LENT MANUFACTURING IN FOOD AND BEVERAGE INDUSTRY

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ABSTRACT

Current manufacturing industry is putting continuous efforts for its survival in the current impulsive and competitive economy. The concept of lean manufacturing was developed for maximizing the resource utilization through minimization of waste, later on lean was formulated in response to the fluctuating and competitive business environment. Due to rapidly changing business, the moulding industry is basically more focussed in bringing out new makes which are not only impressive as per the look but also is competing in the quality and pricing. The present review concentrates on the food industrial manufacturing with a think of lean concept. Also, the study emphasizes the procedure of lean manufacturing and its benefits. Apart from the positive aspect of lean manufacturing, the drawbacks in the present industry and the possible measures to overcome for the safety and beneficial production is seen.

Key words : Food Industry, Lean, Manufacturing, Packaging, Waste.


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1. INTRODUCTION

Plastic Bottles nowadays is something that is in high demand, is it mainly because of its durability. Majority of people around the world use it in a daily basis. Containing innumerous uses, plastic bottles or plastic to be specific, must be one of the greatest discoveries in the recent centuries. Plastic bottles were first used commercially in 1875 but remained relatively expensive until the early 1960s when high-density polyethylene was introduced. They quickly became popular with both manufacturers and customers due to their lightweight nature and relatively low production and transportation costs compared with glass bottles. However, the biggest advantage plastic bottles have over glass is their superior resistance to breakage, in both production and transportation. Except for wine and beer, the food industry has almost completely replaced glass bottles with plastic bottles.

In the current era of globalization, industries are adopting new tools and techniques to produce goods to compete and survive in the market. The most daunting issue faced by
Lean Manufacturing in Food and Beverage Industry

Manufacturers today is how to deliver their products or materials quickly at low cost and good quality. One promising method for addressing this issue is the application of lean management principles and techniques. Lean manufacturing is a set of tools and methodologies that aims for the continuous elimination of wastes throughout the production cycle. Companies that do not institute continuous improvement after implementing process innovation are likely to revert to old practices Lean manufacturing (LM) has shown to be a good example of process innovation in companies, having continuous improvement as one of its cornerstone. Regarding implementation, LM is seen as not easily applicable to industries with large batch processes such as the food and beverage industries.

It is generally perceived that LM principles cannot be easily be applicable in food industry as the other industries. As the food is not make to order kind of manufacturing and also the quality of the packaging material needs to be closely managed for the wellness and safety of the people. However, evidence found in the literature suggests that LM can be successfully carried out for the foods such as red meat, bakery items, condiments, pizza, sauce, ketchup, frozen food etc.

A lean strategy with the accompanying training and problem-solving sessions will provide "new eyes" for management and workers to first see the hidden waste and then to begin to eliminate waste. Once these eyes are seeing waste, then motivation and creativity to include safety and sustainability in the lean efforts strengthen the benefits [1]. The progress in lean implementation is snail-paced and needs to be augmented when seen for food industry. However, evidence found in the literature suggests that LM can be successfully implemented in a food manufacturing company to improve production efficiency, to improve product quality, and to reduce production cost by reducing waste and adding value [2]. Lean manufacturing is not a magical solution. It involves a change in leadership that requires considerable communication, coordination, and organization which results in a change in the company’s culture. In order to create a lean manufacturing environment, the organization needs to be aware of where it is at that point. They must know why they need to change and why change is important. It is necessary to provide the answers to these questions to employees so they become more engaged in the process [3]. The ultimate lean target is the total elimination of waste. Waste, or muda, is anything that adds cost to the product without adding value [4]. In one of the article author has made the research in two case studies and traced out the problems being faced for LM, as for stating few, the breakage of glass bottles, change over’s needed for dies and punches, frequent changes in design of packaging bottles, cans and tins [5]. Implementing the concept of lean does not mean that the quality is going down. Problem with quality happens in all the systems, but quick inspection and every worker involved in solving technical issues rather than ignoring makes the uniqueness of lean pointing towards quality [6].

