Coffee Supply Chain Performance Improvement: A Case Study of Digital Transformation

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Abstract

The study examines the coffee supply chain (SC) using a case study approach and examines how technology and digitization can provide solutions and improvements regarding efficiency, satisfaction, and profitability. The case study is a Greek company, which and operates in many Greek cities. The coffee supply chain starts from the farms where the cultivation and production of green coffee beans occur in many countries worldwide. Then, the coffee beans are transferred to the plants from the farms. After that, many processes occur until the final products are produced (receipt, storage, quality control, roasting, grinding, packaging). The final products are stored in warehouses ready for shipping to the retail stores. In the last step, consumers are served from the coffee shops through the different sales channels. This study examines the cast study operation in recording, tracing, and tracking coffee through all the stages of the SC from the warehouse to the final consumer, aiming at optimizing key processes. To achieve that, specific supply chain performance indicators are used. Improvements in these operations positively impact companies and this is reflected in improved supply chain indicators, better financial results, and enhanced brand image. Results show that most of the company's primary stakeholders will also have positive effects (employees, suppliers, partners with stores, final consumers).

Keywords
Supply Chain, Coffee Industry, Production Management, Warehousing, Digital Transformation.

1. Introduction

The importance and meaning of SCs is reflected in the following quote: "*Supply chains compete, not companies*" (Christopher, 2016). Sales and marketing are the leaders in successful business models, but their efficiency relies on SCs. SCs provide the right quality product at the right price, at the right time, and place to the final consumer at the demanded quantity. Every industry has its distinguishing characteristics and operating challenges, but the issues in SC remain the same. Therefore, all the organizations must make major decisions for SC in five areas (Hugos, 2018; Zaridis et al., 2021; Vlachos and Dyra, 2020):

- *Production* – It replies to questions about the products that the market wants, their quantities (demand), and the corresponding schedule. The organization must balance between efficiency and responsiveness. Hence, this area needs an appropriate production plan to consider the total demand, the plant's capacity, quality control, human resources, workload, equipment capacity, and maintenance.

- *Inventory* – This has to do with the stocks in each SC phase (raw materials, semi-finished goods, finished goods, packaging materials, auxiliary materials). If a company holds more than the needed inventory, it is costly, while the opposite is dangerous, and each organization must find the optimal inventory levels and reorder points. Each company must make decisions regarding its inventory strategy depending on the product and market characteristics, along with various limitations such as cost, availability, seasonality, capacity, etc.
- *Location* – This refers to the place where the production unit and warehouses will be located. It is a difficult question, and the decision must be cost-efficient for the company. The issue for using the existing or new facilities often happens when a chain becomes more extended, and the distribution gets more complicated. The locations are the pillar to design and develop the paths for the final delivery. There are also important and strategic decisions about centralizing the sites or not, ownership or not, and activities in each facility. All the previous decisions are related to the costs of facilities, labor cost, infrastructure, workforce, proximity with customers and suppliers, as well as delivery to the market. They are challenging and crucial because they are decisions with long-term plans and not easy to change.
- *Transportation* – This refers to the movement of inventory from one SC node to the other. This area must consider costs, time, and availability to cover demand in each phase of SC. In most SC networks, the transportation costs can be higher than a third of the entire operating cost of a SC, and the decisions are crucial.
- *Information* – It has to do with data collection, exploitation, visualization, sharing, and safety. The data from all the processes of SC are the "new oil" for every company because they can make effective and quick decisions with the correct use of them. Data could also help to take actions to optimize all the SC processes and KPIs. Companies use data between others with the purpose of coordinating all the daily activities –tasks related to the previous areas (production, inventory, location, transportation). Data are also used to forecast and plan production schedules, purchasing orders, demand coverage, or help for long-term decisions such as new production units, new facilities, and entering or exiting a market

Nowadays, in highly competitive markets and industries, innovative ways and optimization of supply chains are elements of particular importance to companies. The introduction in recent years of new technologies radically changed the landscape of more consumer-oriented businesses. Consumer behaviors and demand patterns have been significantly affected by easier access and increased availability of information (Haddud and Khare, 2020). A typical example of modern consumer behavior is personalization, which concerns higher service expectations and customized orders, forcing companies to seek new solutions (Lin and Vlachos, 2018). All the above can affect and change the supply chain management of a company, and the need for adaptation is more necessary than ever. It is more than evident that the exploitation of new emerging technologies can improve business productivity. Costs can be reduced, and SC will be more stable and efficient. New technologies also create greater transparency and simplify all the SC processes by offering a significant competitive advantage to all the companies that understand it (Rodrigues et al., 2018). Digital business transformation (digitalization) comes to revamp all the SC and expand their potential. Moreover, sustainability is a global concern in SCM in the last years and supply chain partners are actively getting involved in relevant objectives and goals, which act as game-changers. Consumers are more sensible towards sustainability issues and demand effective actions from supply chains.

