Impact of Industrial Revolution 4.0 on Textile Supply Chain Management in Vietnam

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Abstract:
The objective of the article is to assess the actual impact of the industrial revolution 4.0 on the supply chain management of the textile and garment industry in Vietnam. Through assessing the actual impact of supply chain management on Vietnam’s textile and garment industry, the author proposes recommended solutions to help Vietnamese textile and garment enterprises improve the efficiency of supply chain management.

Keyword: Industrial Revolution 4.0, supply chain management, textile, Vietnam

1. Introduction

In the process of creating and developing every organization, supply is always an indispensable activity. As society develops, supply increasingly asserts its important role. Now in the process of integration and globalization of the world economy, increasingly fierce competition to compete successfully in such a volatile environment requires businesses to participate by building a complete supply chain for their own. Developing a complete supply chain will create a foundation for businesses to save unnecessary costs, improve added value for products, and increase product competitiveness with competitors. In addition, it also helps the domestic industry to join the global production supply chain and develop the worldwide consumption market. This requires businesses to pay close attention to the entire flow of materials, how the supplier designs and packages the products and services, how the finished product is transported and preserved, and what the customer does. demand, especially with the growing garment industry today.

So what do businesses in the textile industry have to do to build a supply chain that meets the needs of the market?

2. Context of Vietnamese textile and garment enterprises

- Vietnam's textile and garment industry is the industry with the second largest export turnover in the country, export turnover in 2018 reached 35 billion USD, average growth CAGR 12% in the period 2011-2018. 80%), because the garment industry is a labor-intensive industry, it will gradually shift to countries with abundant labor force and low production costs.

- Vietnam's textile and garment industry is mainly a processing industry (CMT, FOB level 1) making the export value, although very large, the profit low due to the low profit margin of the processing segment.

- The major problem of the industry is the imbalance of supply and demand in the value chain. The yarn segment is exported, but the garment segment has to import fabric, because the textile and dyeing segment in Vietnam has not been developed, making it unable to control raw materials.

- The ongoing US-China trade war offers an opportunity to shift orders from China to Vietnam: Vietnamese textiles and garments rank second in import market share in the US, just behind China. Therefore, Vietnam's textile and garment industry is expected to benefit from the shift in orders when Chinese textiles and garments are subject to 25% tax. From 2014-2018, China's export market share in the US market showed signs of decreasing gradually, the market share of Vietnam's textile and garment increased from 9% to 13% and continued to maintain a high growth rate. and stable.

- Vietnam and Bangladesh will have great advantages thanks to cheap labor costs and strong production capacity. Bangladesh is mostly orders with high volume, simple technical requirements and low labor conditions.
- In the medium and long term, Vietnam will continue to benefit from the wave of shifting garment production out of China to neighboring countries. However, in the long term, it is necessary to have a solution to go deeper into the value chain (ODM, OEM), the cost advantages of Vietnam will gradually disappear and face great competitive pressure from countries like Cambodia, Bangladesh, or even garment FDI enterprises themselves move from China to take advantage of tax incentives.

3. Assessing the impact of Industry 4.0 on the automation level of equipment and technology in the textile industry

For industrial enterprises in general and textile enterprises in particular, the first impact of Industry 4.0 on the production process is the ability to automate and digitize stages in the transformation of input factors, input into outputs. New technologies in the textile production process are divided into two main groups: Group 1 is the automation of stages in the production process and transportation system and group 2 is the management, tracking, and connection system. Factory data online. When both these groups reach the highest level and integrate with each other will help form smart factories.

a. Assess the impact of Industry 4.0 on the automation level of the Yarn industry

* Impact of Industry 4.0 on the degree of automation of yarn quality control

The stage of product quality control in the yarn factory is also a stage strongly influenced by Industry 4.0, which is reflected in the fact that Industry 4.0 has positively impacted on the quality control automation equipment system to help businesses communicate with each other. Continuously updating the quality of finished products and semi-finished products on the line, easily comparing the quality of production shifts to assess the capacity and quality of labor.

