

Tendencies in the Supply Chain Management in the Colombian pharmaceutical sector

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ABSTRACT

The main hypothesis of this study is that Colombian companies in the pharmaceutical sector work at least the 50% of processes in the third level of SCOR model. This hypothesis is supported in national regulation requirements for the sector, which have tried to adopt international standards. Economic and cultural environments allow a second hypothesis: companies apply less than the 75% of the best practices suggested by SCOR model. Four sub-sectors were studied: veterinary, medicine plants, medicines and vitamins. These sectors represent approximately the 90% of the pharmaceutical sector, and their study permits the first approach to know the tendencies in the complete sector.

Keywords: Supply Chain Management, Pharmaceutical Industry

1. INTRODUCTION

Based on previous studies about of productive chains, mainly made by public institutions, this research offers a deeper knowledge about the more common practices in the supply chain management in the Colombian pharmaceutical sector, according to particular economic, social and cultural conditions. These conditions permit that the world-wide best practices not be used in their entire dimension.

Five sub-sectors were studied: veterinary, medicine plants, cosmetic and vitamins. These sectors represent approximately the 35% of the pharmaceutical sector, and their study permits the first approach to know the tendencies in the complete sector.

2. SUPPLY CHAIN MANAGEMENT

Robert Handfield and Ernest L. Nichols Jr [1999] define Supply Chain Management (SCM) as: “Supply Chain Management includes all activities related with goods’ flow and transformation from the raw material stage until the final user, and the related information flows as well. Materials and information flow upward and downward within the supply chain”.

Sunil Chopra [Chopra, 2004] focused on three great stages for the SCM: design (or strategy), planning and operation. This model’s success depends on each stage’s management AND synchronization, efficient management of processes, information technologies’ support and procedures and fluid relationships among the chain’s linkages. Other models have been developed trying to describe and understand the supply chain management: one of them developed by Clarkston [2000] and another by the Global Supply Chain Forum.

Supply Chain Council (SCC) was created in 1996 by Pitiglio Rabin Todd & McGrath (PRTM), AMR Research and 69 volunteer companies united under a non-profit global organization dedicated to the research and improvement of SCM by the creation of the SCOR model. Supply Chain Operations Reference-model (SCOR) is a reference model of process for the SC whose main functions are the industrial diagnosis and the implementation of the best practices for a proper SCM. The SCOR model has the flexibility to adapt itself to the operating structure of each chain. SCOR is divided in 5 first level management macro-processes:

- Plan: balances resources and requirements of the company to supply the demand. It establishes schemes to integrate and synchronize intraenterprise and extraenterprise activities considering all the chain’s linkages.
- Source: seeks to get goods or services to carry out the plan.
- Make: transforms products until its final state fulfilling what was established in the plan.

- Deliver: distributes goods or services the chain's next linkage.
- Return: coordinates the products' return along the chain.

The second level defines the kind of configuration of each process in categories: stock-to-order, make-to-order and make-to-engineer. According to the configuration the companies design their operational strategies. Elements for each category are defined in the following level, such as information flows, performance metrics and the system capabilities needed to support the best practices. In this level, the company's ability to compete in the chosen market is defined and the operational strategy is refined. The model doesn't specify implementation details of the contained elements in the three levels. Finally, in the fourth level the companies implement the best SCM practices looking to acquire a competitive advantage and suit to the surrounding conditions.

3. PHARMACEUTICAL SECTOR

The global performance of the sector has shown growth, although in recent years it slowed down; the growth figures went from two digits in 2001 to an average growth of 8% for 2002 and 2003 (Trombetta, 2005). The global sales volume in 2004 was approximately US\$550 billions, with a 46% share for United States becoming the major actor followed by the European Union and the rest of the world.

The sector is characterized for having great investments in the research and development process of synthesis of molecules and new active components that allow a more effective and economic treatment. Once the molecule is synthesized, the lab patents the formula for its economic exploitation, having protection over its intellectual property and, by this way, excluding the competitor from the chance to produce or merchandise the product for a 20 years term.

