Guidelines for Improving Productivity, Inventory, Turnover Rate, and Level of Defects in Plastic Industry

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Abstract

The purposes of this study are to study the current situations, opportunities, and obstacles in manufacturing industry, and to create a model for improving the efficiency while reducing levels of inventory, turnover, and level of defect. This study used snowball sampling from 20 companies from plastic industry in Thailand. The results found that 2 companies were large, 10 companies were medium, and 8 companies were small. The results further showed that 19 companies were original equipment manufacturer while only one produced its own brand. Employees who operated machines had performance at 80-90%. In contrast, other departments which were not concerning with injection machine, such as finishing, assembling and packing, did not have their performance measured. All companies operated 7 days with 24 hours, especially injection machine department, with 2 or 3 shifts per day. Considering inventory, raw material was a small amount due to the plastic resin prices, which had changed frequently depending on market prices. Purchasing in bulk raw materials resulted in a risk of loss from the price difference. Most companies would assign employees, who controlled the injection molding machine, to finish pieces during the injection molding machine was running; therefore, the work in process inventory was small volume between 1-3 days. Meanwhile, finished goods inventory was 3-30 days. Customers would give the annual forecasting but they would split orders gradually on a weekly basis. Defect rate was controlled by customer at 2-3%. Turnover rate was 5-10%. The company should measure the performance in all departments to know strengths and weaknesses; and then create a project to improve productivity with suppliers, employees, and customers involvement such as 5S, QCC, Kaizen, TPM, TQM, ISO, SPC, and lean manufacturing system. The company should create work instructions both in Thai and Burmese or Cambodian or Laos to reduce communication issues. Since small but frequent orders were not worthwhile to set up frequently manufacture, the companies determined to produce high volume at one time, leading to high level of inventory. Thus, the company should focus more on forecast and negotiation to avoid dead stock. The company should understand its employees to maintain current employees and at the same time create attractive welfare to attract prospect employees. Company qualified for quality, cost, and delivery will survive in fierce competition. According to the establishment of AEC, there are opportunities to create its own brand, and relocate to border areas of AEC

Introduction

Currently, plastic has a huge role in our day life. Most of appliances are made of plastic or plastic components such as packaging, electronic appliance, auto-parts, construction, safety, housewares, medicals, agriculture, recreation, safety, filament (non-textile), and foot-wares. Thus, the plastic industry is an important industry which many factories scattered across the country, a total of 3,850 plants which 85 percent as the SMEs. The number of workers in this industry accounted for 290,270. Thailand imported plastic about 0.227 trillion tons of plastic per annum which ranked 11th in the world. Meanwhile, exported about 0.198 trillion tons per year accounted as 4% of GDP (Namthawat, 2013).

Labor productivity is critical to the competition. In addition, it can also increase sustainability revenue. Company with higher costs will result in lower competitiveness which leads to loss and finally has to withdraw from the business. Thailand labor productivity has increased by 2% per year which is very low when compared with other countries such as Vietnam and China with 4% and 10% of increase, respectively (Tansakul & Sutthiwatanaruputh, 2014). The unit labor costs of Thailand increased by 3% while Indonesia fell by 12% (Tansakul & Sutthiwatanaruputh, 2014). According to both low level of productivity and high level of unit labor costs, the competitiveness of Thailand is reduced.

Inventory is one of the most expensive assets of many company which representing as much as 50% of total invested capital. Managers have long recognized that good inventory management is crucial. In addition, a company can reduce costs by reducing inventory. On the other hand, production may stop and customers become dissatisfied when an item is out of stock (Heizer & Render, 2014).

To sum up, according to a low level in production, a high level of labor unit costs, and high level of inventory, employers need to create the improving program to improve productivity, reduce inventory, turnover rate, and level of defects which will enhance company's competitive advantage.