The online factory data monitoring and management system is a system consisting of a server and many computers installed with specialized software that uses an internal network to continuously collect and monitor the quality of transportation, operation of the yarn machine through the sensor system and built-in electronic devices on the machine. The system can warn and detect quality problems early for the whole factory or separately for each machine to have a solution. The system can be connected to the ERP system of the whole company. Usually the system is provided and integrated on machinery and equipment by specific manufacturers that Vietnamese textile enterprises can approach for investment such as: Savio BMSvision with Spin Master system, Rieter with Spin Master system. SpiderWEB system…

For enterprises producing high-quality yarn, the ability to invest in an automation system for quality control of the line is to improve their competitiveness. Good production capacity, good scientific and technological infrastructure in quality management. This advantage also helps businesses find customers with large and long-term orders.

In addition, under the impact of Industry 4.0, Vietnamese yarn enterprises also face many difficulties when they want to invest in improving the level of automation in yarn quality control due to the automated infrastructure system of control equipment. quality control requires a high capital cost; The equipment infrastructure at the quality control stages must be digitized, data must be connected to the internet and connected to a server, so it also requires businesses to have good information technology infrastructure.

Another impact on Vietnamese yarn enterprises is the monopoly on technology: currently there is only one firm in the world capable of providing a fully automatic quality control system in that yarn manufacturing industry. is the company Uster - Switzerland. The company has all quality control machinery and equipment from raw cotton, to semi-finished products and finished products. To be able to connect to a fully automatic system, it is necessary to purchase all Uster's experimental equipment and use its software to operate the system. Technology monopoly often causes impacts that are difficult to overcome such as high cost of spare parts, often long troubleshooting time...
* Impact of Industry 4.0 on the degree of automation of the Equipment in the spinning line

Under the impact of Industry 4.0, production equipment on spinning lines will tend to be digitized and upgraded to a more automatic control system. The automation control technology of the equipment in the Yarn factory over the past time has actually focused on areas that use a lot of labor such as: changing yarns, dropping yarns, picking and tearing cotton.. etc

Automation of devices is the premise of building IoT connectivity in the Yarn factory. New equipment invested since 2017 until now most of them have an Internet connection port, just need to have a network connection to the server and the company's software to be able to monitor output data and closing time. computer, problem... on the computer. Along with the advances of current internet technology, all machines can directly connect to mobile phones through 3rd party software such as Teamviewer, Ultraview... Can monitor effectively production on a remote line and contact directly to tailor the technology to the operator's discretion.

Although there are many positive effects as above, the investment in the direction of Industry 4.0 also makes the investment cost of yarn equipment increase, equipment depreciation is large, operating costs are high, and the invisible wear and tear of equipment Previously invested capital has increased, causing many difficulties for mainly small and medium enterprises in Vietnam. In addition, most PLC automatic control devices, software programs, if there is a problem, must be replaced with genuine products for good and stable operation, which can lead to faulty systems. As a result of extended maintenance time, maintenance costs increase.

Another negative impact of Industry 4.0 on automation in the yarn industry is that there is no comprehensive link between equipment suppliers because yarn machine manufacturers all use their own programmed software. Therefore, equipment of different manufacturers cannot yet connect to each other to form a common control network in the yarn factory. This limitation in the future has not been solved because most of the companies in the world keep the technology secret and have not let the systems of different firms interfere with each other's systems. The current solution for the unified operation of the whole yarn factory is to use only one company's equipment, which easily leads to the disadvantages of equipment exclusivity as mentioned above.

* Impact of Industry 4.0 on automatic transportation system:

Under the influence of CNCN 4.0, it has helped to form ways of transporting cans, transporting combed slivers automatically. This is an unprecedented and breakthrough solution to save more labor in the near future, reduce the burden on workers, and improve labor productivity.