The coffee industry and one of the most prominent organizations in Greece in this field were selected as a case-study. The coffee industry has one of the most attractive and representative applications in SC because the range covers from the farm to the final consumer with a lot of data and observations.

In this paper, we focus on the analysis and measurement of performance in SCs. A case study will be used to assess the importance of key performance indicators (KPIs) and to identify possible improvements. We will examine how innovative ideas, technologies, and digital improvements can optimize and improve the essential KPIs. Using real data and results, we will study, research and suggest ways to improve SC and optimize SC efficiency. Finally, we will try to suggest some ideas to eliminate the carbon footprint and emissions due to SC and logistics activities in the production unit and the warehouses to align with the company's sustainability strategy. For confidentiality reasons we will refer to the company as COFCO.

2. Literature Review

2.1 Supply chain of the coffee industry
Coffee is a key agricultural commodity traded on the global market that has a significant economic impact in many nations where the crop is grown (Kittichotsatsawat et al., 2021). Its aromatic and taste features, as well as its energizing and invigorating properties, have made it extremely popular (Giraldi-Díaz et al. 2018; Hameed et al., 2018). Coffee SCM is a worldwide operational approach for coffee firms to improve their competitiveness.

Businesses are seeking to improve their competitiveness by altering their operational strategy, which includes using the SC management paradigm (Nguyen et al., 2017).

The life cycle of a typical bean of coffee starts from the growing phase and includes many actors of varying interests and priorities (Bothiraj et al., 2020; Ikhwana, 2018). There are different species of plants in various countries on three continents (Africa, America, Asia). Coffee companies like this case study, have a direct trade policy, and coffee specialists travel worldwide to make direct trade with known farmers. They visit the farms, watch and observe the growing, picking, and processing phase, and sign contracts with the needed varieties and quantities. As a result, the main product (coffee beans) covers the demand of coffee consumers.

It is vital for companies to conclude the correct contracts at the proper time. The procurement department is responsible for this; in cooperation with the marketing department, they predict demand for the following months, analyze and anticipate the coffee price, and make the needed orders (contracts). The financial and commercial departments are also responsible for eliminating any danger from these transactions, protecting the company, and ensuring the cash flow. The procurement department cooperates with the logistics department for the transportation phase, from the farm to the company's production unit. The logistics department is responsible for receiving and handling orders as well as for the proper storage of green coffee beans and their sourcing to the production facilities. In terms of production, the processes that follow are roasting, packaging, and storage of the final products. The retail stores order products, and every day the picking–packing process runs to ship the products to the network. Finally, when the orders arrive at coffee shops, the coffee products are stored until the final sale to the consumers. Final consumers can purchase the products by visiting the physical stores or having them delivered at their place by making phone, web, or mobile app orders. Along this journey, tracking and tracing of coffee beans is very important in this industry. In a quest to enhance the After all, there is the after-sales SC process. This phase has to do with the reverse logistics procedure and the whole conversation the last years for plastic, coffee waste, and environmentally friendly actions.

The delivery process has many areas to improve to meet customer's expectations, and technology can provide appropriate solutions. One of the most significant areas to examine and optimize is the last-mile delivery process. The whole retail sector, especially in food and beverages, works on optimizing the last mile. The consumers' expectations are high, and there is enormous competition to succeed in safe, proper, and quick delivery.

2.2 Supply chain performance metrics

As it refers to materials' flows as well as distribution through numerous channels to the ultimate consumer, SC performance transcends business borders. It is also relevant across typical organizational operations like procurement, production, distribution, marketing and sales, and research and development. Several KPIs have been introduced and widely used by academics and practitioners aiming at monitoring operational performance (Lima-Junior and Luiz, 2017; Maestrini et al., 2018). Decision-makers are then responsible for the necessary intervention that will lead to certain improvements (Vlachos et al., 2008). Some important KPIs are presented in the sequel (Cohen and Roussel 2013; Janeš and Faganel, 2013; Marziali et al., 2021; Roe et al., 2015; Tasdemir and Hiziroglu, 2019; Williams et al., 2008; Zhang et al., 2019).

