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Digital Innovation and Food Waste Reduction in Dubai's Restaurant Industry: A Qualitative Case Study

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Abstract

The hospitality industry in Dubai forms the basis of the city as a food epicentre; yet, it is also a significant source of food waste. Having a cuisine infrastructure with more than 13,000 restaurants and cafes and one of the highest densities of food-waste in the world, the need to reduce food-waste in the Dubai restaurant sector has taken on a new crucial sustainability dimension. The paper examines food waste antecedents and scale and impacts of food waste in the hospitality industry of Dubai and assesses whether digital waste-management applications can help reduce the food wastage. Based on a comprehensive analysis of the available literature, policy frameworks, and technologically-based interventions, the study outlines how artificial intelligence (AI), the Internet of Things (IoT), machine learning, and mobile apps can be applied to improve inventory management, demand prediction, food safety compliance, and redistribution of surplus. In addition, the qualitative data obtained through the interview of the top industry players were coded using an axial coding method to discover common themes related to the idea of operational inefficiencies, adoption of technology, and sustainability incentives. The results show that waste-management applications, when combined with the existing food-safety systems like Hazard Analysis and Critical Control Points (HACCP) and complemented by the managerial training, can significantly decrease the food waste and increase the cost-efficiency and social responsibility. Based on this, the paper finds that the technological facilitated waste minimization is an essential component in ensuring the hospitality sector in Dubai is in tandem with Sustainable Development Goal (SDG) 12.3 and moves toward a more circular and sustainable food system.

Keywords: *Food Waste Management; Hospitality Industry; Digital Waste-Management Systems; Circular Economy; Qualitative Study*

Introduction

Dubai is commonly depicted as a type of paradise in the desert which is commonly lavish and spending spree. The restaurant culture in the city is closely connected to food tourism, which is one of the key components in the process of projecting the global gastronomic image of Dubai. Today, there are

more than 13000 restaurants and cafes in Dubai and the institution of restaurants and cafes has a history of over 50 years. The first restaurants were initially opened in the 1970s to cater to the growing expatriate population and the relevant urban modernisation. As far as the applications and restaurant inventory software are concerned, there is no evidence of the first date of the industry adoption; however, there is evidence that the adoption started in the late 2000s-early 2010s. In spite of such technological progress, food waste in restaurants in Dubai is a widespread problem, which is further complicated by the fact that 30 percent of the entire amount of food produced in the world is wasted. This issue is exacerbated by the growing sector of hospitality, which explains why better waste-management can be used to foster the idea of sustainability and to address ethical concerns (Crocker, 2024). The food sector in Dubai has to deal with numerous challenges related to the use of imported goods, the existence of a heterogeneous workforce, and the existence of high temperature ambient conditions. Some of these initiatives include the Person-in-Charge (PIC) programme and Hazard Analysis and Critical Control Points (HACCP) systems that follow the seven guiding principles in an effort to support food-safety management and compliance among hospitality businesses. A study discusses the serious problem of food waste in the context of Dubai hospitality industry by highlighting the fact that the UAE has a per-capita food-waste of about 224 kg per year. It highlights the need to tackle the issue of food waste to achieve international sustainability goals, specifically SDG 12.3, the vision behind which is to reduce food waste by 50 percent by 2030 (Sadeh 12.3.5, 2024). Foodnomics is a mobile app that reduces food waste by cost estimation, which uses AI to identify food and create awareness to consumers (Liu & Boulom, 2025). An Android application also helps to eliminate food waste through surplus-food management (Shirbhate, 2024). A mobile app that takes pictures of food, recognizes them, weighs them, and suggests options of recipes to reduce food waste is proposed in this paper (Gunawardane et al., 2019). The key drivers of restaurants are social responsibility, novel business models, customer acquisition, and cost (Ozdemir et al., n.d.). The management of food-wastes is crucial in the hospitality industry; excessive portions and client dissatisfaction lead to wastes (Kilibarda et al., 2019). Food waste is one of the main factors that cause global warming, and the minimisation of waste can save economic resources (Martin Najeera, 2022). Third-largest, twenty five percent of the world food production is wasted, and the hospitality sector is the third-largest consumer (Crocker, 2024). New technologies improve sustainable disposal of food-waste (Chhikara et al., 2024). The restaurant sector in Dubai can use waste-management applications to optimise food-waste minimisation in its restaurants by automating waste management, refining inventory management, and enhancing the workflow in the kitchen. These are digital solutions based on AI and IoT that make the operations facilitate and enable efficient redistribution of food (Stoica et al., 2023). The features included in the application are inventory, expiry, recipe, and a donation platform. It encourages sustainability and community involvement in relationships with proximate food banks and shelters with geolocation technology (Bongarde, et al., 2025). Another study discusses an AI-powered application that would help reduce the level of food waste in Dubai by leveraging the idea of food donation to local food banks and, in the process, improve the existing food sustainability and promote responsible consumption behavior among the population in accordance with the sustainability goals of the UAE (Kumar et al., 2024). Waste-management system relies on IoT and AI to sort and quantify food waste in real time, giving Dubai restaurants the accurate data about the waste patterns and inventory management, which eventually minimize food waste and support cost reduction (Mehta, 2024). Machine-learning applications in the restaurant handle inventory and expiry dates by striving to maximise the reduction of food-waste by proposing new recipes using nearly-expired items. This enhances economic efficiency and sustainability, which can be applied to waste-management applications in Dubai restaurant industry (Bankar, 2024). Another study discusses predictive models using machine learning and the Internet of Things to monitor food supply chains in real-time and help restaurant applications in Dubai optimise stock, demand, and optimal storage conditions to reduce food waste (Öztürk et al., 2025). The restaurant sector of Dubai can reduce food-waste by the use of AI-powered applications which examine information on inventory, client preferences, and consumption behaviour, and subsequently forecast accurately, allocate resources efficiently and improve the logistics of food donation to the fullest extent possible and help strengthen sustainability (Onyeaka et al., 2023). SDG 12.3 can be applied to the food industry in