Literature Review

Performance

Performance analysis is a process used to evaluate the cost efficiency, reliability, and timeliness of corporate management and design. The purpose of performance analysis is to identify areas of improvement in company's activities as well as to aid strategic decision making. This study is mainly concerned with performance, especially operational performance.

Operational performance is related to organization's internal operation such as productivity, quality of product, and customer satisfaction (Feng et al., 2007). It is typically assessed along with the dimension of percent returns (Frohlich & Westbrook, 2001; Poirier & Quinn, 2004; Rosenzweig et al., 2003), percent defects (Frohlich & Westbrook, 2001; Rosenzweig et al., 2003), delivery speed (Buzzell & Ortmeyer, 1995; Frohlich & Westbrook, 2001; Chen & Paulraj; 2004), production costs (Frohlich & Westbrook, 2001; Poirier & Quinn, 2004; Rosenzweig et al., 2003;

Chen & Paulraj, 2004), production lead time (Buzzell & Ortmeyer, 1995; Frohlich & Westbrook, 2001; Rosenzweig et al., 2003), inventory turns (Frohlich & Westbrook, 2001; Zhu & Karemer, 2002; Ranganathan et al., 2004), and flexibility (Chen & Paulraj; 2004; Rosenzweig et al., 2003).

Productivity and Firm Performance

Productivity is the ratio of outputs (goods and services) divided by the inputs (resources, such as labor and capital). The manager's responsibility is to enhance the productivity because improving productivity means improving efficiency (Heizer & Render, 2014).

Based on the microeconomic theory, the efficiency of production or economic performance is divided into two categories, i.e. technical performance and efficiency of resource allocation. Technical performance refers to a possible maximum output from the processing of minimal inputs. Meanwhile, the efficiency of resource allocation means a maximum of producing in which the manufacturers are satisfied with the matching of resources and objectives. In other words, the efficiency of resource allocation can be explained as the yield derived from using the lowest cost.

Conventionally, a firm performance has been observed and measured in accounting words (Conant et al., 1990; Jennings & Seaman, 1994). However, the literature concerning with measurement of business performance (Kaplan & Norton, 1992; Lynch & Cross, 1991; Otley, 1999) proposed that managers prefer to locate relatively less importance on traditional financial performance's measures, e.g. return on investment or net profits. It is consistent with Baross and Santos (2006) , who proposed that firm performance be an outcome from the ability to use resources and CEO care for overall result of both finance and non-finance performance. In general, the word performance results in the leading position of measurements such as profit, cost and market share (Laitinen, 2002). Sink and Tuttle (1989) asserted that performance should not be dealt barely as a financial perspective. In addition, Li and Olorunniwo (2008) suggested that performance can be evaluated by non-financial performance such as efficiency, growth, and profit.

The firm performance serves as a major link among the strategies, implementation and evaluation operations (Emmanuel et al., 1990; Haktanir & Harris, 2005). This is corresponding with Melia and Robinson (2010), who proposed that evaluating the firm performance is related to the strategy of the organization. Therefore, organizations need to set clear goals and rules to improve efficiency and move towards the achievement of the goals. In addition, many organizations believe that the performance evaluation can be conducted based on the implementation of any strategies. The reported performance will take place at all levels of the organization similar to financial report (Neely et al., 2002).

Organizations, especially in the private sectors, must cope with tough competition and the need to survive and grow. While the external business environment comprises competitive forces, internal competency relies on limited resources. Recently, business executives and researchers have focused on investigating the relationship between competitive priorities and firm performance. Operational measures which are usually used as firm performance measures include productivity, quality, cost,

timeliness, and accuracy (White et al., 1999; Ahmad & Schroeder, 2003; Hallgren, 2007; Kathuria et al., 2010).

Inventory

Managers around the globe have long recognized that good inventory management is crucial. The objective of inventory management is to strike a balance between inventory investment and customer service. Inventory can serve several functions that add flexibility to firm's operations. There are four functions of inventory, i.e. separating various parts of the production process, decoupling the company from fluctuations in demand and providing a stock of goods that will provide a selection for customers, taking advantage of quantity discounts, and hedging against inflation and upwards price changes (Heizer & Render, 2014).