- *Inventory turnover* measures how well a company can move its inventory. It replies to the question of how often the organization sells its entire stock over the year. This KPI can help all the involved departments optimize all the buying practices and policies parallel with the gauge demand for all the products. The ability to move the inventory faster is essential because it affects the storage costs. It increases the efficiency of SC and improves financial indicators (for example, cash flow). It helps the commercial department sell products at premium prices and make offers and promotions not to clear the stock but for serving the strategic goals. Inventory management balances the right inventory level with high customer service performance and optimized costs. There are also relevant to inventory turnover measurements, and we will try to optimize and increase the indicator for the slow-moving products.
- *Delivery & shipment times* are also two essential KPIs for all the SC companies. We could easily say that these metrics are more critical in the phase of the last mile delivery where a store must deliver an order to the final customer. They affect satisfaction and total experience. Delivery time as one of the most essential factors that affect the net promoter score of a company, the customer lifetime value, and loyalty. The delivery and shipment time and costs are also essential in the part of the SC from the company warehouses to the points of sale.
- *Cash to cash cycle time* is also a valuable indicator that can say a lot for the SC of a company. It is the time between paying the suppliers for raw materials and components and getting paid for a product. It is also a metric that can help companies increase efficiency and spend resources for other uses and not in SC.

- *Warranty costs* as a percentage of sales is a KPI that allows companies to understand the spending on repairs and replacements compared to total sales. It also measures the defective units/products compared to the total units sold. This KPI can increase the efficiency and performance of the quality control and quality assurance department.
- *Deficit orders and returns* are indicators that affect customer satisfaction, increase complexity, reduce performance and increase costs in all the warehouses. Therefore, the fewer the deficit orders – products and the fewer the returns are the best for the company.
- *Customer cycle time* is one of the most critical metrics too. It counts the time to complete an order, from the time of placing the order till the final delivery. We could also refer to the SC cycle time, which is the same time but setting inventory levels to zero. This indicator could measure the efficiency of SC overall, but it is not easy to calculate it. The shorter the cycle time is, the better for the company, and it means that the processes are agile and flexible. High SC cycle time or high customer cycle time must drive the company to take corrective actions.
- The *fill rate (demand satisfaction rate)* measures the amount of customer demand that is met through the stock. At the same time, lost sales and backorders must lead to zero. Suppose a company knows its fill rate can improve inventory performance. In that case, the best way to succeed is to give all the necessary departments access to the inventory data and educate them to understand the available inventory. At the same time, the *availability rate* is the KPI that measures the percentage of the available products for the customers (stores) to order.
- The *service rate* measures the percentage of the received orders which delivered in time. This KPI must be very close to 100%, and we focus on this, which is an obligation for our organization. It is also essential to separate this rate into two parts; first, we calculate the KPI on shipped orders, and secondly, we measure delivered on-time orders. This separation will indicate a low rate if we have a problem in stock or the shipping–delivery phase.
- *Customer satisfaction* and the whole customer relationship management is also a significant indicator. We have several indicators which we attend, and by combining them, we can measure absolute satisfaction. Except for the attendance and the improvement of indicators, the company has a department dedicated to customer service responsible for all the B2B communication. The department also attends and records B2C communication and has continuous cooperation with the Marketing department for anything that happens in the company's social media.

More and more companies get engaged in systematic efforts that will help them improve their SC performance. Being associated with global SCs, the coffee industry strives to embrace solutions and interventions for all SC phases "from farm to cup". The monitoring and assessment of such efforts expands the knowledge on the sector and provides meaningful insights for academics and practitioners.

3. Methods

The goal of this research is to look at how technology and digitization can provide solutions and improvements regarding efficiency, satisfaction, and profitability. A case study analysis was chosen as the preferable research instrument due to the necessity to better comprehend such a complicated undertaking through in-depth observations in a natural context (Meredith, 1998; Thomas, 2011; Yin, 2017). A single case study is regarded appropriate for exploratory inquiries and helps researchers to have a deeper understanding of the problem analyzed (Bao et al., 2017; Eisenhardt, 1989). The situation of COFCO, in our opinion, is an illustration of a company trying to adapt contemporary managerial tools to achieve operational excellence and SC leadership. This does not imply that the findings can be applied to other cases with ease. Analysts will, however, can make comparisons, spot similar patterns, and be guided by successful implementations.