In Colombia, during the 40s and the 50s the pharmaceutical sector started with the arrival of some subsidiary foreign laboratories, such as Abbot, Bristol Mayers Squibb, WhiteHall, Shering, Glaxo Wellcome Colombia, Merck Colombia and Bayer, among others. Between the 60s and the 80s Colombian laboratories were created around the development of generic medicines. Nowadays, there are more than 300 laboratories in Colombia among Colombian companies and international subsidiaries. The illustration shows the supply chain (SC) of the pharmaceutical sector, according to DNP data and some adjustments.

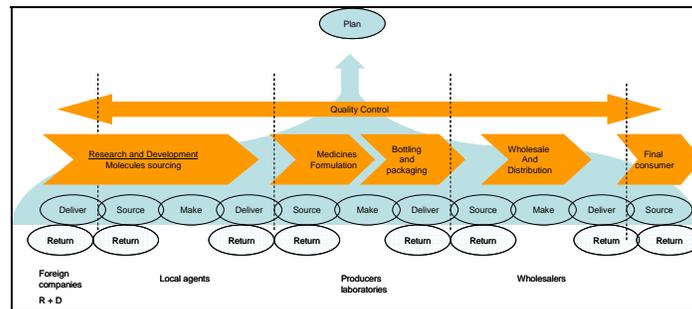


Figure 1. Supply chain of the Colombian pharmaceutical sector (Source: Arcila, et al)

The research and development phase includes the production of active principle, medicines, antibiotics, vitamins and biologic medicines. The medicines have two main components: the molecule that acts on a specific illness, active component, and the excipients which are neutral substances that act as the active component conductors. This is one of the most important parts within the chain for the sector, but in turn, it's the one that requires more resources and time¹. It has been considered that the development of a new medicine may cost from US\$800 millions up to US\$2 billions per medicine, and the estimated time for its development may last from 12 to 15 years². In Colombia, the active molecules' synthesis stage are not being performed, these are imported³.

In Colombia production and distribution of pharmaceutical products is authorized by the INVIMA⁴ through a Sanitary Register, which is given after a careful assessment of the product. Manufacturers' activities are inspected regularly by local authorities that, among other labors, check the fulfillment of GMP⁵(Good Manufacturing Practices).

¹ <http://usinfo.state.gov/products/pubs/intelprp/cost.htm>

² Ibid.

³ Departamento Nacional de Planeación.

⁴ INVIMA: Instituto Nacional de Vigilancia de Medicamentos y Alimentos

⁵ Ministerio de Salud y Previsión Social.

The pharmaceutical product market is divided in six categories for their marketing and distribution: vitamins and provitamins, pharmaceutical and medicinal products, excipients, biologic products excepting vaccines, antibiotics and veterinary medicines. The distribution channels used by the laboratories are⁶: department stores (supermarkets and drugstores), benefit societies, wholesalers and independent drugstores. Institutional channels include: hospitals, clinics and health centers (EPS⁷, dispensaries, schools, companies). In recent years, the institutional market has increased due the relevance of the Health Promoting Entities (EPS -acronym in spanish-) (different from the Seguro Social [Social security]) within the Colombian health system⁸.

4. METHODOLOGY

This research was designed as a qualitative and quantitative study, without statistical representation. During the field work questionnaires developed by the SCC were used with the aim of identify process held in companies, the best practices used (59 related to supply, 58 to production and 14 to deliveries) and the information systems used in each of them. Questionnaires were applied by teachers and students of the graduation program (Arcila et al 2006; Gutiérrez, 2006; Wiesner, 2006). The study was focused on companies dedicated to production (formulation and packing), marketing and distribution. These companies were selected by convenience according to their interest and previous contacts. At each company, the interviews were answered by directors from areas leading processes of purchase, production or distribution. The following chart shows the quantity of studied companies and their distribution.

Table 1: Company Size

Micro Small Medium Large

	Growers	Producers	Distributors	Wholesalers
Veterinary		2		2
Medicinal Plants	1		1	1
Vitamins		1	1	
Pharmaceutical		1 ⁹	1 ¹⁰	

Companies were classified according to their size and assets value and number of employees¹¹. The assets value defined ambiguous situations. According to this classification, the sample included: 3 large companies, 6 medium companies, 1 micro company and 10 small companies.