Under the influence of Industry 4.0, the automation process of the Yarn factory has achieved the following steps: The system for transporting the cores and spools of yarn from the raw machine to the machine and the conveying system of the combed spools from the machine. slivers to combers with a fairly high degree of automation; the can transport system is being developed and perfected; The system for transporting the bundles from the winding machine to the warehouse and palletizing as well as the automatic baling system has been developed in the world and is having a positive impact on the large yarn enterprises in Vietnam.

* Impact of Industry 4.0 on the status of equipment and technology of the fiber industry

Automatic sensor technology increases the safety of equipment in production at Vietnamese yarn enterprises that have invested in advanced equipment. Through the survey, it can be seen that for the area of the carding machine (the forerunner of Yarn production), the area where the working needles exchange fibers, the technology of Trutzschler (Germany) has been equipped in the combing area (the length of the brush). cup size 1/1000 inch - very small) has metal collision warning sensor systems so that when the combing needles tend to be close together, there will be a danger warning and the comber's operating system will recommend stopping the machine.
Inverter technology makes the control of the dynamics of the working areas on the device almost absolute (accurate to milliseconds (ms)), which increases the stability of the quality of the zones. forward areas such as draw frames, roughing machines (areas with parts for lengthening and leveling slivers)

Operating systems of machines are programmed on popular computer operating systems such as Windows 7 to simplify, simplify, easily replace, restore technology, this is very beneficial when it can be overcome. quickly when something goes wrong. If the machine had a power failure before, the operating system had a problem, the information stored in the technology may be lost, the machine may stop for 1-2 days to wait for the expert to come to handle it, now only It only takes a few minutes for simple operation, programs are copied by USB and can be restarted very quickly, which helps to keep production smoothly, reduce closing time, and stable production line. more determined. For example, the Rieter G32 spool, Toyota RX300, Savio, Murata spool machine all have these features.

Ultra-small camera and sensor technology keeps quality control under control and increases efficiency as micro-sensors and cameras housed in extraneous fiber scrubbers (cotton area), Uster filter cutters Uster lab machine.

B. Assessing the impact of Industry 4.0 on the automation level of the textile industry

* Impact of Industry 4.0 on the degree of automation of equipment on woven fabric production lines

Textile machine manufacturers have always been at the forefront of integrating information technology in textile production through the use of CAD, two-way communication and artificial intelligence. With existing looms: electronic dobby and jacquard heads, self-stop at yarn break and weft self-selection, etc ... can all easily be integrated into the computer network of any manufacturing plant. . The automatic process can control all the functions (1) Stopping the machine at weft break (2) Positioning the warp break and (3) Controlling the loom through a computer. The process of replacing the weaving shaft and correcting the weft error when stopping the current machine still requires the operator's operation.

The goal of Textile mills is to achieve maximum efficiency and productivity for each fabric parameter and machine configuration. The loom data acquisition and tracking system meets these requirements. The system consists of 5 main parts in structure with wired and wireless communication. The system can be used to control one or more machines.

However, for Vietnam's textile industry today, the automation process is still at a very limited level, and most of the weaving machines and auxiliary equipment in the factory are still separate operating devices that have not yet been used. connection, this is the point that is greatly affected under the impacts of the achievements of Industry 4.0 on the domestic textile industry alone.

* Impact of Industry 4.0 on the textile product quality control system

In the world, the application of digital image recognition and processing technology has begun to be applied in fabric inspection, it helps to detect errors accurately, increase productivity; collect and store data into the system; reduce the waste of raw materials for the sewing process; reduce manual labor. Currently, in Vietnam's Textile industry, most of the finished fabrics and finished fabrics are checked by the naked eye of workers at the KCS stage or in other words, most of the defects in the finished fabric are not detected due to the owner's fault. authority of the fabric inspector. The fabric checker must be aware of defects on the entire roll surface of the fabric that is run through the testing machine at high speed, so the error rate is about 70% when checking manually. Besides, the error identification rate also decreases at the end of each shift because the workers' psychology at the end of the day has begun to get tired and the work is also quite boring.