To accommodate the functions of inventory, companies maintain four types of the following inventories. First, it is raw material inventory which has been purchased but not processed. The second type is work in process (WIP) inventory which refers to the components of raw materials that have undergone some change but are not completed. Third, maintenance-repair-operating (MROs) inventory is often a function of maintenance schedules, repair schedules, and other schedules. Finally, it is finished goods inventory which is the completed products awaiting for shipment or future customer demands (Heizer & Render, 2014).

The number of works in process from overproduction affected the manufacturing process and production cost. Traditional concept focused on the overproduction or pre-production for a long time in order to get the lowest cost per unit regardless of thinking whether there will be a lot of work in process or not. The problems of overproduction include the loss of time and labor in unnecessary production, storage space, costs of moving, waste not being resolved immediately, sunk costs, and hidden production problems.

Turnover Rate

Turnover refers to the amount of movement of employees in and out of an organization, normally presented in terms of the turnover rate (Chruden & Sherman, 1972). Meanwhile, Mobley (1982) defined the meaning of employee turnover as the discontinuance of membership in an organization by the person who received monetary compensation from the organization. In addition, Tanke (2001) has defined turnover as the movement of employees out of the organization. All of the aforementioned turnover definitions by different scholars helped the researcher in concluding that the movements of employees, who received monetary compensation from the organization, by rotating around the labor market, between organizations, jobs and careers, are normally present in terms of the turnover rate.

Level of Defects

Product defects refer to anything that makes the product unsafe while using (Robinson, 2009) which may occur from many reasons. The first defect is a result of poorly designed or tested products, not enough or too little. The product does not function as it was designed. The second flaw is a result of production that is not

correct, such as the wrong use of materials. Consequently, the production does not meet product specifications. The last one is incomplete guidelines on the practice, and inappropriate or incorrect warnings of the dangers.

Defect rate refers to the ratio between the number of product defects, errors or defects which are harmful to total output. In some cases, it may be calculated as a percentage of the waste. If the waste is very small, the defect rate will be calculated on the amount of parts per million pieces (PPM). Meanwhile, as the service cannot be taken apart, it will count the number of defect per million opportunities (DPMO).

Plastic Industry

The plastics industry was defined as an industry that manufactures polymer materials and offers services in plastics important to a range of industries, including aerospace, building and construction, electronics, packaging, and transportation (Wikipedia, 2014). Two primary business models that dominate the plastic industry are commodity products and specialty products. Commodity products manufacturers are typically large, multinational player, led by chemical and oil and gas exploration firms that use crude oil and chemical additives to produce raw plastics. In contrast, the typical specialty products manufacturer is a private company which has a single plant and employs fewer than 100 employees (Kema Inc., 2012).

Considering the cost structure, the study founded that it is similar for both the commodity and specialty business models. Raw materials are the major manufacturing expense, often costing up to 50% or more of revenue. Crude oil or natural gas is the primary inputs used to manufacturer resin. On the other hand, plastics product manufacturers use resin or recycle plastic as the key input. Some but not all plastics can be recycled which can be used instead of resin to decrease input costs. Meanwhile, the employee wages are the second highest cost at approximately 10-20% (Kema Inc., 2012).

Research Methodology

Samples and Procedures

The design of this study is a qualitative approach which was done by using in depth interview by means of snowball sampling from 20 participants working as managing directors, executives, production, and sale managers from 20 companies. The data collection was made from April to June, 2015. The data analysis was done by means of content analysis by 3 professionals working for industrial management and industrial engineer.

Results

The results found that 2 companies were large, 10 companies were medium, and 8 companies were small. The results further showed that 19 companies were original equipment manufacturer while only one produced its own brand. All companies operated 7 days with 24 hours, especially injection machine department, with 2 or 3 shifts per day.