terms of adopting a second supply chain on the primary food chain, providing IoT-based preservation systems on the retail level to manage food waste. The strategy involves waste collection incentives at the collection centres and food waste conversion to secondary products. By optimising supply-chain decisions regarding the cost of preservation and inventory management, the industry will be able to significantly decrease food waste, save material resources, and maximize economic value, thus supporting the goal of 50 percent food waste reduction by 2030 (Iqbal & Kang, 2024). Entrepreneurs are faced with dilemmas about the profit-based and non-profit based business models (Almeida Oroski, 2020). Food waste is a major issue in the world, and the production is approximated to be up to 1.3 trillion tonnes per year. One of the possible ways to reduce household-level food waste is the implementation of modern technologies, and the Exspiro application is a good example. The features that are integrated in this application like notifications relating to the upcoming consumption and recipe suggestions, contribute to the food sustainability habit. Besides, the application provides a statistical module that informs users about the most common types of food gone to waste so that it would enhance awareness and support the management of resources (Pajpach et al., 2023). Previous research focuses on the digital tools of waste management in the HoReCa industry, specifically mobile apps that can simplify the process of overseeing waste and inventory management that might be beneficial to the Dubai food sphere to minimize wastage effectively (Stoica et al., 2023).

Literature Review

Circular-economy can reduce food waste and enhance resource efficiency. The technologies of artificial-intelligence are capable of tracking and streamlining food production, providing redistribution of overproduction, and supporting waste management and recycling efforts (Onyeaka et al., 2023). Food waste has negative social, economic and environmental impacts (Bhatt, 2024). Previous research discusses how a mobile application will reduce food waste through the surplus food donation of businesses, especially in the food industry. The given approach is bound to significantly enhance the waste-management trends within the hospitality sector of the city of Dubai, thus, improving the issue of food shortage (Bailur et al., 2023). Many hospitality businesses in Dubai have shortcomings in ensuring food safety even when the staff has primitive training. This has led to increased effort to deliver extensive training on food safety at management level. The improved safety of local hotels and restaurants has been improved using enhanced applications of the Hazard Analysis and Critical Control Points (HACCP) methodology. A survey has revealed that over 90 percent of small food outlets were faced with at least one major food-safety challenge; only 8 percent of these restaurants had managers who had sufficient training and the trained managers had fewer major problems (Al-Awadhi et al., 2011). The issue of food waste in the dining restaurants in the City of Dubai can be considered a severe issue, which can be explained by excessive production, the inefficient demand prediction, and buffet-style approaches to the service. The high amount of waste in the hospitality industry highlights a strong need to carry out a timely study to identify the root causes and come up with effective mitigation measures (Sadeh & Abu Hijleh, 2024). Food-service industry can reduce waste by forming strategic alliances and providing specific education (Crocker, 2024). The SmartNoshWaste paradigm leverages blockchain, machine-learning and cloud-computing systems to optimize food-data regulation, which would enable Dubai restaurants to mitigate excess and waste through real-time tracking and analytics that will lead to a 9.46 percent decreased food waste (Dey et al., 2022). The adoption of the secondary supply-chain model will guarantee maximum use of food waste leading to conservation of 62 per cent of material resource, reduction of preservation cost by 65.8 per cent, and increase in profits by 49 per cent. The integration of IoT technologies provides an opportunity to regulate the deterioration rate of products depending on the shelf life, allowing conducting remote inventory checks and decommissioning of spoiled goods, which lowers the appearance of food waste in turn, increasing the shelf life of the products and the duration of the inventory cycle (Iqbal & Kang, 2024). Food waste is a serious world problem with the volume being produced yearly up to 1.3 trillion tonnes. One of the possible ways to reduce household-level food waste is the implementation of modern technologies, and the Exspiro application is a good example. The