There isn't a unique configuration of the SC on the studied companies, although there are tendencies that depend on factors such as geographic location of the suppliers and the negotiating position of sides, clients and suppliers. Wholesalers and distributors of imported pharmaceutical products or raw material mainly develop the distribution process under order, but the supply of international sources is focused on keeping inventory since a continuous supply is financially unfeasible.

⁶ Ibid.

⁷ Empresas Promotoras de Salud. Health Promoting Entities constituted from the Law 100.

⁸ Ibid.

⁹ Represents a group with four companies.

¹⁰ Represents a group with two companies.

¹¹ Law 905, August 2004.

Kind of Company	Employees	Assets (SMMLV)
Large	More than 200	More than 30.000
Medium	51 – 200	5.001 – 30.000
Small	11 – 50	501 – 5.000

SMMLV: Minimum monthly legal payment, equivalent to US178.

Producers and non-producers supply themselves in the home market (not necessarily with hoe products) usually under the order scheme since relationships with suppliers are direct and the delivery times may be agreed. In most of the companies that develop production functions, the supply one looks for keeping inventory. However, the long-term planning capability of biggest companies, which is based on sales, allows that orders from the commercial area to the supply area follow long-term sale expectations within the chain without substantial modifications.

It's worthy of mention the chain configuration that bigger companies tend to adopt. These companies, being a single one or as a group, have independent supply organizations whose function is providing everything necessary to fulfill the production and/or distribution function within a company. Searching for a better global performance, both sides (the supply unit and the production or distribution unit) work in a coordinated way acting as customer and supplier within the same company. Their performance is assessed independently, according to specific goals of each side role. Two cases are noted here, in the first one, two of biggest studied companies work under guidelines of a parent company. These guidelines include independent infrastructure for the supply management. In the second one, one medium size Colombian company adopted the independent supply structure on its own initiative, looking for a closer relation with raw material suppliers, since their main interest is represented on bigger size markets than the Colombian ones. In both cases, multinational subsidiaries and the Colombian company, the proper SCM and vision have allowed their expansion at Latin-American.

Although in most of the studied companies the delivery management is directed to keep, there are some often cases focused on orders' management. The existing competition in the pharmaceutical product consumers' market makes pretty close the relationship between distributors or merchandisers and those reaching the final. Only the mutual interest allows a high rotation of product inside of a consignment product scheme, which is the most common inside of the chain. Sharing the information related to the product's rotation was shown as an important element for the rotation of products. Although all the interviewed companies think of it as an important matter, not all of them have the infrastructure for keeping updated information and for supporting the corresponding processes of decision making.

5. PROCESS ANALYSIS

PLANNING

The planning processes are present in all companies. The less planning schemes correspond to minimums stock levels established to organize and guarantee the companies' basic operation. However, the planning in a specific linkage of the chain or among linkages or covering the whole chain relies on the company's basic functions, the competitive advantage and the observed benefits when focusing on linkages and their relationships and the obtained support by technologic tools. The following table shows the general characteristics of the planning processes.

Table 2: Planning Process Characteristics

Process	General Characteristics
General Planning	<ul style="list-style-type: none"> Companies developing production processes linked to planning processes and the development of GMP. Usually, supply chain's tasks are known as functions that are spread inside of the other company's functions, in other words, these tasks are assigned as part of other functions developed in the company¹². There isn't demand planning. The lack of information and complete studies on the sector's demand has led the companies to focus their planning on sales projections.
Source planning	<ul style="list-style-type: none"> In most of the small companies, the raw material purchases are made based on daily and/or weekly reviews of the existing inventory, although a couple of them are monthly. In medium and big companies, monthly, trimester and yearly sales budgets and the corresponding exploitation of materials create the purchase planning and the monthly review of the sales execution allows the generation of purchase orders.
Make planning	<ul style="list-style-type: none"> The relationship between the purchase plan and the production plan is direct. From 11 companies making production processes, just one (1) has procedures for planning the productive process.
Deliver planning	<ul style="list-style-type: none"> Given that transportation is subcontracted (in 90% of the companies approximately), the dispatching process planning consists of a call to the transportation company that is in charge of picking up the dispatches. Procedures for the final configuration of orders and the optimization of routes and involved resources are up to the company.