3.1 The COFCO company

This case study examines the COFCO company by observing and analyzing the whole SC from the farm to the final consumer. COFCO started in 1999 in Greece with a coffee shop and today has more than 450 shops in six countries (Greece, Cyprus, United Kingdom, Canada, UAE, and Switzerland). The company does not stop its growth and expansion in existing and new countries is in its strategy. At the same time, COFCO has its own coffee production unit (about 2,000 square meters with 5 roasting machines and 7 packing lines) and warehouses (about 5,500 square meters). The capacity of the production unit and the warehouses is such that it allows further development plans. The COFCO's vision is to establish itself as an international leader and pioneer in the coffee world by offering specialty coffee and transforming the art of artisan coffee into science.

COFCO has a direct trade policy, and coffee specialists travel worldwide to make direct trade with known farmers. They visit the farms, watch and observe the growing, picking, and processing phase, and sign contracts with the needed varieties and quantities. As a result, the main product (coffee beans) covers the demand of COFCO's

consumers. Additionally, the knowledge of the specialty coffee and the direct relationship with the owners of the farms led the company to innovate and pioneer with limited edition products from small farms.

4. Findings
4.1 Production Management

COFCO cooperated with an Italian company leader in manufacturing equipment for the coffee industry. From the reception of green coffee to packaging machines COFCO has an automated turn-keys plant with new generation management systems. The software helps the production staff and foreman to run and control all the different stages of cleaning the coffee, storage in silos, weighing with accuracy, blending, roasting (large scale), grinding, degassing, and aromatization by tracking all the necessary data for each process. More analytically, we could separate that the Production Department of COFCO has two main units: (a) Green Coffee and (b) Production Unit. Both units are running many processes every day. Therefore, it is easy to understand that the production team is the heart of the organization, and their role is essential and significant for the whole company's development and growth.

The Green Coffee unit has many responsibilities, which are crucial for the company. Some of them are the following: (i) Capture and attend the green coffee market, (ii) Indicate the risks and the opportunities (products, suppliers, market, pricing, parity), (iii) Attend and manage all the purchases, contracts, transportations (including time and cost analysis for each purchase), (iv) Attend and manage green coffee inventories (demand – offer), (v) Ask and collect samples, store the quality assurance results, check them during receipt, and (vi) Receive green coffee. All these processes are part of the SC from the farm (supplier) till the receipt in the COFCO's production unit. However, all the phases are totally computerized in the ERP, WMS and other company systems.

The department stores and manages all the purchases (orders with contracts) and supplier information in the ERP and this is a typical process without the need for further optimization. However, all the suppliers of COFCO before the first cooperation and every year are passing from a strict evaluation process. Assurance tests for products and services, financial situation, and behavior are factors that build the supplier's ranking and control, which secures high quality and standards. This innovative ranking system seems to increase satisfaction and reduced defective receipts.

Regarding the receipt process, the workers expect and know the orders on a daily basis with the help of the ERP system. In addition, every morning the ERP syncs with the WMS. Hence, workers have the option to check them from their computer or tablet. Upon reception, the product's inventory level is updated. At the same time, the system prints the appropriate label, and all incoming products are tagged in the warehouse. Finally, workers know exactly from the WMS system where to transfer each product and scan the barcodes for the final storage. All the received products are also transferred to the ERP system (automation runs every 15 minutes), and the accounting department can quickly check and automatically store the incoming invoices. The WMS system precisely knows the production warehouse's inventories, lots, and storage points (pallets, shelves, routes, different warehouse points).

The previous process has the following advantages for the SC and the company: (i) Employees know and expect all the orders, (ii) The company receives precisely what the worker scans. They cannot receive if the purchase order is not the in the ERP, (iii) They know immediately if a received order has differences or deficiencies from the placed order, (iv) The stock is identical in the WMS and the ERP system, (v) Traceability starts from the receiving phase, and the product has all the information from the supplier, (vi) There are no errors in prices and invoicing, and (vii) The financial department can easily manage the cash flow of the company from the order.
The process is fully automated and digitized, and the performance of all the involved departments has increased. In less time, without errors and less effort, the incomings work perfectly, which helps the whole company work better and more efficiently.