features that are integrated in this application like notifications relating to the upcoming consumption and recipe suggestions, contribute to the foodsustainability habit. Besides, the application provides a statistical module that informs users about the most common types of food gone to waste so that it would enhance awareness and support the management of resources (Pajpach et al., 2023). Previous research discusses how a machine-learning application aims at reducing food waste in the industry and offers functionality as demand predictions, ingredient optimisation, and near-expiry price prediction that can benefit significantly the food industry in Dubai in terms of waste management (Ifham et al., 2023). IoT and big-data technologies can be used in reducing food-waste in the Dubai food industry. Resource efficiency can be enhanced by using waste-management applications that integrate sensors and analytics to monitor and optimise food supply chains (Ahmadzadeh et al., 2023). Previous research focused on the development of a common food-waste management system, WAPRO, to a variety of food-service organizations, with a special focus on prevention of unnecessary waste (Ghanem, 2020). Food retailers and HoReCa owners are highly satisfied with the TooGoodToGo application, which indicates that it is effective in reducing food waste. The app seems to be a tool of increasing the number of customers, but without significantly improving revenue. The retailers that have a long history of operations are therefore in a better position to take advantage of these advantages. The study also indicates that significant importance of web-application services in promoting sustainable activities among food retailers (Lagorio & Mangano, 2024). A study discusses the integration of machine-learning, IoT, and blockchain to control the food-waste in the Dubai industry and suggests its relevance to the industry through applications that optimise items, predict demand, and track spoilage and enhance sustainability and efficiency (Özturk et al., 2025). A previous study highlights the importance of waste reduction through smart logistics and IoT in similar environments, like the case of Dubai (Hanis & Fernando, 2024). Another study focuses on the SmartNoshWaste system, which uses machine-learning and blockchain to reduce food waste in decentralised smart-city systems. It stated reduction of food waste (9.46), which utilized blockchain, cloud computing, QR code technology, and reinforcement learning (Dey et al., 2022). Smart scales provided by Winnow Solutions are used as waste-management services in the food industry of Dubai to track and reduce food waste. These technologies support the efforts of hospitality-sector, which comply with the regulatory frameworks to promote sustainability and reduce waste by means of efficient management practices. Food waste is a big challenge in the world which has negative impacts to the environmental, social and economic pillars of sustainability. In particular, the United Arab Emirates, and Dubai, in particular, become one of the major per-capita producers of food waste, which requires immediate intervention to reduce the problem. Hospitality industry in Dubai is noted to be a significant source of food waste, therefore the necessity to conduct additional theoretical and data based studies that would help to unveil its causes and drivers. Current programs, like the UAE Food Waste Pledge, aim to decrease food waste by creating partnership between hospitality institutions and implementing technology (Sadeh and Hijleh, 2024).

