Resolving Conflicting Paradigms in Vertically Integrated Textile Firms: A TOC Case Study

1 Introduction

Vertically integrated firms are expected to generate higher profits than independent firms in the value chains which are characterized by high margins (Williamson, 1979). Independent firms often end up wasting significant amount of resources in bargaining over the profits in such contexts, whereas the bargaining is automatically restrained by the bureaucracy in case of integrated firms (Balakrishnan and Wernerfelt, 1986). Integrated firms typically enjoy the benefits of economies of scale, reliability in raw materials supply and high level of product knowledge (Amadeo, 2019). Since the industries in which they operate tend to be very capital intensive, such as steel and textiles, there are potential barriers to entry for the competition (Balakrishnan and Wernerfelt, 1986). However, huge capital expenditure also necessitates high levels of capacity utilization for such firms to achieve economies of scale. Therefore, integrated firms tend to be quite rigid and find it hard to follow market trends at fast pace (Sraders, 2018).

Supply chain management in the context of integrated firms is quite challenging when the product lifetimes are small, the demand is seasonal, the variety is large and the lead times are long and uncertain (Sodhi and Lee, 2007). Demand forecasting becomes difficult due to information distortion and the bull-whip effect (Sodhi and Lee, 2007). Maintaining high levels of capacity utilization becomes a challenge due to huge swings in demand (Modi et al., 2019). The complexity of managing increases several-fold when the product varieties explode as one moves from upstream entities towards the downstream entities. The coordination, synchronization and prioritization of the production activities across different entities becomes further complicated when various entities are also involved in independently selling their own products (for example, many integrated textile companies sell yarn and fabric in addition to selling garments). Traditional efficiency based practices often result in very poor operational performance in such cases. All these challenges are being experienced by Indian textile manufacturers who are no longer able to compete simply based on the low price, as they did in the past (Hindu, 2019). Past luxuries in form of subsidies and export incentives from the Indian government, quotas and exemption from duties in the US and Europe, cheap labour and favourable exchange rates are no longer available to the Indian textile manufacturers (Verma, 2002). Several US and Europe based major retail brands are switching to cheaper suppliers from Bangladesh and Vietnam for their core apparel products to keep their

prices low so that they can compete with the e-tailers (Datta and Kuruvilla, 2019; Mohanty and Kuruvilla, 2019) . As for the high-throughput fast fashion garments some retailers prefer suppliers from China, Portugal and Turkey, who can offer short and reliable lead times (Datta and Kuruvilla, 2019). Indian garment manufacturers find themselves stuck in the middle as they are neither able to compete on the dimensions of cost nor on the lead times.

The company chosen for this study is a very large vertically integrated textile manufacturing company in India. It is involved in activities related to making and selling yarn, fabric and garments. The company deals with nearly 30000 cotton producers and employs more than 10000 employees. A large portion of its sales comes through exports where its customers are big brand retailers operating in nearly 20 countries. The company was struggling with the problems of long and unreliable deliveries, low efficiencies in production, huge airfreights and penalties, increasing costs of inventories, interest on working capital loans, overtime and other operating expenses and deteriorating revenues and working capital condition. The financial sustainability of the firm was under serious threat.

2 Background

The process flow diagram of manufacturing operations at the company is shown in fig 1. The process typically starts with converting fibre, such as cotton, into yarn (*spinning*). The yarn is then knitted into fabric (*knitting*) which is then dyed to achieve the desired color (*dyeing*). Dyed fabrics are then converted into garments (*garmenting*). This is a typical V shaped plant where few raw materials get converted into a large variety of intermediate products at each stage (Schragenheim and Dettmer, 2000). So, from a single fibre nearly 25 types of yarns of different strengths and diameters can be produced. The yarns can be knitted together in different combinations to produce roughly 90 types of fabrics of different widths, structures and thickness. The fabrics can be further dyed to obtain about 800 different types of piece dyed fabrics which can then be converted into around 3000 different types of garments of varied styles, sizes and colors.

The entire process is characterized by a mix of divergent (dyeing and garmenting) and convergent (knitting and packing) flows at different stages (Datta and Kuruvilla, 2019). It was a major challenge to deliver the garment orders of the retail brands on time and in full (OTIF). The large variety at each stage led to serious problems of synchronization. So, for example, even if one of the required yarns is not available knitting cannot process the order. Not surprisingly, the OTIF was very low (around 25%) and the lead times were very long and variable for the garment orders (ranged between fifteen days to six months). The delay penalties were mounting and the big retailers were moving to other suppliers. The financial sustenance was in question and the company needed to find a way to significantly improve its operations in quick time.