¹² Situation fortified because GMP are distributed in different functions and processes inside the company.

SOURCE

Generally, the sample companies purchase to stock. Processes associated to companies' purchases are defined by the GMP. Analyses applicable to materials, storage processes and quarantine mechanism are defined. The following table shows the main characteristics found in the supply process.

Table 3: Source Process Characteristics

Process	General Characteristics
Inventory management	<ul style="list-style-type: none">• The most used inventory management strategy is keeping a safety inventory as a consequence of the sales variability and the lack of demand management.• Inventory in small companies is controlled by the FIFO system given that large imported volumes are consumed in long periods of time. For their part, medium and big companies use the FEFO¹³ control given that they have a much higher inventory rotation.• The previous matters lead the companies requiring the control of the products' expiration dates to have strong information systems for supporting the trazability function of the products.
Suppliers Management	<ul style="list-style-type: none">• The sample companies have specific procedures to assess suppliers.• Non-producer companies include visits to the facilities and their financial assessment within their supplier's selection criteria.• Non-producer companies based the assessment of suppliers performance on deliveries and the product's external characteristics. Producer companies consider the physical-chemical characteristics of supplies and raw material and, in some cases, the production processes.• Small companies and some medium ones have short-term agreements with suppliers.
MRO management	<ul style="list-style-type: none">• Maintenance, repair and operation (MRO) materials generally have informal processes for planning, receipt and distribution.

MAKE

Only companies in the medicinal plant subsector have R&D processes associated to the generation of new medicines and raw material production processes developed in the country. Most of the studied companies produce for stock, just one veterinary and other medicinal plant company report production according to the customer's specifications.

Table 4: Make Process Characteristics

Process	General Characteristics
Production schedule	<ul style="list-style-type: none">• Despite of having incipient planning processes, small and medium studied companies have cyclical rush hours and bottlenecks that aren't reflected in sales neither in production plans.
Good Manufacturing Practices	<ul style="list-style-type: none">• Companies are strict with processes required by the GMP, such as handling of in-process and pending products, quality checks, quarantine and storage of in-process and finished products and raw material.• Non-required processes by the GMP are structured by a minimum quantity of companies according to particular needs.• The GMP certification is the most relevant in the sector for most of the companies, leaving aside others as the ISO that is only present in 3 non-producer companies.
Productivity	<ul style="list-style-type: none">• Generally, companies measure productivity in term of variation between sales/costs budget and real values, but not as a relation of income and expenses.
Outsourcing	<ul style="list-style-type: none">• At a greater o lesser extent, producers outsource part of the production turning complex the plan since there isn't any compromise with third parties at certain production level.
Product Formulas	<ul style="list-style-type: none">• Producer companies manufacture products based on specific and standardized formulas that have been tested and approved the verification process, fulfilling the INVIMA regulation.

DISTRIBUTION

The prevailing dispatch model is delivering products to big distributors agglutinating of demand and, in fewer cases (generally medium and big companies), directly deliver to merchandisers (small drugstores or those not belonging to big drugstore chains). Some laboratories make direct visits to merchandisers and deliver information on demand to wholesalers. Regarding sales to big supermarket chains, laboratories directly sell to those chains due to the margins and discounts requested for them.

¹³ Inventory with first expiry date is used the first.