The storage of the green coffee in the production's warehouse is under controlled temperature and humidity conditions. Automatic instruments and IoT sensors record and save the conditions continuously. Before the roasting phase, the green coffee is weighted with accuracy and transferred to silos. The weight is also stored automatically in the WMS and specialized software system (IoT). The wastage from the incoming coffee (due to humidity) is also available. The next is the roasting phase; foremen are watching the process and the roasting curve through the specialized software system (heat treatment), and all the roast data are saved and transferred to the WMS and ERP system. Roasted coffee is weighted, and roasting losses are calculated. The roasted coffee is stored in suitable labeled containers, and each roast lot is codified. Based on specific recipes, the varieties of roasted coffee that are to be blended are weighted again and led to the blender. They are stirred for a certain period of time, predefined from the system. Some of the roasted and blended coffee goes to the aromatization phase

where specific recipes are used, if necessary. The final product is packaged in suitable packaging, and the finished products are stored in the warehouse, ready for sale.

It is more than evident that modern software, contemporary hardware, and equipment can increase each phase and machine's performance, quality, and availability. The Overall Equipment Effectiveness (OEE) indicator and other KPIs are measured daily and help the supervisors and managers to optimize and improve problematic areas. OEE improvement in the last eight months of 2020 was spectacular, and in most of the machines and phases, the company achieved a 10% increase. OEE is an indicator that combines three terms: availability, performance, and quality. Despite the increase of 10%, COFCO has a low OEE (about 55%), which means that it has the margins to grow and expand without the need for further investments. It is also clear that all the processes can be improved and optimized to achieve even better results.

However, the increase in availability improves costs, optimizes time and resources, reduces overtime, and reduces the time to make a product. Performance has to do with the speed of each machine and equipment by comparing the actual production with the theoretical design. Maintenance is one factor that affects performance, but others must be improved too (train of operators, manuals – instructions, standardization of processes). If performance is low, the company consumes more resources, wastes money, and needs more operators. Finally, quality has to do with the value of a product and customer satisfaction. The reduction of defective products is the main goal for every company.

The production team and the whole management can watch anytime from anywhere the production processes, and there are many helpful dashboards and screens with statistics and KPIs. Thus, the company has all the weapons to optimize its production KPIs and improve plant's statistics.

4.2 Maintenance

Last year, the company optimized its SC in the production unit by developing a custom machine maintenance module with new technologies. The software which is integrated into the company's WMS works with maintenance commands and plan. Data about all the assets (equipment – machines) of the production unit are stored with details, and maintenance workers know for each machine what and when to do (manuals, relevant videos). There are automation and sensors, and we know all the scheduled or emergency maintenances, all the unexpected damages or failures, and the whole time for each job.

The system improved performance and availability, the response time reduced, and the department supervisor knows with detail the productivity for each machine and all the staff. Although the system is new, the maintenance department builds the knowledge base for each machine, and by using machine learning algorithms, the software will improve more availability and performance. Prevention will also be a fact that will optimize more all the KPIs.

Compared with previous reports, failures, damages, and incidents in the last three months of 2020 were 15% fewer than the previous semester. It is the result of using the system and improving the scheduled maintenance. In the updates of the maintenance module, some additional KPIs were employed:

- The *total mean time to repair* (acknowledgment + response + resolve time)
- The *reactive maintenance work hours* (total failure time / total maintenance time)
- The *predictive maintenance* KPIs (job count, jobs/day, time/day, total time

Hence, in the monthly dashboards and reports, the whole company can see these KPIs and their values, and they understand the improvement and how all these actions can affect the performance and profitability. All the KPIs have much information (description, center-left value in the current period, down-left trend in relation with the previous period, down-right differences with the previous period) for decision-makers. Moreover, the maintenance team and the management know between others:

- *Jobs*: The total number of maintenance tasks
- *On-time jobs*: The jobs that have a predefined duration and executed on time
- *Punctuality %*: The percentage of on-time jobs
- *Delay time*: The total delay time on jobs with predefined duration
- *Response time (AVG)*: The average response time by technicians to the damages reported by foremen
- *Failures*: Total number of jobs that are declared as damages (failures), their average per day, the average maintenance time for them per day, and the total failure time

- *Mean time between failures*: The average operation time before the subsequent failure (makes sense for each machine)
- *Mean time to repair*: The average time needed for repairing a machine
- *Unplanned*: Total unplanned jobs, unplanned jobs per day, and unplanned jobs time per day

The supervisors and managers could now control all the equipment (individually or as a whole) and the staff productivity. As a result, the maintenance employees also have more time, and they can allocate their time more efficiently. In addition, they know their jobs and their performance, and it is easy to make data-driven decisions and improvements. The company is waiting for even better results from more usage of the module and its improvements and addons after the first months of operation.