Under the impact of Industry 4.0, digital image recognition and processing technology began to be applied in fabric inspection, which helped reduce waste through early detection of defects on fabrics, contributing to increased productivity and quality. at the following stages; synthesize and compare manual and automatic fabric
checking processes by machine; reducing production waste in the Sewing stage due to the increased quality of raw materials.

* Impact of Industry 4.0 on the degree of automation in calculation and product design at textile factories

Calculating product design is the first stage where creating the brainchild in the textile factory brings value to customers. Modern loom manufacturers have produced next-generation looms that can design weaves right on the machine, which can be linked to each other and through professional fabric design software. From the data collected from the customer, from the loom, from the designer's idea that fabric samples can be quickly created and updated to all the design, production, marketing, business at the same time. The number of samples created on the basis of big data, rich variety, regularly updated, can form fashion trends are the key points that automation in calculation and design of textile products results. with the appropriate management model and modern machinery and equipment can bring to a factory if there is a basis for synchronous application.

c- Assess the impact of Industry 4.0 on the automation level of the Dyeing industry

Under the impact of Industry 4.0, smart laboratories are always equipped with barcode systems, color measurement and matching computers, storage and search systems for color samples, dyes, chemicals, weighing machines, Automated dye and chemical mixing, preparation and transport, automated laboratory dyeing machines. The factory is always equipped with a system of weighing dyes, soluble chemicals and automatically transporting them to dyeing machines, dryers, and equipment for testing fabric and color quality.

In the dyeing stage, the achievements of industry 4.0 are also strongly applied, typically the formation of a smart dyeing factory. The smart dye factory represents a leap from traditional automation to a fully connected and flexible system that can utilize a continuous stream of data from related production operations and systems to learn and adapt to new requirements. With traditional automated factories, automation only takes place in single devices, centralized monitoring and one-way communication. In smart factories, thanks to the availability of sensor technologies, CPS, IoT, big data, it is possible to digitize technological devices and processes, collect and manage data, perform implements two-way machine-to-machine (M2M) and human-to-machine communication, which can improve productivity, reduce costs, reduce resources, and reduce waste loads.

The roadmap for smart factory development in the dyeing sector starts with the automation of single steps of the dyeing process between 1990 and 2005, moving through to the automation of both dyeing and integrated management. system integration. This is followed by the development of an expert staining system that enables the selection of materials, optimization of the dyeing process, finishing, performing fault analysis and recommending optimal treatment solutions. Since 2016, with the availability of CPS, IoT, big data systems, a smart dye factory model has been proposed, tested and developed.

An ideal smart dyeing factory, including an integrated dyeing system, two-way communication between modules, including: smart dyeing laboratory; smart factory; Smart logistics system.

In the dyeing and finishing stages, besides the application of robots and high automation in the production process as mentioned above, the dyeing industry also has a fundamental change in the process of making color formulas and controlling the process. dyeing using big data. With this method, dyeing factories can organize the storage of good quality and successful past dyeing recipes from which to create new dyeing formulas with high accuracy and good quality for the process. The process of using, helps dyeing factory to improve dyeing accuracy at the first time up to 95-99%.

Thus, under the influence of Industry 4.0, the development trend of the dyeing industry is to build smart dyeing factories, thereby helping businesses reduce production costs, especially labor and treatment costs. environment...to gain greater benefits by better meeting customer requirements.

d- Assessing the impact of Industry 4.0 on the automation level of the garment industry
* Impact of Industry 4.0 on the degree of automation of equipment in the garment production line

Under the impact of Industry 4.0, equipment on the sewing line is not only ordinary automation devices, but also must ensure the ability to collect and transmit data, and connect to regular production management systems throughout the chain.

