THE DETERMINATION OF UTILIZATION LEVELS OF INDUSTRIAL 4.0 TECHNOLOGIES
A REVIEW ON GARMENT ENTERPRISES OPERATING IN TRABZON

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Abstract: The enterprises in today’s competition environment should obtain and use the technological production systems, qualified, and proper information media that industry 4.0 conditions necessitate. Because a new rival firm may start to use smart factory technology in every new day. In this research, some of the ready-made enterprises in Trabzon were examined by semi-structured face to face interview and natural observation techniques to determine the utilization levels of industrial 4.0 technologies. Besides, this research made suggestions for those enterprises about the innovations that can perform in the future. In conclusion, it can be understood that whether the enterprises reviewed have the operation and employee structure to use the smart factory system. The enterprises need to apply the lean production necessities into internal processes by vertical integration; afterward, the same enterprises need to apply the agile manufacturing strategies in the external processes by the horizontal integration to start to use industry 4.0.

Keywords: LEAN PRODUCTION, AGILE PRODUCTION, HYBRID PRODUCTION, SUPPLY CHAIN MANAGEMENT, APPAREL INDUSTRY

1. Introduction

Production of textiles in Anatolia has almost a 3,000 years of history. After the silk and spice roads lost their significance and being used the cheap Chinese and Indian products by westerlies (Yüzel, 2010: 230), the products with high amount and low standard were started to be produced by the Far East, the products with small amount and high quality were started to be produced by the immediate circles. Textiles have grown in importance in the world trade and economy by improving the technology that is used in producing of the products whose raw material is the textiles.

Textiles and garment products constitute almost 6% of the world trade. While the developed countries benefited more from this trade, the developing countries have been superior today due to cheap labor, technology and energy costs (Erkan, 2013: 94).

Fast moving technology has increased the global competition and caused difficulties in satisfying the customer. Variety of products has increased; length of life has shortened; the number of orders and production parties has decreased (Apilioğulları, 2018: 89). Turkish textile and clothing sector has affected from this change and dispersed with producing products with high amounts, standard quality, and low costs. On the contrary, they started to produce multialternative products and deliver in short time as much as possible to remain in trade (Firat and Ceyhan, 2015: 145).

Industry history can be divided into parts as industry 1.0, industry 2.0, industry 3.0, and industry 4.0 (Fig. 1); this circumstance caused the concept of agile production (Industry 4) to be developed. The variety in the customer demands that created the need for agile production brought serious conditions of competition and caused the concept of mass customization to emerge (Thilak et al., 2015: 1).

2. Lean, Agile and Hybrid Production Strategies

The lean system can be defined as removing the efforts that do not create a value in the period from ordering to distributing (Vincenti, 2002: 58). Value is described as the monetary value that is attributed to characteristics and components that need to be in a product. Accordingly, adding product specifications in a product that the customer does not like to pay is the waste of time and source (Moven and Hansen 2010: 728). In other words, it should be focused on the features that add value to the product and resources should be allocated; other factors as the waste need to be removed. While the companies which adopt lean production focus on the activities that do not add value in the production process, other companies deal with revenue (Apilioğulları, 2018).

The activities that add value and do not value are determined by creating a flow map. However, while some of the activities that do not add value can be eliminated by small arrangements, short-term arrangements are not sufficient some of the activities. Continuously eliminating non-value adding activities is called as kaizen technique in the literature (Apilioğulları, 2016: 80). Some of non-value adding activities cannot be removed in a short time because of the unsuitability of the production method and available technology (Hansen and Moven, 2010: 728). Labor quality and social culture constitute a significant topic among the factors that cannot be obtained and removes in a short time. Because, while the technology can be renewed in one or two years, being renewed the human factor can take long years. For this reason, the person is the most important value if he is qualified. Decisions in lean production need to be made by thinking deeply; however, the decisions should be rapidly applied. Speed means being agile and flexible (Apilioğulları, 2018).

Agile production was created to rapidly meet the pluriformity in customer demands (Vinodh et al., 2009: 6941). Agile production and lean production are the systems that established based on performance and mobility. However, the performance mentality of agile production is at an advanced level (Narasimhan et al., 2006: 441). This superiority provides agile production to be at the top of the agenda by increasing the diversity of customer demands.