2. MANUFACTURING METHODOLOGIES

2.1. Different Ways of Manufacturing Employed in Food and Beverage Industry

Aseptic packaging has been developed as a result of the market's demand of a method of packaging natural products. Thus, the evolution of packaging technology has been:

Cans: This way of packaging is used by roughly 90% of the market. However, this kind of packaging is using more and more aseptic packaging techniques. Asepton Drum: It meant a revolution as a substitute of 5 Kg. cans that are used in the industrial sector. It is a high technology drum, made of cold rolled steel sheet and internally lined with an un-plasticized, food grade, PVC film. It is primarily used for the packaging of liquid and semi liquid food products, like juices, pulps, purees and concentrates. It maintains the quality of the product and can be re-uses several times once emptied. Tetra Pak's range: This kind of packaging is
well known by most of the people. It is very well introduced in the milk, dairy and beverage industries. It is not a suitable type of packaging for industrial volumes. Products with fibres and particulates cannot be filled. Alternatives: PKL, Glass bottles, jars and PET. Glass is losing momentum in the market and PET is developing fast for the aseptic filling of juices and beverages. Frozen foods: Freezing of foods enables the best quality products, but it is not a well established technology for industrial purposes. Applications of HRS aseptic fillers. Aseptic filling can be used for any type of fluid or doughy product processed by the food industry. In order to satisfy all requirements, producers of aseptic bags use various kinds of materials: high-barrier, multi-layer, flexible laminates, transparent or dull, coextruded, metalized of provided aluminium foils. Bag-in-box & Bag-in-drum: 55 gallon bags. These bags, available in metalized material (simple or high barrier) or coextruded material, are produced both for the European market associated with conical drums. Traditional products such as tomato concentrate, paste and pulp, citrus fruits juice and fruit puree, they are produced with 1 inch spout. For delicate products such as diced tomato and diced fruit 2 inches closures are used. Gusseted bags up to 220 litres. The typical gusseted bag is adaptable to any kind of external box, steel drum, cardboard box, plywood box, and jute bag. Modern bags guarantee an excellent barrier to oxygen. Such bag offers a capacity of 5, 10, and 20 litres also. Big size bags. Big size bags up to 1000 litres have been developed with particular care towards practical handling, transport and storage. Form-Fill-Seal (FFS) packaging: Form-Fill-Seal technology allows producing of finished packages (filled, closed and labelled), in a single process, starting from reels of material. Bags are available in formats up to 0.5, 1, 5, 10, 15 and 20 liters, and are manufactured with metalized or coextruded material.

2.2. Current Packaging in Food Industry and Implementation of Lean Concept

The complexity of the factory will also have an impact on the methods of production. The rapidly changing fashions in food mean that no one in the food supply chains want to get caught with excess stock. There is nothing worse than having a large stock of a specialist raw material when the fashion changes, except perhaps having a large stock of packaging material. As a result, manufacturing operations have to be set up to be very flexible to meet demand. The way that food manufacturers have responded to the food fashion aspect of the business is to make little and often. This has always been a feature in short shelf-life foods, such as chilled products, bread and fresh produce, but is increasingly used in factories that manufacture long-life products, such as frozen and canned foods, biscuits and preserves. Food fashion has taken food manufacturers into the area of low stocks and flexible manufacturing. This appears on the shop-floor as short production runs, multiple line changeovers, complex material controls and a need for precise, right-first-time production.

