


Chapter 9

Reducing Food Waste Through Predictive Analytics

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ABSTRACT

Reducing food waste is a critical challenge that impacts environmental sustainability, economic efficiency, and global food security. Predictive analytics, leveraging big data and machine learning technologies, provides innovative solutions to address this issue by enhancing demand forecasting, optimizing inventory management, and improving supply chain responsiveness. By analyzing historical consumption patterns and employing advanced algorithms, businesses can better align production with consumer demand, thereby minimizing overproduction and food spoilage. This paper discusses various predictive analytics applications in the food industry, including real-time monitoring, demand forecasting, and waste analysis tools. It highlights case studies demonstrating the effectiveness of these technologies in reducing food waste, ultimately contributing to a more sustainable food system.

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1. INTRODUCTION TO FOOD WASTE

Food waste is a tangible consequence of the larger global challenge that is food security, which means that all humans have access to enough safe and nutritious food to keep them healthy and active (Varzakas 2024). The unintentional wasting of food has large negative sustainability effects, from wasting the water, land and energy that go into its production, to their emissions of greenhouse gases. For this reason, reducing food waste is a target in its own right of the Sustainable Development Goals. It is also relevant to other targets worldwide to eliminate poverty and suffer from hunger, and to increase the resilience and adaptive capacity of agriculture production systems. Those exploring effective solutions to the challenge that is global food waste may have at times asked whether there is a link between food security and food waste. The fact that food waste occurs in large enough quantities to deserve research by itself suggests some sort of trade-off. Contrary to this instinctive belief that food waste is a waste of scarce resources, we propose a more subtle view, where food waste can be seen as a signal of the abundance of a resource; then it becomes an indicator of policy inefficiency in the broader context of food security. Yet there seems to be some concurrent research suggesting that the wasting of food is either a policy response itself to a tightening of supply or that it occurs when there is food to spare, or alternatively when population-wide hunger is satisfied; other research in contrast highlights a different direction of causation, with food waste being a negative determinant of food security (Fox 2025). In other words, some households may use food waste as a strategy to deal with an unexpected increase of their immediate food deprivation, thereby reducing their risk of becoming food insecure. Food is not necessarily wasted only by those with enough wealth or food to spare; a reduction of food insecurity may instead be the real goal of some wasteful households. Such contrasting premises leave open the market for policies both for reducing food waste and for enhancing food security.

2. THE IMPORTANCE OF REDUCING FOOD WASTE

Food and agriculture represent one of the largest global industries and form the cornerstone of most economies around the world. The availability of food for the excavated growth of the population provides the key to any country's development (Daszkiewicz 2022). It is of utmost importance to have food abundance available for all the population, leading towards achieving sustainable development goals. A portion of this food is inevitably wasted through the stages of its value chains, including production, packaging, distribution, and consumption. Food waste is one of the largest portions contributing to the magnitude of global waste generated. Food

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