Agile production is not only effectively and rapidly meeting the customer demands, but also includes proactive evaluating the
possible market opportunities (Brown and Bessant: 2003: 707; Al Samman: 2014: 1094)

Agile manufacturing is a production and supply system that is equipped by extraordinary competencies to meet the rapidly changing needs of the market in terms of flexibility, customers, competitors, suppliers, substructure, and responsiveness. The chief goal of this system is to answer the customer requests in minimum duration by rapidly reacting due to the available flexibility between the product models or the production lines (Yusuf et al., 1999: 36).

To be able to make customized production in serial production performance has brought speed and flexibility to the supply chain concept by the digital era (industry 4.0). If the agility is solely accepted as speed, it cannot be understood in real terms. Because agility is a system that necessitates fundamental structural changes including digital technology use that will provide the flexibility. While the agility means reaction quality, flexibility is a concept that means versatility that cases harmonizing. In other words, flexibility is the ability of a company to change a current project with another one in a short time or to shift it to other areas (Gizel, 2013: 184). Flexibility and speed necessitate transparent and reliable collaborations that will provide all the participators move together in the process in which the supply chain reaches ultimate customer from the point where the components of product arise.

Industry 3.0 should follow industry 4.0 during the transition process. Namely, first of all, the lean production requirements of 3.0 industry needs to be met; afterward, industry 4.0 should be materialized with significant changes in means of production and communication technologies by the investments. A number of technologies, computer-aided systems and methodologies need to be learned and utilized in the evolving process of the manufacturing enterprises to production agility (Tolüsiene and Mankutė, 2013: 723).

There are two stages in the application of Industry 4.0 system (see Fig. 2). After being completed these stages, the smart factory system is materialized in the enterprise.

Much as the agile production system is expressed as the final point of industrial 4.0 production system, it is not true to adopt only one strategy in the companies. A single strategy is not in accord with all the company structures. Therefore the hybrid strategies (using lean and agile strategies together) ought to be used. There are three different ways of using hybrid production strategies. I. classification of products at 80% to 20% (Pareto curve approach) according to their quantity and quality; II. the approach of adopting lean production strategies in the production process till the decoupling point; afterward, adopting agile strategies after this stage; III. using lean strategies in the normal flow of the products; however, using the external source in immediate changes in demand (Apilioğulları, 2017: 30-34; Al Samman; 2014: 94-95). Production structure, the area of activity, region, economic conditions determine the production strategy which the enterprise should adopt. In this research, the conditions above were considered when the production strategies of the enterprises that were subjected to this study were determined.

3. Purpose and Scope of the Research

Three companies that were subjected to this research are as follows; the company which perform contract manufacturing on outerwear for Turkey (Company I); the company which perform contract manufacturing on ladies’ top clothing (Company II); the company that both perform contract manufacturing at certain times and make production and sale to the customers Turkey-wide by its own brand (Company III).

Kasap and Peker (2009) conducted studies on automotive companies; Fırat and Ceyhan (2015) conducted studies on a textile company; Kleszcz (2018) analyzed on the employees in a ceramic factory; Kumar et al., (2015) performed surveys on the simplicity and agility in the aviation sector. Accordingly, it is possible to research on a limited number of samples instead of a large number of studies for the qualitative surveys. Therefore, three garment enterprises which make production under different conditions and can reflect the general profile of Trabzon Province were received for consideration. The purpose of this research was to make suggestions about the strategies which make them more competitive and profitable by determining related companies’ utilization level of industry 4.0.

Two studies were considered at the idea point of this research. One of these studies was conducted by Rachel et al., (2000). They explained lean, agile and lean-agile strategies which are proper for the product and market structure of the companies with the help of the examples about companies that are in service in different sectors. With reference to their expressions, lean production should be used in mechanical products; agile production should be utilized in carpet production; lean-agile production and supply chain system ought to be used in the electronic product. Brice et al., (2004) conducted a survey on textile and garment companies which make production in different fields (1-high fashion products, 2-fabric products; 3- sports accessory design and 4-brand products) and sale in England. They pointed out at the end of the investigation that 1, 3 and 4 numbered companies are suitable for lean-agile; 2 numbered companies are suitable for lean production and supply chain systems.

However, the companies that compete with such efficient market factors are few in number in Trabzon. Thus, revealing how the companies in Trabzon should act and discussing the situation from different perspectives will bring a larger point of view to the literature. In this direction, we evaluated the enterprises as the garment companies which can do business for the region in Trabzon province and other regions (country-wide and/or Europe).