In the field of spreading and cutting: Currently, Vietnamese garment enterprises only use semi-automatic spreading and cutting machines, some types of plaid or special fabrics cannot apply these devices. Meanwhile, the current generation of advanced spreading/cutting machines has used software solutions to manage the cutting process. These software allow communication between personnel and cutting equipment. This is one of the clear applications of the achievements of Industry 4.0, providing the ideal solution for planning and managing the process of spreading, cutting and peeling. The real-time monitoring system allows instant decisions in critical situations such as in the event of a fabric defect, a roll of fabric that does not conform to requirements, or an alert if there is any discrepancy between the products. what was planned and actually implemented. In addition, equipment manufacturers have also used bar code or RFID technology in numbering product bundles after cutting, making management on the sewing line later simpler and more efficient.

For sewing equipment on the line, many Vietnamese enterprises have used programming equipment or some semi-automatic equipment to sew difficult or labor-intensive stages. However, these devices are not yet digital devices and cannot be connected in the management system. Currently, in the world, sewing equipment manufacturers are ready to enter a new era with an almost completely digitized sewing machine system. In the past, sewing devices were mainly adjusted to the sewing mode by the user, based on personal experience. Now, with the new generation of sewing machines, these adjustments have been digitized. The sewing mode setting is set automatically with perfect precision, to perfectly match the types of materials to be sewn; The sewing machine even has the ability to automatically adjust the sewing mode to ensure the best possible stitch quality. At the same time, companies also use IoT in managing sewing equipment. The App is developed according to the machine to be able to manage, browse and edit data (including equipment data and data on productivity and quality at sewing position) through mobile devices, connecting connected to the sewing machine via the USB ports. In particular, these devices can completely connect with older generation sewing equipment, but will be limited in some options.

Following such a device development trend, it can be seen that the digitization of equipment is a prerequisite for successful application of Industry 4.0 in production, as it facilitates data collection and connection with Real-time management system. With the current situation that the garment industry is mainly individual devices, the collection and processing of data is still limited, leading to difficulties in applying management tools in the direction of Industry 4.0.

However, in fact, some garment enterprises in Vietnam are still implementing a temporary solution by manually entering the production data into the management software system. Although this method does not help with real-time administration, it also partly supports the collection and analysis of data to provide timely solutions in production.

In the long term, to invest in the direction of Industry 4.0, businesses need to invest in comprehensive digital equipment or digitize existing equipment by installing more suitable connection tools.

Under the influence of Industry 4.0, many software manufacturers have developed digitally designed products to meet the specific needs of their customers, such as the current “Fashion on demand by Lectra” software. Available in two packages, one for tailoring and the other for custom manufacturing, a solution to automate on-demand production right from order receipt to development stages, product and cutting room. This is a living proof of the impact of Industrial Revolution 4.0 on textile production and business. Connecting the digital platform to the cloud data center, it connects the product design and development department, the cutting room and a brand new modern cutting machine remotely.

http://www.ijmsbr.com/
Besides, 3D technology has helped designers shorten the time in drawing up samples, instead of taking 2-3 weeks, now it only takes a few hours, meeting the requirements of the current fast fashion trend. According to the traditional process, it takes 30 - 50 weeks from the time of sketching until the customer approves the final sample, if 3D technology is applied, it only takes 5 - 9 weeks, thanks to the editing operations can do right away so it doesn't take much time

* Impact of Industry 4.0 on the degree of automation between stages

Due to the impact of Industry 4.0, RFID and robotic technologies are used to manage and perform transportation operations on the sewing line. The entire chain of raw materials, semi-finished products and finished products is managed by RFID tags, so that when it needs to be transported, the robot can accurately identify the type of goods, using the robotic arms and the tape chain to pick up and transport to the required location. Conveying on the line is mainly applied by hanging or conveyor belt with induction technology, which helps to accurately identify which type of semi-finished product needs to be moved to which working position.