Productivity

Considering medium and large companies, employees who operated machines had their performance at 80-90% based on the measurement by using cycle or takt time received from customers, or set standard time by using time and motion study. In contrast, the performance of other departments, such as finishing, assembling and packing, which were not concerning with machine, were not measured. Most of them were ISO 9001 qualified, guaranteeing the productivity control for all processes by using work instructions. On the other hand, small companies operating in fierce competition with small number of employees did not have enough resources to set and control performance measurement system; therefore, most of their performance was measured by using their owner or supervisor's experiences.

Inventory

Regarding plastic industry, raw material inventory was a small amount due to the plastic resin prices, which had been changing frequently depending on market prices. Purchasing in bulk raw materials resulted in a risk of loss from the price difference. Moreover, the plastic resin had to be ordered from suppliers which were determined by customers, and the work in process was between 1-3 days. Most companies would assign employees, who controlled the injection molding machine, to finish pieces during the injection molding machine was running. Therefore, the WIP was small volume. Meanwhile, finished goods inventory was 3-30 days. Customers would give the annual forecasting but they would split orders into small ones on a weekly basis. Small but frequent order was not worthwhile to set up manufacture frequently; therefore, the companies determined to produce high volume at once, leading to high level of inventory.

Level of Defects

Defect rate for all industry was controlled by customer at 2-3% using 3 stations of quality control points, i.e. incoming point, in-process point, and outgoing point. The majority problems occurred from human mistakes, e.g not following the work instruction, low skill, misunderstanding, and the employment of foreign workers who might not understand and dedicate to work.

Turnover Rate

Turnover rate was 5-10%, which was acceptable. Most of the turnover rate occurred in operation or daily-wage employees while the turnover rate from staff or salary employees were very low. Most companies were located in an area with many factories; thus, employees had an opportunity to compare the compensation, welfare, and benefits offered in the companies nearby. Consequently, the staff turnover rate is relatively high, almost the same for all companies.

Discussions and Conclusions

The company should use time and motion study to set standard time, which is needed to measure performance in all departments. In addition, the companies need to calculate the actual capacity which will result in accurate resource planning, such as

number of workers, materials, machines, capacity, and working hours. Moreover, employees will sense equality. It is also advisable to create a project to improve productivity with suppliers, employees, and customers involvement such as 5S, QCC, Kaizen, TPM, TQM, ISO, SPC, and lean manufacturing system. The company should create work instructions in Thai, Burmese, Cambodian or Laos to reduce communication issues. Small but frequent order is not worthwhile to set up manufacture frequently; therefore, the companies always determine to produce high volume at once which will lead to high level of inventory. Thus, the company should focus more on forecasting and negotiation to avoid dead stock. The company should also understand their employees to maintain current employees and create attractive welfare to attract prospect employees too. Companies qualified in terms of quality, cost, and delivery will survive in fierce competition. According to the establishment of AEC, there are opportunities to create their own brands, and relocate to border area or AEC countries in order to get new customers.

Acknowledgements

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List of Companies

Bk Plastic Product Co. Ltd.	Super Production Co. Ltd.
Act Ishihara (Thailand) Co. Ltd.	Thai Evolution Industry Co., Ltd.
Ukkarit Rungrueng (2000) Co. Ltd	P.E.I. Plastic Co., Ltd.
Vithit Factory Group Co., Ltd.	C.E.S. Systems Co., Ltd.
Fischer Tech (Thailand) Co., Ltd.	Smartrac Technology Co., Ltd.
Millennium Polymer Co., Ltd.	Chokthawee Plastic Co., Ltd
M And N Manufacturing Co., Ltd	Engineer Plastic Products Co., Ltd
Focus Plastic Industry Co., Ltd	Hi-Q Plas Co., Ltd
P.V. E. Engineering Ltd., Part	CRV Packaging Co., Ltd.
Pholvas Packaging Co., Ltd.	A.K.P. Technology Co., Ltd.