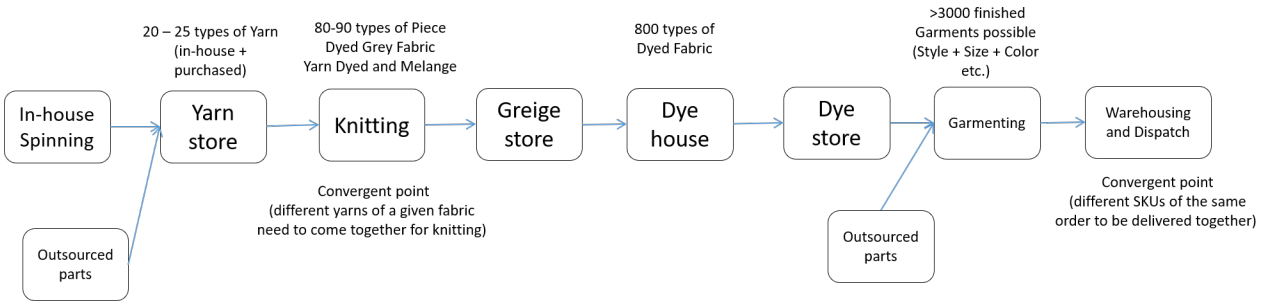

Figure 1: Process flow diagram (source: company documents)

3. Undesirable Effects (UDEs)

An exhaustive list of major issues faced by the case company was first prepared by the consulting company (*name of the consulting company withheld for peer review proces; henceforth referred to as the XYZ consulting company*) after numerous discussions with various stakeholders in the supply chain such as retailers, suppliers, operations, marketing and sales, finance and the top management. These symptoms of poor performance are generally referred to as the undesirable effects (UDEs) in the world of TOC (Dettmer, 1998). The major UDEs observed in the context of the given company are described in detail next.

4.1 Retailers and Export Customers

1. **Long and uncertain lead times**: The lead time for delivery in case of the given textile company was between six to nine months. In addition to the lead times being long they were also uncertain. This meant that there were numerous instances when the orders would not be delivered in time despite the quoted time being very long. This resulted in huge loss of sales for the retailers as their commitments to their own stores, distribution centres and customers were not fulfilled.

2. **Poor forecasting accuracy**: Long lead times forced the retailers to forecast their own demands for the forthcoming seasons well in advance. Given the inherent nature of the fashion items and the length of horizon for which the retailers were making forecasts it was almost impossible to predict which designs would sell well and which would not, few months before the actual season. This resulted in the problem of huge shortage of some designs which would invariably sell out faster than the forecasted rate and excess of the rest which sold at a much lower rate[1].

3. **Poor return-on-investment (ROI)**: The items which went out of stock in the middle of the season could not be replenished due to the long lead times of the company. Hence, shortages persisted for a very long time at the retailers. The faster an item sold the higher the shortage and longer the duration for which the shortage persisted. This resulted in huge loss of sales

[1] see Goldratt et al. (2009) for similar problems

as the retailers were losing out on the opportunity of making significant amount of money on the 'hit' items. On the other hand, the 'laggards' had to be sold at significant discounts in order to release the working capital and shelf space. This further reduced the revenues of the retailers. In fact, most retailers preferred to order lesser number of units per product than required ('buy shallow') so as to minimize the chances of excess stock of the 'laggards'. This conservatism of retailers further increased the shortage[2]. Thus, despite dealing in very high throughput items the retailers' ROI was poor.

4. **Huge storage requirements**: Due to the long lead times the retailers generally ordered only twice a year for the two main seasons (autumn-winter and spring-summer). This resulted in large order sizes, increased storage and handling requirements and lower inventory turns.

4.2 Operations and Suppliers

1. **Lack of synchronization between departments**: The company faced severe synchronization problems at various stages in manufacturing due to the lack of 'full-kit'. In any department, for an order to be processed, it was necessary to have the complete assortment of different items such as fabrics, yarns, trim or approvals. For example, an item of a given order could not be processed in garmenting until all the required fabrics of different colors and thickness, along with trims and customer approvals were available[3]. The lack of full-kit forced the departments to process those items for which the full assortment was available. Since a sales order typically consisted of multiple items with varied requirements, this practice of 'cherry picking' increased the elapsed time between the first and the last units of a sales order in a given department. This had cascading effects and the synchronization problems further magnified as orders progressed from yarn towards garmenting. The elapsed time between the receipt of the first and last units of a given sales order in garmenting could be as high as 180 days.

2. **Unreliable suppliers**: There were frequent delays from the suppliers in obtaining the required materials such as trims and special yarns which were ordered based on the specifications

[2]see Goldratt et al. (2008) for similar problems

in a confirmed sales order.