Currently, Vietnamese businesses only use RFID attached to final products to manage products according to customer requirements. To proceed to operate the automatic transportation system between stages, it is necessary to invest in the application of RFID and sensor technology at each working location, for each type of material/semi-finished product and finished product.

4. Strategy and development of Vietnam's textile and garment industry in the period of 2020-2030 in the context of Industry 4.0

In the context that the 4th industrial revolution is increasingly affecting all links in the supply chain along with competitive advantages at low prices, it is increasingly being eliminated as an inevitable and necessary process. Restructuring and establishing an appropriate development strategy for Vietnam's textile and garment industry for sustainable development in the period 2020-2030. The outlook for industry development in the coming period is:

- Develop Vietnam's textile and garment industry in line with the national socio-economic development orientation; with the Master Plan on Development of Vietnam's Industry to 2020, a Vision to 2030 and related plans, associated with sustainable development, international economic integration, and the Fourth Industrial Revolution;

- Take advantage of the power of Industry 4.0 to develop.

- Stable and sustainable growth, associated with improving social responsibility, promoting the development of green production.

- Attracting all resources from all economic sectors to invest in developing the textile industry. Encourage the development of supporting industry products, production of raw materials and auxiliary materials in order to increase the added value of products; Strengthen research and development (R&D) activities.

In order to meet the above development strategy, investment in technology development needs to comply with the orientation of not investing at all costs, but taking into account investment efficiency. In the context of Industry 4.0, the investment orientation of textile and garment enterprises is towards:

- To develop the textile industry in the direction of specialization, modernization and environmental friendliness; green clean & sustainable;

- Focus on in-depth investment, replacing old and outdated technological equipment, consuming a lot of energy and a lot of human resources;

- Sustainable and effective development on the basis of modern technology, quality management system, labor management, environmental management according to international standards;
- To selectively attract foreign investment, giving priority to investment projects in advanced textile dyeing technology, which have little negative impact on the environment; connecting with domestic garment enterprises, forming a chain of links throughout the value chain.

- Gradually develop high-value products such as medical and textile products for health care, products for industrial engineering, transportation, agriculture, forestry and fishery, smart textile products, etc.

- Sustainable and effective development on the basis of modern technology, quality management system, labor management, environmental management according to international standards;

- Building and forming a database, sharing information on raw materials and auxiliary materials for timely supply and exchange of raw materials and auxiliary materials for textile and garment enterprises; Developing a scientific and technological data system for Vietnam's textile and garment industry;

- Develop and quickly implement the program to digitize the textile and garment industry in Vietnam;

- Standardization of national technical standards and regulations for Vietnam's textile and garment industry in harmony with international and regional standards; Focus on building product standards such as: barcodes, product stamps to combat counterfeiting, counterfeiting, and smuggled goods;

- To encourage textile and garment enterprises to invest in scientific research and apply advanced technology to production; purchase advanced technology and equipment from developed countries, receive technology transfer from leading companies in the world;

- Developing software solutions, researching to connect and synchronize devices of different brands in the same textile production line (software for connection and communication between devices belonging to different manufacturers). different);

- Research and develop TPM predictive maintenance system in the textile industry;

- Research and development of management software for textile factories;

- Research, calculate, build models of smart textile factories;

- Developing fashion industry, gradually building a sustainable fashion market, building centers for fashion design, textile design, product promotion and introduction; The fashion industry develops towards serving domestic needs, tourists, and towards export;

- To selectively attract foreign investment, giving priority to investment projects in advanced textile dyeing technology, which have little negative impact on the environment; connecting with domestic garment enterprises, forming a chain of links throughout the value chain.

Conclude

Vietnam's textile and garment industry is making rapid strides in the Fourth Industrial Revolution to take advantage and improve competitiveness in the 2020-2030 period. In that context, it is essential to recognize and evaluate the current situation as well as propose strategic directions, policies and solutions for industry technology development in the period of 2020-2030.

REFERENCES


x. ICTROI. (2015). Where are Vietnamese garment companies in the global value chain?