Table 5: Distribution Process Characteristics

Process	General Characteristics
Orders organization	<ul style="list-style-type: none"> Work on the orders configuration is related to delivery priorities where the arrival order is the most common practice. In some cases, priorities are handled depending on the customer (if a big order is placed, low volume orders are left aside or a postponement is asked to those customers that allow this measure).
Orders delivery	<ul style="list-style-type: none"> The process of delivering orders is outsourced; the transporter is in charge of routes optimization. It is performed by transport supplier companies which have long-term business relationships; as in the case of raw material suppliers, controls are taken for unconformities without implying supplier substitutions. The outsource reach depends on the company's size and its dispatch management policy. In the extent of companies handling major dispatch volumes, it is required a more complex outsource.
Time of delivery	<ul style="list-style-type: none"> Generally, in small and medium companies, orders are delivered wherever place in the country within 72 hours after the order was placed. Companies working on the same city of order, have delivery time of 24 hours from the moment of request, as long as there is finished product in inventory.
Orders Size	<ul style="list-style-type: none"> These companies have enough flexibility as not to force minimum orders (only a small company forces minimum orders). The consignment figure on finished product in inventory has rare use, excepting department stores which turn over depending on the product's rotation.

RETURN

Returns from distributors and merchandisers are managed in two stages: in the first one, the order is assumed complete if the customer doesn't send any complaint within 24 hours after its receipt; the second stage considers the subsequent real verification of products and, to do it, most suppliers have a period of time for complaints and returns.

Regarding local suppliers, returns are physical or through negotiations for next orders. However, regarding external suppliers and due to the cost implied by the return, the product loss is assumed by producers or distributors that imported the merchandise. When Colombian companies have direct and permanent relationships with their external suppliers, information on defective merchandise generates actions and reviews in the supplier, even when there isn't physical return of the merchandise. Expired products in the distribution channel are replaced by the distributor or producer in Colombia.

6. BEST PRACTICES ANALYSIS

This analysis is based on two approaches. The first one tried to identify the most frequent characteristics among the sector companies. The second focus tried to answer the question ¿which factors have influence on the use or not of best practices in SCM according to SCOR?, considering characteristics of size, position in chain and subsector of the studied companies.

MOST AND LEAST FREQUENT PRACTICES IN THE SECTOR

Most of the surveyed companies indicate that they cover some of the best practices related to supply management, these are:

Table 6: Most Frequent Practices

Process	Common practices
Related to suppliers selection	<ul style="list-style-type: none"> Assessment of the suppliers' network to find duplicates or replacements; assessment of suppliers by selection and qualification according to aligned criteria with business requirements and competitiveness needs.
Related to suppliers relationships	<ul style="list-style-type: none"> Existence of alliances and combined agreements of service and leverage and, in the long term, definition of policies based in suppliers performance; timely definition of rules before negotiations; establishment of criteria to qualify and classify suppliers and the performance comparative analysis of each supplier when making decision on purchases.
Related to provisioning process management	<ul style="list-style-type: none"> Optimization and strengthening of processes considering customers or suppliers, or at a company level; development and continuous improvement processes motivated by the periodic review of process performance; existence of a selection method of deliveries optimized in real time based on customers requirements and identification, implementation and measuring of opportunities to reduce or/and avoid costs; existence of a preventive maintenance total program inside of the company; existence of environmental and security policies for the company.
Related to information management	<ul style="list-style-type: none"> Existence of access to information for the whole company generating visibility for each business unit; existence of real time data on the current state of available inventory and cyclical counts of the company's current inventory.

The least common practices in the surveyed companies were: Two companies work sharing knowledge and inventory management with suppliers; although most companies have performance assessment systems, a few ones automatically update the supplier's performance assessment; in small and medium companies, electronic transactions for inner control of materials aren't very common, neither are the labeling and automatic stamp of products and the existence of consortiums through Internet to have access to shipping brokers; equipment and maintenance products inventory is managed and directed separately by suppliers; lack of transportation bands in the surveyed companies, although some of them include these bands in future projects.

It wasn't possible to make an identification of most common particular practices on each subsector; the least common practices were present in all analyzed subsectors and common practices as well. A more specific and deeper study on each subsector may achieve results in this matter.

In the medium use practices of the sector, differentiating factors were identified among companies making use of them and those that don't. The following chart shows the differentiated practices.