4.3 Warehouse Management

All products are stored in a warehouse very close to the production unit, ready for sale. The conditions are ideal, and the warehouse is structured and imprinted in the system with details. Different places, storage locations, routes, ramps constitute the floor plan of the warehouse.

The ordering is a complex process for COFCO and needs automation and continuous improvements to avoid errors, extra costs, and time loss. The whole process aims to increase customer satisfaction (COFCO stores, franchise owners) and help them order quickly and easily without errors and issues. The process is complicated because COFCO has more than 450 stores worldwide.

COFCO has a website for the partners to order their products. It is a typical e-shop that helps customers to order and does not allow any manual data entry. Although the B2B e-shop can serve all the COFCO stores worldwide, we will focus on optimizing the process for the Greek market. Each customer orders once a week on a predefined day. It is a strict rule that the company wants to be maintained from the stores to keep coffee products fresh and helping its stores not to stock for a longer time by also decreasing the space they need for storage. Therefore, the system only accepts orders until this predefined day, without exceptions, and the incoming order follows the following automatic flow:

- An order on the B2B e-shop is completed
- Orders are inserted into the ERP (scheduled automated task runs every 30')
- Commercial policies apply to new ERP orders (automated task runs every 30')

Orders are then subject to credit control. Every day at 1:00 pm, the credit-control process is executing for all the orders that must be fulfilled the same day. These orders are inserted into the WMS (scheduled automated task runs every 30'), and they are ready for the picking phase. All the processes are automated, and nobody can change policies or prices without having special admin rights.

The company's achievement is that about 99% of the orders are inserted into the system automatically (till 2018, 20% was by phone). At the same moment, there are no mistakes from the data entry, no mistakes on commercial rules and policies, and all the customers know that their order will be served only if their financial obligations are ok (credit control).

For all customers, the necessary information is available in the ERP system (order day, transportation details, price list, commercial policy, credit control limits (open cash balance, open check balance, credit days), etc). The IT and the Marketing Department collaborate to keep website updated. A mobile application is also being developed to offer the customers and the company new experience and new services aiming at improving sales and performance. The new B2B ordering platform will include modern technologies and e-commerce techniques. The new platform will be ready by the end of 2021, and the company expects to increase like-for-like sales and customer satisfaction by about 15%.

The following process, which includes picking and packing, is a procedure that we try to analyze and optimize. Picking is considered the most labor-intensive activity for all the warehouses and SCs. The cost of picking may be more than 55% of the total warehouse operating expense. Therefore, even small improvements and new techniques in the picking process can have an immediate impact (Koster et al., 2007). Two years ago, piece picking was used with a simple paper list printed from the ERP system. Then capabilities of WMS were used, and mobile tablets and scanners replaced printed lists. It was an easy step up associated with better inventory accuracy and total accountability to the labor budget. Voice picking and light picking were also considered but it was concluded that they would not have a significant contribution in the warehouse operations.

In the WMS, run routing algorithms were used and increased the productivity of pickers by about 10%. This was due to the optimization of the storage point of each product. In addition, the width of routes (between the pallets and the shelves) was increased and this simple decision increased productivity. Pickers could now use bigger carts, and they could easily fit more products.

For about two months, the picking and packing process was attempted to run in one step. Although the productivity and performance improved, more mistakes in sending orders emerged, which led to complaints and returns. Therefore, this change was not adapted.

Hence, it is evident that the company never stopped searching for more advanced solutions to help the SC improve the picking process by increasing the served orders daily. The main requirements were:
- Reducing labor costs in covering the current working efficiency
- Updating efficiency in extending new business
- Optimizing the labor and equipment flexibility because of frequent order fluctuation
- Warehouse monitoring, analysis, and decision with digitization
- Optimizing inventory ratio
- Storage utilization and optimization

An ABC analysis was also performed for all the SKUs to distinguish products in the warehouse in terms of value and volume.

