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Food Manufacturing: A Primer

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ABSTRACT
Food manufacturing transforms livestock and agricultural products into products for consumption. It involves businesses that collect raw food materials and process them into edible products. It processes a wide range of food and drinks to cater to the needs of the global population. In the United States, the food manufacturing industry has gone through significant changes in recent decades due to climate change effects on agriculture, rising environmental standards, severe competition, and changing and diverse customer expectations. This paper provides a primer on food manufacturing.

Keywords: food manufacturing, food waste, food processing

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INTRODUCTION

Food is a necessity for survival. The need for food is primal, a fundamental physical drive that can be filled with nurturing and care. Foods are naturally fragile, non-rigid and irregularly shaped objects. They require proper handling and processing. Humans have been manufacturing food since ancient days. The food manufacturing industry consists of food, confectionery, beverage, ingredients, and flavors, and extracts manufacturers. It is an important source of relatively high-paying jobs in the food industry. The bakery segment of the food manufacturing industry is one of the largest segment and it ranks first in terms of establishments and employment [1].

FOOD MANUFACTURING CONCEPT

Food manufacturing is the process of transforming raw food materials into products for human consumption. It does this by processing raw materials such as fruits, vegetables, grains, meats, and dairy products into finished goods ready to sell to households, restaurants, or institutional food services. Food manufacturing plays a major role in the production of sugar, rice, etc. Any food manufacturing company is concerned about shelf life of food products. A product with short shelf life can only stay a short time in the supply chain before it spoils. Food processing, preservation, and packaging will make products last long enough to be financially viable [2].

Food manufacturing is part of the manufacturing sector and also part of the food industry. It is driven primarily by consumer demand for convenience, quality, and value.

Unlike other types of manufacturing, food manufacturing requires a high hygiene and is one of the most highly regulated industries. Food manufacturing processes include three links: raw material procurement, production process, and production sales [3]. The food manufacturing industry includes fresh and processed foods, meat processors, flour, bread or baked products, snack foods, breads, tortillas, cookies, crackers, pastas, and cereal manufacturers. The industry covers a wide range of industrial activities that include food processing, conversion, preparation, preservation and packaging of foodstuffs [4]. For example, in Canada, meat product manufacturing is the largest, with about 28% of all sales, as shown in Figure 1 [5]. Dairy product manufacturing is the second largest industry, followed by grain and oilseed milling, and then other industries.

The food manufacturing industry requires a wide range of workers. These workers include [6]: (1) *industrial engineers,* who plan equipment layout and workflow in manufacturing plants; (2) *mechanical engineers,* who plan, design, and oversee the installation of tools, equipment, and machines; (3) *Chemists* perform tests to develop new products and maintain the quality of existing products; (4) *Computer scientists* who develop computer systems and programs to support manufacturing operations and management; (5) *sales workers*, who promote and sell the manufactured goods; (6) a*ccountants,* who k*eep* track of the food products going into and out of the plant; (7)*Janitors and cleaners,* who keep the factory clean.

FOOD MANUFACTURING TECHNIQUES

Food manufacturers use various food manufacturing techniques to process their products. Some food manufacturing workers use their hands or hand tools to do their jobs. As automation increases in the food manufacturing industry, workers are trained to use machines. Contemporary food manufacturing techniques and equipment have enabled processors to create everything [2].

- **Cutting and chopping:** You can cut vegetables or meats at home, but food manufacturers add value and shorten the time it takes to make dinner by doing this cutting for you.
- **Preserving:** Food preservation extends shelf life and can also enhance flavor. Refrigeration and freezing can also extend shelf life.
- **Seasoning:** Food processing can also augment the flavor of otherwise simple foods by combining ingredients with complementary raw materials. Ancient and medieval merchants had moved spices from far corners of the globe.
- **Homogenizing:** Some food products are processed to keep components together that might otherwise separate. Homogenized milk is treated to keep the cream from rising to the top.

There are other forms of food processing that can transform a commodity ingredient into a specialty food with a significantly higher retail value. Food processing can open up new markets, such as high-volume, year-round businesses [7].

Some products cannot be manufactured without using robots. Wherever the manufacturing environments are harsh or dangerous for people to work in, automation is the obvious solution. Figure 2 shows a typical automated food manufacturing [8].