Table 7: Differentiated practices according with the size of the company

Small companies	Medium or big companies
<p>Practices related to purchase management Immediate replacements over defective material by the supplier with a product fulfilling quality conditions.</p>	<p>Practices related to purchase management</p> <ul style="list-style-type: none"> • Electronic interchange of data to reduce the cycle and costs with customers and suppliers. • The company has automatic statistical control of processes. • The company has its valuation processes incorporated in PDM to reduce cycle and costs. • The company keeps and updates catalogues by Internet with suppliers and customers. • The company manages online documents and automatic approval of suppliers. • The supplier delivers dispatches directly to the storage point or to the point of use to reduce cycle and costs. • The company makes use of engineering to connect purchases with the product development process of the supplier. • The company makes use of shared engineering with suppliers to determine the product's performance. • Optimized reductive count of suppliers.
<p>Practices related to manufacture management</p> <ul style="list-style-type: none"> • Publishing results of the plant's performance to employees in the production process. • Optimization of the packing process. • Setting short movements to avoid waste and loss of materials. 	

The company's position in the supply chain also has influence on the use of some of the best practices suggested by the SCOR model, as it can be appreciated on the following chart:

Table 8: Differentiated practices according with the position of the company in the chain

Transformation	Non-transformation
<p>Specific practices in manufacture <i>Pull</i> manufacturing, including time and in-process inventory reduction through mechanisms to manage demand and visual controls; feedback in real time of the manufacturing processes from the test activities; direct deliver from the factory to the consumer or channel; automatic notification from the laboratory on acceptance of raw materials and finished products; report systems of performance measurements in real time, minimization of in-process product inventory; production programming minimizing changeover costs; each operation of the manufacturing process is authorized to assess the previous operation quality; precision policies in the lot marking for guarantying a subsequent safe tracking; precision is managed in the lot registration for regulatory entities.</p>	<p>Specific practices in supply Development of certification programs for suppliers to reduce or/and eliminate inspection at the moment of receipt; keeping, analyzing and reporting supplier performance information online through extranet applications; automatic updating of supplier performance information, maintenance and update of catalogues with customers and suppliers by Internet; electronic interchange for sending valuations and technical specifications to add suppliers to the database.</p>
	<p>Specific practice in delivery Dynamic simulation of picking to optimize cost, time and labor.</p>

7. CONCLUSIONS

The GMP have act as tools to standardize processes within and industry, however, these practices remained on the operative concept of companies. Many companies have seen GMP as an audit and a government tool to control their business, a few companies have seen it as a useful managerial tool for competitiveness, despite of the benefits obtained by most of them.

Certain sense of convenience in the current situation (where customers are the usual ones, long-standing suppliers and known markets with some difficulties) hold companies from improving the supply chain management, limiting at the same time their aspirations to compete in the international market. Planning is one of the chain's main interaction elements and the lack of an integrated planning within several companies limits the reach of this activity, which is supporting the coordination of the whole chain and diminishing the inefficiencies happening among linkages to decrease risk during supply.

The demand management is another factor that requires strong efforts, it points out to a higher coordination and it can be timely supported by using the TIC. The companies (small and medium ones particularly) concentrate their planning and operating processes in the inventory assessment comparing real sales against projected sales. The logic behind this analysis is understandable given factors such as working capital optimization, fulfillment of GMP, the struggle for market portions that become smaller every time and the existence of wholesalers. However, thinking in sales and not in demand, leave aside aspects such as unsatisfied demands (source of new markets), hidden demands, potential competitors' identification, and substitute's analysis; these are key elements in a competitive and globalized world.

Despite of the diligent job in practices construction and process definition, not all SCOR's suggestions can be performed. The company's operating context (national regulations and commercial practices, among others features), size and reach of the company's resources and its strategy may not be favorable for the use of the most common "best practices". If the factors of Colombian laboratories -geographic location and negotiating position- compared to those of big suppliers were different, they would modify the supply model from an inventory system to an order system.

When comparing processes developed by companies to those proposed by the SCOR model, a very high coincidence is found comparing what is applied to what is suggested. However, only about 40% of suggested practices are performed by more than 75% of the companies, while around 30% of practices are used by less than 50% of the companies¹⁴. These differences support some facts inside of the sector: chain companies work separately without sharing enough information and there is the feeling that they lack of a strong association of professionals that safeguard the companies' interests. Although the use of some practices is limited given the organization strategy, the companies' size or their geographic location, others have not been worked on due to their non obligatory nature. Best practices in the chain's management with minor influence of the environment, can and must get to a higher development level than the current one.