Methodology

Research Design

The research is a qualitative case-study that seeks to examine food waste management practices in Dubai restaurant sector, whereby the research specialises in the application of digital waste-management applications. The case-study design has been chosen because it was necessary to explore in details real-world practices, decision-making procedures, and technology issues in a specific setting, but not generalise widely.

Case Selection

The case study focuses on two people who are directly engaged in the hospitality and food industry in Dubai. These participants were chosen through purposive sampling, on the basis of their

appropriate experience and knowledge in the operations of restaurants, food safety practices and waste-management process. The small number of participants will make it possible to analyze food-waste issues and technology adoption in the selected environment in depth and with a level of detail.

Data Collection Methods

Primary data had been collected using semi-structured interviews from Person X and Person Y, who are the founders of top F&B food management apps in Dubai. This data collection approach allowed the respondents to give in-depth responses that were experiential and retained flexibility to find out other hidden themes. The interviews covered the question of food waste source, inventory and food-safety measures, knowledge and use of waste-management applications, and perceived obstacles to adopting the technology. All interviews were directly transcribed for the analysis.

Secondary Data Sources

In order to support the findings of the case-study, literature review from databases like Web of Science, Scopus, etc has been used. In addition, industry reports and policy documents dealing with food waste, hospitality operations and digital waste-management technology were used. Such sources gave a wider theoretical and empirical frame of reference in which the case-study results were analyzed.

Data Analysis

Interpretation of qualitative data in the interview transcript was conducted through the QDA Miner Lite software. The axial coding method was used to group original codes into interconnected themes and one could find the relationships amongst themes. Seven common themes emerged in the two interviews. The visualisation of the word-cloud was created as well to emphasize most common concepts and strengthen the patterns.

Reliability and Validity

Triangulation method was used to strengthen the credibility of the case study through the comparison of the interview results with the information obtained in the literature review. Coding consistency was realized by redistributing the transcripts to be coded and refining coding categories. Even though the case study is not supposedly statistically generalisable, it offers analytical generalisation by associating empirical findings with the existing theories and models of food waste management.

Ethical Considerations

The process of conducting research was followed by ethical regulations. The process was voluntary, and the informed consent of both participants was taken. All the data were de-anonymised and the data collected was utilized solely in the academic context.

Anonymity and Confidentiality

To protect the confidentiality of the participants, the participants of the current case study were anonymised. Person X and Person Y are the two interviewees who are constantly referred to. All such identifiers that referred to their particular roles, work places or organisational affiliations were excluded or generalised to avoid identification. Similarly, the digital waste-management application, which is mentioned in the interviews, was not denoted by a specific name, as it was rather called a digital inventory and waste-management system. This was to maintain the business confidentiality and to focus the focus of the study on the business capabilities and effects of the technology, as opposed to

propagating or criticising particular brands. The data in all the interviews was stored in a secure place and could only be accessed to serve academic purposes. The high level of ethical integrity and adherence to the set standards of qualitative research was ensured by anonymising all transcription, coding, and analysis procedures.