4. Method of the Research

Taylor (2005) defined qualitative research as the method that is used to reveal the theory behind the facts by observing the facts in their natural environments. These methods and techniques that are used more in numerical sciences, in the beginning, are now used as a flexible and low-cost method to discover the attitudes, experiences, and reactions of non-random samples obedient to a specific profile in social sciences as well (Sofaer, 2002: 330). Natural observation techniques and semi-structured face to face interview from the qualitative research models were utilized in this research to determine the utilization level of Industrial 4.0 technologies and explore the reasons behind the use at the same time.

According to Törnqvist and Fross (2018), the information from the general to the specific is tested and the new and unexplored information is obtained by working on a limited number of observations to make an in-depth analysis in qualitative studies. The current situation was specified in three enterprises in Trabzon by
determining their utilization level of industrial 4.0 technologies; suggestions were made for these companies to be more competitive in the future.

The questions in a semi-structured face to face interview method were collected from the studies in the literature. The reason for using semi-structured face to face interview method is to enable business owners and directors who conceptually do not know the strategical cost methods to express themselves easily by canalizing them into the issue. The interview results obtained were supported by the natural observations performed in the work environments of the enterprises.

5. Results of Discussion

It can be said that both three enterprises have made an effort to fulfill the requirements of Industry 4.0; however, the concepts of lean, agile and hybrid production are not known technically in these enterprises. Moreover, the garment companies that are generally small and medium-sized enterprises are managed based on family business structure. We can also express that they have the potentials to reach remarkable activity and production performance in case of taking professional support.

The questions toward to determine the losses in production as a percentage, size of the party, product range and the qualification of the employees were asked during the semi-structured interviews. Besides, the questions endeavored to find whether the technological equipment and software such as computer-aided design (CAD), computer-aided manufacturing (CAM), material requirements planning (MRP), and computerized production planning (PPS) have been used.

The improvements in companies are limited to the economic power of the companies. In other words, the enterprises renew the technology in direct proportion to their available capital. However, they will not be able to keep up with the digital age as long as to fail at developing the human factor. So, the enterprises should make an effort as immediate as possible to renew the human factor that is pretty hard to be developed.

The company I needs lean production techniques because of a few numbers of product range; making contact manufacturing based on the order; the losses that exceed 40% in the manufacturing process; poor competence ratio of the employees. Company II should start to use agile production system due to the reasons that lean production system requirements have been applied in the intrabusiness processes; having a sufficient experience on exportation and also a sufficient number of qualified manpower; having an export realization plan under its own brand besides the available business segment. Company III should focus on being lean in internal processes and also being agile in the external affairs by adopting hybrid production strategy. The reason is that Company III can market the products that it produced under its own brand; Company III can use external source within the scope of the needs; Company III has qualified a productive worker.

6. Conclusion

With reference to the SWOT analysis in terms of the garment enterprises in Trabzon, there is no textile manufacturing enterprise as well as the number of enterprises that manufacture garment products is few. Distance to raw materials and customer market; difficulties in rivaling with real port and raw material cities; lack of qualified workforce, capital, and infrastructure by the region are the most important reasons of the issue above. However, despite everything, there are enterprises that can be an irreplaceable supplier in comparison with Far East countries in terms of the EU to gain the agility; the new ones can be added to available ones in the same time. It is a stubborn fact that the companies will not have to make contract manufacturing by becoming more modern; they will be able to market themselves to Europe and Turkey's eastern and southeastern regions.

It is frequently seen in the literature that the agile production system is an inevitable strategy especially for textile and garment companies. However, according to the results obtained, this circumstance is proper for the enterprises that have an individual brand, high financial turnover, series competitors. Besides, these enterprises are the companies which need to follow fashion continuously, concentrate on the design and R&D activities at the same time. The conditions in the Trabzon region reflect the profile of garment in terms of the region of the eastern black sea; those conditions are different from the companies in which the study was actualized. Namely, it is pretty hard for companies in which the study was actualized to rival enterprises get busy in Istanbul. Producing under their own brands is also difficult for companies by geographical, economic and human position. In short, the problems experienced in reaching available infrastructure and required sources in this region bring extremely negative conditions about applying the agile production system. Moreover, it can be reached the conclusion that the companies in the region are proper to the lean production system structures by the nature of their activity.

The essential results of this research are that the companies under the region and company conditions will not be able to make production under the conditions of industry 4.0. Therefore, the enterprises ought to provide vertical integration and intrabusiness conditions so as to be required by lean production. After, they should focus on improving the horizontal integration (agile production) by the experience, competence and economic conditions that they will obtain by providing vertical integration and intrabusiness conditions. These enterprises need a remarkable capital and qualified manpower to achieve the goals above.

7. References


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