



Operations Management Strategies for the Textile-Clothing Sector in Colombia

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Mini Review

The textile and clothing industry in Colombia represents a productive sector that has more than one hundred years of experience, which has allowed it to position both nationally and internationally, mainly due to the added value of fabrics, the quality of clothing, design innovation, and the occupation of local labor. However, in recent years the textile-confection, design and fashion sector in Colombia has faced many difficulties due to phenomena such as tax reforms, demand contraction, unfair competition, smuggling, money laundering, import and export policies, exchange rates, trade agreements, among others [1,2]. Additionally, challenges related to high energy costs, environmental costs, and demand for a wide variety of products with short life cycles must be addressed [3].

These changes in the textile-clothing industry have motivated the redesign of production and logistics processes, leading to optimization of operations to achieve satisfactory competitiveness levels, which depends on factors such as production costs, sales prices, human capital, technological development, product differentiation, infrastructure, geographic location, market size, among others [4]. Likewise, it should be considered that the apparel sector presents seasonal demands, in which the inventories must be constantly renewed to satisfy the demand, avoiding unsold inventories that represent large losses to the companies, and it requires convergence with the operations planning process in order to increase the inventory turnover and add value to products.

Given this situation, it is absolutely necessary to apply operations management and supply chain management strategies, aiming to integrate, optimizing and coordinating business processes from raw material suppliers to the final consumer, managing forecasts to recover consumers and retailers confidence [5,6]. Therefore, members of the textile-clothing supply chain must conduct a thorough analysis of the fundamental logistics and operations to fulfill sale promises to final consumers and increase

their productivity. It can be achieved using proper operations management strategies in the textile-manufacturing sector, creating value and addressing the intense competition in both the national and international markets.

Strategies for Inventory Management

In order to reduce the levels of sales and low turnover, the textile-clothing industry can identify the attributes of the supply networks of each type of retailer so that the manufacturers can understand how they should respond to the requirements for different classes of apparel [7]. This allows a greater integration of retailers and producers to manufacture garments under a quick response approach that meet the requirements of the market, even involving vertical integration in some industrial functions [8]. The textile-clothing companies must avoid shelf-out-of-stock at all costs since it implies the loss of a particular sale and the possible future sales of customers. For this, it is recommended use forecasting techniques, such as Fourier analysis methods, that can be easily implemented on SMEs through the use of common spreadsheets [9].

Likewise, it should be considered that the characteristics of the demand in the clothing industry are related to high impulse purchasing, demand uncertainty, high product variety, and a high number of references. In addition, the demand should be classified according to the specific attributes (smoothness, intermittence, uncertainty, and slow-moving). To cope with this issue, it is necessary to manage the historical series to facilitate the use of effective forecasting methods [10].

Strategies for Over Inventory and Overproduction

Over inventory and overproduction not only represent an economic problem for the companies but also an environmental and even social problem, which must be addressed to guarantee the sustainability of the business. For that, it is recommended

to design pull production systems guaranteeing the integration of the echelons within the textile-clothing supply chain, such as integrating design and retail processes, leading to a flexible design process, quickly product delivery to the market and avoiding building up stock that will not be sold [11,12].

Similarly, involving retailers and store managers in the S&OP process can help determine what is or is not selling especially in the case of new product introductions and end of life product forecasts [13], and implementing demand forecasting methods such as Arima and Arimax can reduce the difference between planned inventory and real demand because these methods can process multiple variables and consider periods of high demand that vary from year to year, such as holidays [14]. Another strategy is related to integrating Point of Sale systems (POS) with stochastic computer-simulation models to provide quick response procedures for seasonal merchandise, thus reducing the replenishment time and the potential for lost sales [15], thus obtaining timely and accurate inventories for effective and efficient use of automatic replenishment systems and vendor partnerships [16].

Once over inventory or overproduction occurs, refashion strategies can be applied developing prototypes through deconstruction and reconstruction processes. Refashion is a process that intercepts overproduction, over inventory, discarded clothing, reclaims, and re-cuts, returning the item to the clothing stream, reducing wastes and the demand on raw materials required in the manufacture of new textiles and garment [17]. In this sense, another alternative is the donation of overproduction to improve sustainability indicators related to social dimensions (support to communities in need) and environmental dimensions (waste reduction and mitigate the damage to the natural environment). However, these donations must avoid replacing existing markets, so they must go to different and distant markets of the textile-clothing companies that manufacture said overproduction [18].

Strategies for Reducing High Production Costs

Production costs can be reduced through proper production planning and operations scheduling, which optimizes the resources available in the production facilities. For this, it is recommended to perform an adequate aggregate production planning process in order to minimize total costs associated with labor and inventory levels in a medium-term horizon [19]. For the short term, scheduling techniques must be applied to assign jobs to resources in clothing manufacturing plants reducing the time lost in assembly modules and setup operations [20]. Regarding the planning process of the required resources such as manufacturing modules, setup staff, floor area, machinery, equipment, among others, the use of simulation techniques has been proved to allow the minimization of total production costs under different operating scenarios [21]. Likewise, technologies such as RFID and cloud computing can capture and monitor real-time information to provide production scheduling solutions based on intelligent optimization techniques such as heuristics and metaheuristics [22,23]. Production systems based on lean manufacturing are also a great alternative to reduce costs and increase product quality [24-26], promoting the

implementation of tools and methods such as 5S, DEMAIC, Kaizen, SMED, and TPM, as well as Six Sigma approaches [27].

On the other hand, under a global supply chain approach, it is necessary to consider global sourcing for materials and production services in order to get products and services with the flexibility and speed required by the market [28-30]. Thus, textile-clothing companies can focus on performing own processes that add value and outsourcing those for which the companies do not have sufficient competitiveness. For the case in which textile-clothing companies need to acquire materials from suppliers, it is recommended to implement material requirements planning (MRP) systems to reduce excessive raw materials and provide on-time inventory, avoiding cost overruns and production delays [28,29].

Conclusion

Operations management allows addressing problems related to low levels of sales and low turnover, over inventory and high manufacturing costs in textile-clothing companies in order to improve productivity and competitiveness. Operations management provides strategies that promote the supply chain integration, adequate demand forecasting methods, S&OP methodologies, lean manufacturing principles, implementation of information technologies, and production planning techniques for the long, medium and short term.

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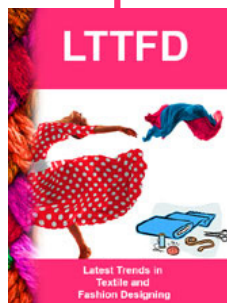


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