3. **Large WIP, raw material and finished goods inventories**: The lack of synchronization and high elapsed times between different items of the same order resulted in huge WIP and finished goods inventories. The practice of monthly planning also increased the raw material inventories. Large levels of inventories presented significant storage and safety related hazards.

4. **Cycles of starvation and overloading**: Due to severe synchronization problems combined with the practice of keeping the machines busy, production in various departments experienced frequent and erratic cycles of starvation and overloading. Typically at the start of the month, the production would starve due to non-availability of all the raw materials, while at the end of the month, when the materials would become available, the departments would be under tremendous pressure to complete the orders (Mohanty, 2019). Packaging also experienced tremendous pressure during the end of the month while it was relatively idle during the first half of the month. Starvation resulted in the loss of capacity while overloading resulted in increased overtime and excessive expediting across departments.

5. **Loss of capacity**: The pressure to complete their pending orders from different account managers often resulted in production having to perform multiple unplanned setups. Since setup times in most departments were dependent on the sequence followed, frequent and unplanned setups often resulted in significant loss of capacities. It further disrupted the flow.

6. **High rate of rejection and 'stealing'**: Frequent changeovers in many departments, such as garmenting and dying, resulted in increased rates of rejection. In order to compensate for the rejected quantities departments regularly 'stole' in-process materials from other orders, whenever possible[4]. Stealing further worsened the problem of delays as the missing materials could be replenished only after completing a sequence of processing steps in yarn, fabric and garmenting, which took a lot of time. Rejection also led to loss of capacities.

7. **Conflicts in capacity allocation**: Since the capacities in the yarn, fabric and garmenting were shared between the garment orders from retailers as well as yarn and fabric orders from external customers, it led to conflicts in capacity allocation and prioritization among different

[4]Goldratt (1999) explains phenomenon of stealing in steel industries

types of orders. Since the sample orders also followed the same route as the bulk orders it further increased the confusion. The divergent nature of material flows combined with the habit of keeping machines busy and running large batches resulted in stealing of in-process materials as well as capacities[5] . All departments were perennially in conflict with respect to allocating capacities to - bulk orders versus sample orders, one retailer versus other retailer, in-house designs versus firm customer orders, existing versus new customers (Datta, 2019). Priorities during execution were informally decided based on *the intensity of the shouts of different customers* (Goldratt, 1999).

8. **Lack of visibility**: Due to the erratic flows throughout the system it was difficult to trace the progress of orders despite the extensive monthly planning process and an expensive ERP system. This led to lack of focus, unclear priorities, excessive expediting and delays due to non-availability of the desired information regarding the status of various orders on the shop-floor. Many a times a delay was noticed only after it had occurred.

4.3 Marketing and Sales

1. **Inability to quote due dates properly**: Due to the long and uncertain lead times it was impossible to predict the time required to process a given sales order for yarn, fabric and garmenting. The lead times quoted by the sales teams were largely based on past standards and made no consideration for the existing load in different departments. This led to either over-loading of the capacities and eventual delays in deliveries or under-loading of the capacities and loss of opportunities of earning more business during the lean periods.

2. **Delays in sample file preparation and final approvals**: In order to avoid any variation in the shade and other specifications, it was mandated that the pre-production sample files also followed the same route as the bulk orders. But since there were frequent delays in sample file preparation due to lack of full-assortment at various stages, it delayed the process of obtaining approvals and getting accurate specifications for the subsequent bulk orders. This delayed the ordering of raw materials, trim and special yarns. The problem of inaccurate specifications

[5]see Goldratt (1999) for discussion on stealing in plants with divergent points

was also magnified because of the long lead times as the customers had to place orders well ahead in time when they themselves were not completely clear about the requirements.

4.4 Top Management

1. **Waste of management efforts**: Major portion of the top management attention was wasted in expediting efforts and answering to the queries from angry customers. Marketing bandwidth was mostly spent in getting the sample files delivered on time through the production. Production's attention was wasted due to frequent rescheduling which had rendered the expensive scheduling software useless. Sales account managers' significant time was wasted in following up and getting their orders out from production in time. Again, the lack of visibility was not improved despite the ERP system and most expediting activities necessitated regular bypassing of the ERP system and use of excel worksheets.

4.5 Finance

1. **High working capital requirement**: High level of raw materials, WIP and finished goods inventories increased the working capital requirements at the company. Frequent delays in deliveries resulted in huge penalties, airfreights and increased overtimes. The company had to keep a significant amount of cash ready in the bank just to pay for the penalties. High interest payments further increased the operating expenses. Timely payments to the banks, suppliers and workforce was a challenge. The company was running into major losses due to mounting expenses. Major retailers were threatening to take their business elsewhere.