4.4 Inventories
Inventory includes raw materials, auxiliary materials, work in progress, and finished goods, aiming at the smooth SC operation. The following observations show the significant improvements in COFCO's SC:
- *Inventory value*: It is an indicator measured with the help of the ERP system at any point in time and as an average for a period. Inventory is the major asset of the SC throughout its length. Therefore, the continuous effort in COFCO is to reduce inventory without affecting customer service. This can be achieved by finding the perfect match between supply and demand. However, the problem is complex because of the turbulence surrounding the coffee market. COFCO tries to avoid excess inventory; the role of direct trade and the long-lasting relationships with suppliers is important and also helps the company to reduce risks and have win-win partnerships.
- *Inventory turnover*: This indicator measures the speed with which all the inventory is sold during a year. The higher the indicator, the better, but sometimes lower turnover is necessary to meet customer service and demand flexibility. For example, in COFCO, the ratio increased the last years from 5 (2017) to 6 (2020). It means that COFCO in 2020 replenished its inventory six times (every sixty days – two months).
- *Cash-to-cash cycle time*: It is a crucial indicator that shows the time a company pays its suppliers against the time it gets paid by its customers. The shorter this indicator is, the better, and companies often try to control this financial KPI because it affects the whole cash flow and is vital for the business. In COFCO, the company sells to its stores every week, and the central credit policy is that all the customers must pay for their previous order to place a new one. There are also credit limits that do not permit the stores to increase their balance. These policies help the company to have a low average collection time from customers, lower than seventeen days. On the other hand, the company pays its suppliers in about sixty-three days, and this difference is vital for the cash flow and the investments they want to make. For the last two years, a team runs sales and operations planning (S&OP) in COFCO. This continuous process helps the company to keep in balance the demand and supply of products. Every fifteen days (and sometimes every week), there is an extended pre-S&OP meeting with about ten people from different departments where they examine all the data they have. They share information about aggregate volumes, new products, product families, customer orders, supplies by preparing the monthly S&OP meeting where managers from these departments and the general management make final decisions. Their goal is to prevent and avoid any issues on the SCM, and their big challenge is to find the balance between stock rotation, customer availability, and satisfaction. The process leads the company to an approved sales and production plan. Then, the team decides the strategy for inventories, new product development and makes all the necessary adjustments based on metrics and KPI's. The existing software and all the new applications are the most significant assets for the whole team to have all the KPIs quickly and easily for each period and helps them to make their decisions, follow their strategic plan and succeed in goals. Finally, there are some more inventory management indicators which company started to measure and help COFCO to increase productivity and profitability.
- *Inventory accuracy*: It is significant for the company that the actual quantities of inventories are equal to the quantities from the systems' reports. The company has achieved almost 100% accuracy.

- *Damage inventory*: It is a metric which has clearly improved the last years due to new processes and software – equipment control and automation.
- *Slow-moving SKUs*: The last effort the SC team and S&OP has to do with the slow-moving SKUs. COFCO always had problems with these products, and there are actions in the last months to manage them most profitably and effectively. The total number of SKUs that the company managed in 2020 was 2,600; 1,800 of them were slow-moving. The inventory value of the slow-moving SKUs accounted for 46% of the inventory values (excluding green coffee). S&OP meetings are facing these numbers. The goal for December of 2021 is to reduce the value of slow-moving products by about 30%. Better mapping, information, motivation of all the departments, offers to COFCO stores are some of the actions, and the first results are encouraging.

4.5 Transportation and Last-Mile Delivery

Although COFCO closely oversees transportation from the farms to the production unit, it focuses on the last legs of the process, i.e. the delivery to the selling points. The aim is to deliver products to the correct location on time. Due to the large network and its dispersion, transportation is not easy for COFCO. The company does not have its own fleet and has cooperation with many carriers and partner agencies. In the last two years, there is an effort to use less but certified and tested partners.

In the ERP system, there are all the details for suppliers and customers. Each customer (COFCO store) has its carrier and agency that serves it. Each day of the week, the warehouse ships to different areas, and there is a strict schedule for this. Some places far away from the capitals of prefectures are served with transshipments, which are generally avoided in order to reduce damages or product losses. COFCO stores bear the transportation costs. The cost is automatically added when an order is placed, and the final amount has to do with the place of the store and the transported volume.

