well as the possibility of providing an annual program of supply on the basis of consumption data.

6. Conclusions

The motivation for this research field is driven by the need to lower healthcare costs and to improve patient care quality by identyfing opportunities for healthcare organizations to improve their logistics processes, considering that hospitals represent the largest cost component of the national healthcare expenditures in most of the countries.

In the first part of the chapter we have provided general definitions and charactersitics of Healthcare Supply Chain and pharmaceutical logistics. We have emphasized the importance of both concepts in relation to emerging trends in healthcare system. Healthcare Supply Chain has become an important research topic in the past decade and its popularity is still increasing. This has resulted in the need to reenginering the Healthcare Supply Chian and, in particular, the pharmaceutical management, the importance of which is fundamental to the delivery of quality services to patients and reduction of costs.

There are two opportunities in this work where reenginering is applied: a) centralized supply system, and b) material management. In the redisigned system, several benefits have been achieved, in terms of:

1. *cost and inventory reduction,* due to more frequent deliveries, and the minimization of hospital central stores;
2. *staff reduction* in terms of amount of work of both hospital pharmacies and patient care staff, previously occupied in the point-of-use replenishment;
3. *higher level of service*;
4. *exploitation of economies of scale,* due to large orders and the absorption of uncertainty on the estimates due to the large numbers.

The transformation of the SCM model requires three mains conditions: *collaborative governance structures, efficient processes and integrated information system*. The right governance structure for SCM allows hospitals to maintain the balance between reducing costs and providing high-

quality care. It requires that the SCM governance evolves to a collaborative approach involving all stakeholders, without which all other efforts to move to the transformation model simply will fail. This collaboration requires the appropriate governance structure and processes. Indeed, when processes are fragmented or incomplete, they cause errors in terms of ordering the wrong item or wrong quantities of an item.

At last, automating and integrating IT systems will allow hospitals to seamlessly link their logistics processes. The centralized management requires that hospitals in the network dialogue continuously with the warehouse, together with a flow of information that travels in both directions (from the hospital to the Central Warehouse and vice versa).

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