One of the food packaging companies, the process being followed is seen the following way; the first process in plastic injection moulding is the drying process. The purpose of drying is to remove moisture content in plastic resin before further process. Dryness is important to ensure a common surface defect such as silver streaks does not occur during processing. The next process is injection moulding. The process begins with setup process. Current practice of setup process takes at least 2 hours to complete. Setup instruction which contain important parameters such as temperature, speed, pressure, stroke, shot volume, and time is used as a guide to avoid trial and error practice. Upon completion of setup process, 2 shots of sample have been submitted for buy-off by QC technician. After the confirmation, production is allowed to run as per scheduled. For semi automatic operation, 1 headcount is allocated per shift to run the machine. For the big automatic part, 1 headcount per shift is allocated to perform visual inspection, deburring and packing. Another 1 headcount is allocated to collect and pack all small automatic parts. In-process inspection is performed every 3 hourly according to the inspection plan for every individual part. The main criteria
are controlled dimensions and visual inspection. Finally, outgoing QC is performed every 2 hourly according to sampling plan for visual inspection. The material flow and sequence of the main processes were sketched on a paper. The material flow from supplier to the main warehouse was done weekly based upon the requirement from customer. It is delivered to the plastic moulding raw material store daily upon request. The plastic resin will be transferred to the centralized drying area using a manual pallet truck. After going through a minimum duration of 4 hours drying, plastic resin will be conveyed automatically to the designated machines based on type of plastic used for production. There are at least 5 types of common plastic resin used for production. They are ABS, PC, PA6, PA66 and PC+ABS. All moulded parts will be sent to the outgoing QC area for final inspection. After that, moulded parts will be kept temporarily in the plastic part store. Moulded part will be sent to customer by electric pallet truck daily upon request.

2.3. Elimination of Wastes in the Present Industry

Many manufacturers look at process improvement, safety and recycling as separate programs, they would benefit from viewing lean, safety and sustainability as three fibres making a single rope used in the improvement journey. Just as a rope is made stronger with multiple fibres wrapped to make one, making lean, safety and sustainability one initiative can make your plant stronger. Generally, the relentless pursuit of eliminating waste, the essence of lean is to eliminate waste and wasteful practices that are hidden. A lean strategy with the accompanying training and problem-solving sessions will provide "new eyes" for management and workers to first see the hidden waste and then to begin to eliminate waste. Once these eyes are seeing waste, then motivation and creativity to include safety and sustainability in the lean efforts strengthen the benefits.

Transport adds no value to the product, as a business are paying people to move material from one location to another, a process that only costs money and makes no value. The waste of transport can be a very high cost to the business, as one needs people to operate it and equipment such as trucks or fork trucks to undertake this expensive movement of materials. Inventory costs money, every piece of product tied up in raw material, work in progress or finished goods has a cost and until it is actually sold that cost is for company [8]. In addition to the pure cost of the inventory it adds many other costs; inventory feeds many other wastes. Inventory has to be stored, it needs space, it needs packaging and it has to be transported around. It has the chance of being damaged during transport and becoming obsolete. The waste of Inventory hides many of the other wastes in your systems.

![Figure 1: Hierarchy of reducing waste.](http://www.iaeme.com/IJCIET/index.asp)
during manufacture. For the same commercial output, usually the less materials are used, the less waste is produced. Cradle-to-grave concept which is the full Life Cycle Assessment from resource extraction (‘cradle’) to use phase and disposal phase (‘grave’). In case of trees produce paper, which can be recycled into low-energy production cellulose (fiberised paper) insulation, then used as an energy-saving device in the ceiling of a home for 40 years, saving 2,000 times the fossil-fuel energy used in its production.

Scraps can be immediately re-incorporated at the beginning of the manufacturing line so that they do not become a waste product. Steps can be taken to ensure that the number of reject batches is kept to a minimum. This is achieved by increasing the frequency of inspection and the number of points of inspection. Installing automated continuous monitoring equipment can help to identify production problems at an early stage. When the beverage bottling is considered, many a times, the PET being used has a slight damage which is brought into the lime light after filling it, hence it is scrapped. It not only wastes the beverage but also the packaging material, time of the labour, Machinery time, Handling time bringing the total efficiency down. Therefore improved quality control and process monitoring system is necessary to reduce the waste up to certain extent.

Waste exchanges are where the waste product of one process becomes the raw material for a second process. Waste exchanges represent another way of reducing waste, disposal volumes for waste that cannot be eliminated [7]. Also, unnecessary motions are those movements of man or machine which are not as small or as easy to achieve as possible, by this bending down to retrieve heavy objects at floor level when they could be fed at waist level to reduce stress and time to retrieve. Excessive travel between work stations, excessive machine movements from start point to work start point are all examples of the waste of Motion. The waste of over processing is where we use inappropriate techniques, oversize equipment, working to tolerances that are too tight, performs processes that are not required by the customer and so forth. All of these things cost us time and money.