If there is a problem in the transportation or returns, the store communicates with the Customer Service department and solves any issue immediately. The new B2B platform will have features that will improve the transportation process: the partner franchisees will know the status of their orders in real time with the use of a tracking system. Moreover, when they receive their order, they will know what to expect in terms of boxes or pallets, and they will confirm delivery on the mobile app. The acquisition of privately owned trucks or the use of more warehouses in Athens or Northern Greece is a problem that concerns the company. Many executives in COFCO believe that it could be a very profitable and efficient investment for the company, and this project may run in the following years.

The final part is about the delivery process from the COFCO store to the final consumers. It is the last-mile delivery process, and it is function of the SC that affects end-customer satisfaction. Customers expect their orders on time (quickly) and with the products in excellent condition. They also expect high levels of product availability, and they are susceptible to errors. The competition in delivery in the coffee market is big, and each store must meet customer expectations.

COFCO makes efforts to train all the SC partners that are involved in the delivery process. In the last two and a half years, the company developed a private training platform with lessons and seminars for delivery and best practices (among other topics). They also run campaigns to improve the delivery employees in the whole network. For example, they wear official clothes, they learn sales techniques and at the same time they are trained to be polite and patient with all the customers. In addition, they learn to drive safely and obey traffic rules.

The e-commerce department of the company is trying to improve the web and mobile app ordering platform. They analyze the orders and the time between the receiving, preparation, and delivery and seek to improve any weaknesses. Consumers also know their order status, and they can cancel or do a review anytime they want.

5. Conclusions

Nowadays, companies must make their SC more resilient without weakening their competitiveness. In order to achieve this, managers must first understand their vulnerabilities and consider a roadmap to fix and address them. At the same time, the business environment in Greece and globally is more competitive than ever, and consumers are more demanding by looking for great experiences in products and services. Moreover, every day our world and people are digitally transformed, and change and the companies must follow to survive. One of the most vital functions that must change is the SC.

In COFCO, they know that they must improve and optimize all the SC processes. Therefore, they decided to balance to a lean SC model that will reduce costs and increase productivity and quality. At the same time an agile approach allows high customer satisfaction.

The findings and the recorded improvement in several of the SC processes in COFCO are impressive. The results indicate that the inclusion of new software systems is changing the SC and the whole organization.

A specific team from both financial and commercial departments supervises the green coffee market, the prices, exchange rates and tries to find opportunities and avoid risks. In 2020 the purchases of green coffee were more than 70% of total purchases and more than half the organization's expenses. The good financial indicators lead to easier access to loans, if necessary.

The storage capacity increased about 10% by using the software systems and different types of shelves. At the same time, the production unit and the warehouse know with accuracy the inventories (in all the phases); they know where they are stored and which lot they have. Moreover, they are all labeled, and traceability is facilitated. All the production processes are automatic and fully controlled by the system. Foremen know exactly the production program, and they attend all the scheduled operations. At the same time, all employees know what they have to do, and effective monitoring and control increase productivity and profitability.

The approach to maintenance helped COFCO reduce by about 15% the failures and issues in all the machines and equipment the last semester. This fact increased many KPIs that affect productivity and availability. Moreover, the labor costs are reduced, the time is used more efficiently, and predictive maintenance will increase equipment life.

The ordering process from the stores is fully automated, with no errors on quantities or prices. The B2B e-shop redesign will increase like-for-like sales and customer satisfaction. Picking and packing processes improved, are automated, and pickers recorded about a 10% increase in productivity in 2020.

With respect to transportation, COFCO designs new features that will increase customer satisfaction. Last mile is one of the most vital functions in SC and affects customer satisfaction and loyalty a lot. During the last year and a half, the development is continuous, along with the growth of e-commerce and delivery. Nowadays, delivery accounts more than 35% of the total income of a COFCO store. The whole organization (COFCO company and the stores) knows and understands how critical it is to deliver a product on time. Many investments are going to improve this function, and new automations are developing for the service. However, in the retail coffee section, where the average delivery receipt is lower than 4.5€, the profitability of delivery is complex and vital.

All the processes of SC from the farm to the final consumer are built around customer satisfaction. COFCO has excellent and efficient ticketing and CRM system that helps record all the issues, information, and complaints about suppliers, stores, and consumers. The valuable data helps the company discover its deficiencies and deal with them. Thus, the SC is improved, and all the relevant satisfaction indicators are better than before, which is also reflected in the reviews of final consumers. Fewer quality issues, reduced deficit orders and returns, zero backorders, and no delivery complaints are some examples for COFCO stores.

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