Analysis

Core Phenomenon	Category	Subcategories	Interview Evidence
Food Waste Impact	Financial Loss	Reduced margins, lost profit	Person X: "Less wastage = more profit"
	Operational Risk	Business instability	Person X: "Wastage can pull down a restaurant"
Causes of Waste	Over-ordering	Poor purchasing discipline	Person Y: "Over ordering is number one"
	Poor Forecasting	No historical data usage	Person Y: "People don't look at 3–6 months of data"
	Production Errors	Incorrect batch sizes	Person Y: "They make 10kg when they need 3kg"
Technology Use	Automation Benefits	Faster ordering, cost comparison	Person X: App A simplified supplier ordering
	Cost Visibility	Tracking food cost and waste	Both emphasize cost tracking
Technology Barriers	System Glitches	Software errors, limitations	Both mention glitches
	Complexity	Poor system setup	Person Y: "Rubbish in, rubbish out"
Human Factors	Staff Training	Skill and awareness gaps	Person Y: "80–90% don't know food cost"
	Accountability	Responsibility for waste	Person Y: chefs sign for mark-outs
Sustainability Approach	Collaboration	Supplier–platform–restaurant alignment	Person X: "150% important"
	Scale Dependency	Bigger businesses need systems	Both mention size matters

Theme 1: Food Wastage has a Direct Effect on profitability

The two respondents pointed out that wastage of food directly and quantifiably affects the profitability of a restaurant. Wastage is among the pillars that are crucial in an operation of food and beverages, as pointed out by Person X. He gave an example whereby a restaurant buys 1 kilogram of apples with a view of selling it at 6 AED but half of it goes to waste; therefore, the business has removed

any gains achieved on that product. Mr. Person X asserted that wastage in small proportions would impact negatively on the economic performance of a restaurant, and this reiterates the argument of the fact that, less wastage means a greater profitability. This was supported by Person Y who presented the waste of food in terms of the total revenue. He observed that the waste level of about 2 -2.5 per cent of total revenue is a general acceptable level in the restaurant market in Dubai. However, he also described that increased revenue can in many cases increase purchasing of raw materials, and as a result, the absolute quantity of waste increases. Herein lies the need to manage waste against sales instead of looking at the overall amounts.

Theme 2: Management of inventory as a Control point

The management of inventory proved to be an important control tool of minimizing the amount of food wastage. Person X explained that before moving to digital inventory system like App A, every inventory was tracked manually by use of excel spread sheets. The weekly inventory was conducted and compared to the point-of-sale (POS) sales data to predict food cost and the level of wastage. He also observed that food products were weighed prior to discarding them so that he could have a better scope on the level of waste. Conversely, Person Y emphasized structural flaws in the broader industry and said that 8090 percent of restaurants in the UAE did not have a clear idea on the actual costs of food. He stressed that the aspect of inventory management can be viewed as one of the most challenging operational activities in the hospitality industry because it is complex and time-consuming. Failing to do full accounting of inventory increases food waste that can be avoided.

Theme 3: Waste as a Failure in Forecasting and Planning

Weak forecasting and lack of proper planning were found to be one of the key factors to food waste. Person X gave the case of meat procurement where the suppliers supply the entire cut of beef which needs to be trimmed and cleaned. The process may lead to waste of up to 10 % which is an issue especially considering the high price of meat products. He stressed that even a small contribution to wastage reduction e.g. 7 per cent can result in significant cost savings in restaurants. Person Y did not give a particular example of how operation was handled; however, in his general remarks about inventory and cost control, there is the indication that inaccurate demand forecasting and over-ordering have not been new issues in the industry as they have an indirect and contributing impact on high levels of waste.

Theme 4: Technological and Digital Systems

Both interviewees accepted the fact that technology is increasingly becoming relevant in food waste management. Person X, the implementation of digital inventory and waste tracking systems has enhanced greatly the visibility of the usage of the stock, the level of wastage and the cost of the food. Digital systems made it possible to track and decide more effectively in comparison with manual ones. Equally, Person Y highlighted the importance of technology in the process of making the complex inventory processes less complicated. He proposed that digital technologies could minimize human mistakes, enhance the quality of data, and avail managers with real-time data, which would lead to a leaner and scalable approach to waste management, especially in high-volume restaurant settings.

