Food Waste Management

Subjects: Sociology
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Feeding the people sustainably continues to be a challenge in the present times. Enormous amounts of food wastage aggravate this problem. In developing countries, food wastage primarily occurs within the supply chain. Lack of technological infrastructure in these countries causes significant post-harvest loss. While research shows that developments in food supply chains can reduce food wastage, no systematic research has been done so far to show the possible relationship between the use of technology and food loss.

Keywords: Food Waste Management ; Food Supply Chains ; food processing industry

1. Introduction

The food and agricultural systems of the world have been feeding more people than before. However, although more food is being produced, the problems of hunger and nutrient deficiencies are prevalent [1]. Aggravating this problem is the fact that about fourteen percent of food produced globally is lost during the post-harvest production stage [1][2]. In other words, 1.4 Gt of food suitable for human consumption is wasted each year [3][4].

Although in developed countries, food wastage mainly occurs at the consumer end, in developing countries, food wastage primarily occurs within the supply chain [5], where the lack of infrastructure is the key reason for significant post-harvest loss [2][6]. Studies shows that post-harvest to distribution loss is highest in central and southern Asia, at nearly 21% [1][7]. Further, 85% to 90% of the observation points in central and southern Asia are from India, suggesting that food loss in supply chains are a major problem in the country. Indeed, several sources state that nearly 40% of the food produced in India is wasted [8][9][10][11].

A range of factors, such as microbial, enzymatic, chemical, physical, and mechanical ones, lead to food spoilage [12][13]. These factors necessitate the development of logistics systems in food supply chains [14]. Computerization and technological platforms facilitating online communications within food supply chains can facilitate the management of agricultural resources [15]. Researchers suggest that supply chains with advanced technological platforms can prevent nearly 50% of such loss [16]. These findings emphasize the potential of food supply chains to reduce food loss and achieve higher food security.

The author uses the food systems (approach as described by the United Nations High-Level Panel of Experts on Food Security and Nutrition; [17]) to define the food supply chains and further identify opportunities for reducing food wastage in the food processing industry in India. According to the HLPE United Nations (2017) report, the food supply chain consists of the activities and actors that take food from production to consumption as well as the disposal of its waste [18].

2. Technological Platforms Relevant to Food Supply Chains

The author used the key sources of literature in supply chain management, production technologies, and operations management to identify the most important and relevant technological platforms [19][20][21][22]. The author identified specific technological platforms that can improve the efficiencies in food supply chains:

1. Internet-based data monitoring and communication.
2. Enterprise Resource Planning (ERP), i.e., software that helps integrate components of a company, including supply chain, by sharing and organizing information among participants at different levels [21].
3. Supply Chain Event Management (SCEM): this term refers to methods that process supply chain events [23]. In other words, it is a process of monitoring the planned sequence of activities systems along a supply chain and reporting any errors with the help of computerized monitoring devices [24].
4. Radio Frequency Identification (RFID) systems, i.e., small electronic tags that track the position and movement of items [25][26].

5. Electronic Data Interchange (EDI), i.e., computer-to-computer exchange of documents for order processing, transactions, accounting, production, and distribution [21].
6. Programmable Logic Controller (PLC), i.e., a control system to monitor parameters of input devices and to generate decisions-based output parameters [21].
7. Cloud computing, i.e., an internet-based system to access a shared pool of computing resources (Mell & Grance, 2011).
8. Machine-to-machine, i.e., M2M communication or wireless or wired technology that captures data from a remote location using sensors and connects to the back-end enterprise systems via WLAN, satellite, or cellular communication [27][28].

In addition to the aforementioned technological platforms, literature described several other terms referring to the application of these platforms, such as logistics execution systems, network design applications, warehouse and transportation planning systems, and dashboard analytics for display and monitoring.

3. Conclusions and Prospects

The overall conclusion is that technological platforms can play a role in reducing food wastage in supply chains. For most firms, supply chain complexity and perishability of the raw material and products can serve as useful indicators to identify the relevance of technology.

Further, technological platforms can help reduce food wastage in supply chains, both directly and indirectly. The following examples show the direct effect of technological and other technology platforms in food supply chains.

First, automated PLCs reduce the chances of manual error and process failures. They also enable firm-level monitoring of a range of process parameters. Second, ERP helps identify efficient routing systems to improve logistics networks. Third, inefficiencies in the procurement system can be resolved with extensive backward integration. Technological platforms discussed in this study can facilitate the monitoring and control of such integrated supply chains to reduce wastage further. Finally, technologies like M2M communication enable significantly better control of ambient conditions.

All these effects of technological platforms help in reducing food wastage in supply chains by enhancing operational visibility and process control. Moreover, it also revealed several other indirect effects by which technological platforms can help reduce food wastage. For example, combinations of technologies like ERP and barcode readers enable the development of methods like “ready-make-discard”. With such methods, retailers can identify and sell the earliest manufactured product unit. Such methods are crucial for supply chains like C8, where the products are highly perishable. This finding suggests that the scope of technological platforms in reducing food loss goes beyond the improvement of parameters like visibility, precision, and efficiency. Like in the case of C8, these systems can enable newer practices in supply chains to reduce loss of perishables. Also, technological platforms can help identify areas of high wastage. Thereby, firms can initiate efforts for process improvement, like in C3. Further, technological platforms can improve demand forecasting by connecting food manufacturers to retail stores or restaurants. For example, rapid demand fluctuations were a significant challenge at C4, which caters to the fast-food restaurant industry. Their product has low shelf life even under refrigerated conditions. With the help of internet-based technological platforms, C4 could communicate with their customers more efficiently. This implementation significantly reduced the food wastage in their supply chain. Finally, technological platforms can enable automation of certain processes. Although these processes may still require manual monitoring, they can reduce food wastage, as was noted in the C5.

Thus, technologies enable other processes that can indirectly reduce food wastage in supply chains. In sum, the study supports the proposition that technological platforms have the potential to influence food supply chains in a manner that would reduce wastage.

Reduced food wastage can potentially help in improving food security, reducing hunger, and malnutrition that are the critical issues in India and other developing economies. One purpose of this study was to generate evidence to support the potential of technological platforms in food wastage management in developing countries. Collaborative and synergistic actions are from the government and private sector to implement policies that can address the high volumes of food wastage in supply chains. Improving supply chains in the processed food industry can make a substantial difference in developing economies, as most wastage occurs after harvest, but before the produce or end-product reaches the final consumer. This study identifies a range of technological platforms that not only appear promising to address this problem but have proved their effectiveness in several food-processing companies in India. The investments made for the

installation of such technologies can potentially be amortized with the savings from prevented food wastage in the long-run. The findings from this study can be applied to other developing economies that suffer from high food wastage and poor technological infrastructure in supply chains to address hunger and food security concerns across the world.

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