3. IMPROVEMENTS THAT CAN BE MADE IN THE PACKAGING INDUSTRY

Looking at reducing pack weight and using modified atmosphere packaging or improved seal integrity techniques to reduce the risk of food waste can be made. By using returnable, re-usable transit packaging material to reduce secondary packaging waste. Only If cutting off the catering packs does not create food waste due to product deterioration, Catering packs can also minimize packaging waste. Improved packaging design can also reduce the carbon impact of packaging. Redistributing the surplus food fit for human consumption can be redistributed to commercial organizations or charities such as Plan Zheroes, Fare Share and Food cycle. If not suitable for human consumption, investigate whether it can be sent for animal feed. Recycling food where redistribution is not possible, one can consider composting food waste or sending it for anaerobic digestion instead of disposal to landfill. Improving packaging functionality, for example reclose able packs can be used. And also on pack guidance, for example recycling, date labeling and storage freezing and defrosting guidance can be made so as to utilize those packaging material up till that particular date instead of disposing. For aluminium, the focus will be on increasing collection, through recycling at work, local authority foil and can collections, and investment in on-the-go infrastructure.

Lean concept is being employed by few of the manufacturers in the present era. Few examples being, Marks and Spencer changed the plastic tray used to protect its beef to a thin skin pack wrapped tightly around the product. This method cut the packaging down by 69% and extended the shelf life of the product by four days. Coca-Cola has reduced the weight of
its soft drink cans by 5%, potentially saving 15,000 tonnes of packaging a year across the European aluminium can sector. This represents approximately 78,000 tonnes of CO2 the equivalent of taking 25,000 cars off the road. Heinz has changed the design of its ‘easy open’ can ends, saving 1,400 tonnes of steel without any effect on the performance of the cans and saving Heinz in the region of $750,000 in production costs worldwide.

4. CONCLUSION

Packaging policy should minimize the environmental impact of packaging over its whole life cycle, without compromising its ability to protect the product. Lean manufacturing starts with optimizing packaging through recyclability, reusability and recovery as a standard and market innovation and development which meet the growing demand for re-useable and recycled packaging, across all types of packaging. Keeping apart packaging stuff, other factors which are having major impact is the transportation costs, Inventory costs, production problems and shelf life are also showing a great impact. Reducing the handling time control over production of cheap packaging covers, trays, bottles, bowls etc is ought to be reduced to a great extent reason being less quality material is proportional to the damaged packs making secondary packaging necessary. This overcomes the wastes from defective items and also overproduction as well as handling costs. Wastes are being recycled to a great extent which is a good hint for the manufacturing industry, but over processing of the recycled goods so as not to show up the decolouration to the customer, the strength of the material is deteriorating thereby making unnecessary costs of over processing. As far as longevity and visibility of the packings and bottling are concerned, the quality material with the proper manufacturing and expiry dates can be printed by the business people so that trash of packing is reduced by reusing.

Though the lean concept is being used by few of the company’s, food and beverage industry has 25% to 30% success rate. As Recycling prevents resource destruction, prevents pollution, saves energy, saves money and also creates jobs, throughout the world plastic and PET has a great sway, making its impact on the public and Economy of the country. But the ill effects of plastic are also up to great extent. This is due to recycling plastics are getting diluted with the food items being packed within and the quality of recycling plastic not being maintained etc. Public being very selective and cautious over the packaging and material used for the packaging as well. Health and safety considerations add to the complexity of processes, but do not alter the fact that they are still processes that can be improved. The secondary issue being the vast food wastage, deterioration of packaging material by time. Looking onto the other face, Lack of persistent and challenging leadership, Lack of a clear vision of the future and of what is possible to be achieved, Lack of patience and follow through, Failure to perceive that lean is a viable strategy to help achieve competitive advantage and Lack of constant visibility by management on the shop floor are also probable and most likely reasons for the underlying of lean manufacturing in Food and beverage Industry.

REFERENCES


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