Theme 5: Challenges in the Implementation of the system

Although there is the positive side in the use of technology, both interviewees showed the significant challenges in the implementation of new systems. Person X, the message was that after moving out of manual tracking systems to digital systems, it takes time, training, and optimization. Resistance by staff and learning curve with new software may slow the adoption. Person Y further supported this view by stating that the issue of implementation is a challenge in many restaurants because

of the absence of technical knowledge and reluctance to change. His focus was that unless there are suitable leadership, and well devised strategies of implementation, even well formulated systems can fail to provide their desired outcomes.

Theme 6: Training, Accountability and Human Factors

Human factors were noted to have a great impact in the levels of food waste. Person X also emphasized accountability of staff and said that reduction of waste only works when the employees are aware of the financial and operational impacts of their behaviours. Correct training assists personnel to control ingredients handling, portion management, and waste disposal measures. Person Y also stressed that a lack of training is also a common problem in the Dubai hospitality industry. He also observed how numerous personnel are only provided with the basic training, which is never enough to handle the complicated inventory or keep the right records on waste. To him, increased management control and constant training is a requirement in the reduction of waste in a sustainable manner.

Theme 7: Scale and Sustainability

Last but not least, the two participants spoke about the association between scale and sustainability. Person X noted that the absolute amount of food waste generally increases over time as the operation of a restaurant operations intensifies unless there are effective control systems. Nevertheless, he claimed that up-scaling operations also give a chance to introduce more innovative technological solutions that would enable to make operations more efficient and less waste-intensive. Person Y concurred with this opinion by saying that the more the businesses grow, the more sustainability grows. He stressed that the large scale operations should use waste minimization measures as part of their business models instead of viewing sustainability as a secondary consideration. This will not only contribute towards the environmental objectives but also increase the financial sustainability in the long term.

Figure 1: Word Chart

Figure 1 illustrates food waste as the central issue that comes out in the interview corpus. The interrelations among the inventories, cost, ordering, forecasting, and the supply chain are high, which shows that the key waste is originated during the planning, ordering, and tracking of the inventory characteristics within the food supply system. Point-of-sale systems, digital infrastructures, and software are all parts of technological artifacts that are on the rise, highlighting the importance of their critical part in waste management, and at the same time, experience repeatable system failures and barriers to implementation. The variables related to humans, i.e. staff, training, accountability and management, can

also be identified, which shows that the effective waste control is not only dependent upon the technological systems but also on the human organizational processes. The collective noun cloud is an indication of a strong linkage between operational efficiency, cost containment and reduction of food waste to food and beverage industry.

Conclusion

The problem of food waste in the restaurant business of Dubai is an eminent environmental, economic, and ethical issue, which has been exacerbated by the rapid development of the hospitality sector, the use of imported foodstuffs, hot weather, and the increasing demand for consumers. The existence of food safety systems like HACCP and programs like the Person in Charge (PIC) program notwithstanding, there exist incompetence in food demand prediction, portioning, storage and administration training, and management that promote too much waste. This study shows that AI-powered, IoT-powered, machine learning-powered, and data analytics wastage management application can provide a scalable solution to these issues. These applications allow tracking of wastes in real-time, predictive inventory management, expiry notifications, recipe optimization, and redistribution of food surpluses using their collaboration with food banks and shelters. The qualitative data also indicates that other reasons why restaurants are eager to use these technologies are cost-cutting, social responsibility, innovation, and reputation. Technological solutions are not enough though. It is necessary to integrate it with the existing food safety frameworks, enhance managerial training, promote the policy framework, and work with the managers throughout the hospitality value chain. Through the adoption of digital wastage management solutions as part of a circular economy process, the restaurant sector in Dubai can greatly decrease food waste, increase operational efficiency, and play an important role in the realization of Sustainable Development Goal 12.3. Finally, the food waste solution with technologies will make Dubai not only a world food destination, but also a pioneer in the field of sustainable hospitality.

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