BENEFITS AND CHALLENGES

Food manufacturing has enabled feeding a steadily growing and increasingly diverse urban population. It also saves time and makes it easier for people who do not enjoy cooking. As convenience becomes more important, consumers increasingly demand highly processed foods such microwaveable soups or ready-to-cook dinners. Food manufacturing industry is not as sensitive to economic situations as other industries.

Although manufactured foods are convenient, they are usually mechanically engineered and mass produced sometimes on land that is treated with chemical fertilizer. Also, many manufactured foods are developed to satisfy cravings which may lead to overeating and obesity [2]. Food manufacturing involves labor-intensive food-processing operations and has one of the highest number of workplace fatalities, workplace injuries, and illnesses among all industries. Food manufacturing involves repetitive, physically demanding work. Workers often stand for long periods and are susceptible to injuries to their hands, wrists, and elbows. Workers in food manufacturing are more likely to be fatally injured and experience illnesses than those in private industry [9].

Food quality and safety continues to be a major challenge for the food manufacturing industry. US governmental bodies (such as the Food and Drug Administration, Center for Disease Control, Department of Agriculture, and Food Safety and Inspection Services) are increasing pressures on food manufacturers to improve their working conditions and ensure the safety of workers. Even with regulations and policies, food recalls and consumer illnesses continue to occur [10]

It is common these days for two food manufacturers to merge. There are several growing pains and issues such as who will be CEO, where will the headquarters be located, which employees will survive, etc. [11].

Food manufacturing consumes a lot of energy in food processing. The global climate change has compelled some manufacturers to consider renewable energy as an alternative source of power for their operations [12].

Food waste is an important issue for the society, economy, and the environment. In developed world, 42% of food waste is produced by households, while 39% losses occur in the food manufacturing industry, 14% pertains to food sector (ready to eat food, catering and restaurants), and the remaining 5% in retail and distribution. Even if the food wastes are to used as raw material for new products and applications (to achieve "zero waste economy"), they will need further processing [13]. When the surplus food cannot be sold on the primary channels, some companies are compelled to use alternative markets or give for free to non-profit organizations that assist the poor.

In US, Canada, UK, and other developed nations, the food manufacturing industry is well established and has already matured. In some countries, the industry is underdeveloped due to the deficiencies in machinery, equipment, and capable workforce.

CONCLUSION

Manufactured food is being processed based on the policies that prioritize profit and convenience over health. Governmental bodies around the world are encouraging us to eat less salt, sugar, and fat, and consumers are demanding healthy food and manufacturers are responding to that increasing demand. Depleting natural resources, climate change effects on agriculture, every-increasing legislations, severe competition, and changing and diverse customer expectations in today's global world, the success of the food manufacturing industry will be influenced heavily by its ability to maintain and improve productivity. More information about food manufacturing can be found in the books in [14-17] and related journals: *Food Manufacturing Journal, Food Manufacturing Africa,* and *Food Review.*

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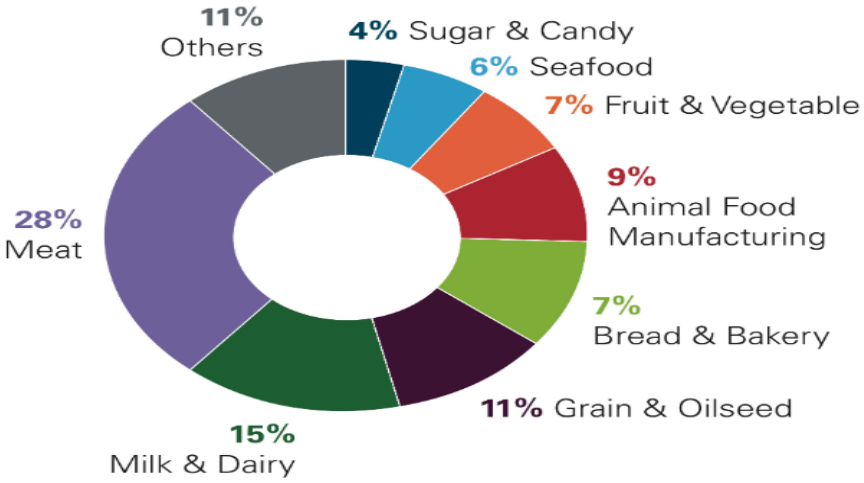

Figure 1 Major food manufacturing sectors [5].

Figure 2 A typical automated food manufacturing [8]