As expected, companies having product transformation among their main functions, make use of a wide range of best practices for manufacturing management following, in part, the good manufacturing practices set as a requirement by the regulatory entity. The minimum frequency of these practices inside of companies that didn't have transformation as a main function, were also expected. However, it's still relevant the fact that transformation companies do not stand out for the use of specific supply and dispatch practices, that are inherent of their management, beyond of what "non-transformation" companies do. From the previous facts, it's remarkable that non transformation companies have identified and are making use of the supply and dispatch best practices as source of value to their management and as source of differentiation compared to transformation companies. Raw materials volume handled by bigger size companies are not the only neither the main factor for creating independent supply organizations, there is also the business strategic vision that keeps the relevance of the supply function and the advantages that can be achieved through its use, without hesitating when concentrating efforts and resources.

The apparent motivation for micro and small companies is not recourse to best practices is the limit on resources, although in the light of the analyzed cases in this study, the main motivation is the lack of a creative vision of long range that allow, with just few resources, the achievement of some of the better suggested practices and their competitive advantages. The association becomes a strategy to face supply from a stronger position given that a better negotiating position of Colombian producers facing foreign suppliers could allow the achievement of the benefits from using some of the best practices. For example, having specialized entities in supply and/or logistics and transportation management allows a more efficient use of the company's resources, but this requires an integral strategic vision inside of the company and not as individualized as the current one.

¹⁴ Of 14 deliver best practices, 6 are used by more than 75% of interviewed companies and 5 by less than 50% of companies. Of 58 make best practices, 25 are used by more than 75% of interviewed companies and 18 by less than 50% of companies. Of 59 source best practices, 24 are used by more than 75% of interviewed companies and y 21 by less than 50% of companies

At this point, it's worthy of mention emphasize the quality management of non-producers distributors, that doesn't redound to the quality management of producer companies, and instead is supported on it. Although it's not one of the best practices of the SCOR model, it's a good practice in the Colombian context that allows the direct maintenance of coordination levels in the chain.

Applying the best practices and working together have influences from several levels in the companies, from strategy to daily activities. In this sense, the Information and Communications Technologies (TIC -acronym in Spanish-) are one of the tools that may be a big support to improve the competitiveness. In the pharmaceutical chain case, there is a great lack of TIC, especially in small and medium companies. However, this isn't about proposals for copying models that have been successful in other environments without considering the typical conditions of the country's business environment. In this sense, the sector's companies have a great advantage that can't be ignored: flexibility, understood as the capability to cover the market and demand requirements. Standardized productive processes having maneuvering capability, orders configuration (in products and quantities as well), purchase processes and periodical inventory review, quality associated to the GMP regulations, short time between orders and deliveries, and good relationships with customers and suppliers provide advantages to the pharmaceutical chain compared to incoming companies in the industry. These and other advantages may be leveraged making use of TIC in the chain processes and making a more detailed analysis of the SCOR's best practices that may be applied to the Colombian situation.

8. FUTURE STUDIES

It's clear that this study is the first step toward the understanding of the supply chain in the sector. As first approach, it was tried to present a general outlook regarding process and best practices. However, there is left a long distance to cover for achieving a better chain understanding and so have the tools that allow setting improvements to face the globalized world.

It would be interesting to carry on this work, developing deeper studies in several subjects as: inventory management, demand management, productive process monitoring, use of metrics and benchmarking. These studies will allow the generation of a knowledge body (quantitative and qualitative) regarding the chain operation, but there is another part in the equation that must be analyzed: the quantitative impact of GMP in industry. Through a study that deeply analyses the GMP impact, there could be set strategies to: 1) setting improvements to GMP so they gain qualitative features incorporated in a management tool, and 2) involve the chain's companies in the use of GMP as a tool for competitiveness improvement.

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