

SUSTAINABILITY DIMENSIONS IN CLOUD KITCHEN OPERATIONS: A LITERATURE REVIEW

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Abstract

The fast development and proliferation of cloud kitchens have transformed the food service business across the globe by adopting digital technologies and delivery-based business models. However, academic attention to the sustainability prospects of this new industry has been increasing in the last few years. The paper will give a detailed literature review of the sustainability in cloud kitchen operations literature that involves the social, environmental, and technological sustainability in cloud kitchen operations using scholarly articles published within the last ten years (2015-2026). The review makes conclusions based on various scholarly articles, reports, and empirical studies to acquire knowledge about how sustainability practices impact the operations effectiveness, welfare of stakeholders, and the business sustainability in the cloud kitchens. The social sustainability aspects include employee welfare, working conditions and quality of customer service as compared to environment sustainability which is sustainable packaging, reduction of waste and responsible sourcing of food ingredients. Technological sustainability aims at the utilisation of digital platforms, automation, data analytics, and artificial intelligence to improve the functioning of the operations and optimisation of resources. The review determines the emerging trends, gaps in research, and future perspective in the evolution of sustainable cloud kitchens.

Keywords:

Cloud Kitchen, Sustainable development, Food Service.

INTRODUCTION:

The fast evolution of the food service business has given way to the creation of the cloud kitchen, or ghost kitchen, or virtual kitchen. These are technology-driven food production units that do not have a traditional dine-in facility but mostly concentrate on online food delivery services. The rise in demand of convenience, online booking systems and economical business models has played a key role in the expansion of cloud kitchens especially in urban areas like Mumbai and Pune. The growing role of a sector makes it even more critical to

explore the ways in which the principles of sustainability can be applied to the work of cloud kitchen to guarantee the long-term sustainability and responsible business activities.

Food service industry is a notion that has numerous aspects like social sustainability, environmental sustainability and technological sustainability. Social sustainability refers to the act of promoting employee welfare, customer satisfaction, ethical practice of labour and communal involvement. The fair working conditions, safety of the workers, and quality of the services are also significant factors when applied to the cloud kitchens as they are the ones that guarantee customer loyalty and organizational reputation. Environmental sustainability has to deal with making sure that the ecological footprint of the business operation is kept to minimum. Such issues as sustainable packaging, waste disposal, energy conservation, and sustainable sourcing of food materials are all becoming topical as the food delivery services lead to great amount of packaging waste and carbon emissions.

Technological sustainability is the other crucial dimension which has influenced the success and effectiveness of the operations of cloud kitchen. The application of digital technologies, such as online ordering system, data analytics, artificial intelligence, use of automated kitchen system, and inventory management software has transformed the cloud kitchen ecosystem. These technological innovations make the operations more efficient and enjoyable to customers as well as aiding in the optimization of resources and cost reduction.

Because of the greater relevance of sustainability in the modern business processes, the ways in which social, environmental and technological factors could interrelate in the cloud kitchens, should be investigated. The review of literature will be carried out in an extensive manner to determine the current trends in research, theoretical methods, and empirical researches on the operations of cloud kitchen regarding sustainability practices. The synthesis of the past study will assist the review to provide a more insightful perspective on the aspects of sustainability

in the cloud kitchen business and highlight the areas where more academic studies should be carried out.

RESEARCH OBJECTIVES:

To review the existing literature on social sustainability practices in cloud kitchen operations.

To examine the environmental sustainability initiatives adopted by cloud kitchens as reported in prior studies.

To analyse the role of technological innovations in enhancing sustainable operations in the cloud kitchen ecosystem.

REVIEW OF LITERATURE:

LITERATURE REVIEW ON SOCIAL SUSTAINABILITY PRACTICES IN CLOUD KITCHEN OPERATIONS:

The main aspects of social sustainability in the cloud kitchen business include employee welfare, fair labour practices, work safety, customer satisfaction, and ethical business practices. The literature that exists creates an emphasis on the fact that cloud kitchens are very reliant on human resources, including the kitchen staff, delivery partners, and support personnel. Research has highlighted the need to give employees fair wages, good working hours, safe kitchen conditions, and training opportunities. Also, keeping the customers by the quality preparation of food, hygiene and clear service delivery also constitutes an important part of social sustainability. The analysis of past studies facilitates the comprehension of the benefits of social sustainability practices on employee satisfaction, higher service quality, and organisational stability in the long run when operating a cloud kitchen business.

Recent studies show that the environmental impact can be reduced through switching to recyclable, compostable, or bio-based materials instead of conventional ones, depending on the practical end-of-life management, such as the collection and sorting infrastructure. When using off-premises food services, the material selection influences the waste results and also has to meet the functionality requirements (including heat resistance and leakage control). To be effective, the so-called sustainable materials should be able to meet the performance criteria and align with the current recovery systems, otherwise they can become a source of landfills and downcycling as a result of contamination.

The research on the reusable food-packaging systems shows that the positive effect on the environment will depend on the repeated cycles of use that will reduce the effects of production, and the effective reverse logistics. The adoption rates are enhanced when the operational difficulties are minimized by easy deposit-return systems, uniform container formats, and precise incentives, as well as strong food-safety guarantees. In cloud kitchens, the

emphasis is made on the system design, coordination with partners, cleaning standards, and consumer engagement, instead of simply switching materials.

Light weighting is linked to the use of fewer materials and less transport emissions, but it may jeopardize the level of protection, resulting in more food waste. Recent research recommends the use of a multi-criteria approach, a carbon footprint optimization, a barrier performance and durability, and recyclability. In cloud kitchens, the strategies of preserving the integrity of products, including right-sizing, material replacement, and mono-material simplification, are more suitable compared to aggressive down-gauging that can lead to leaks, destruction, or loss of heat.

Food-delivery packaging studies point at the significance of such a functional performance as leak-proofing and thermal retention in satisfying customers and staying sustainable. Packaging failures may result in wastage and returns. Design-oriented scholarship focuses on how sustainability is about good containment and hygiene, and how seals and materials can be improved to reduce spillage and contamination. In the case of cloud kitchens, the use of leak-proof and food-safe packaging is an important tool in order to promote sustainability because it will result in a less wasteful and more efficient delivery process.

Supplier level environmental certification is a governance tool that aims at standardizing sourcing, process controls and enhancement in the packaging supply chain. The ISO 14001 is standardly employed as a benchmark to the environmental management systems, which improves supervision, records, and supplier responsibility, which are highly significant in cloud kitchens in outsourced packaging procurement. The certification enhances traceability and reduces inconsistency in environmental performance, particularly in conjunction with buyer audits and quantifiable KPIs such as recycled content and responsible forestry.

Clearly, the problem in the packaging disposal behavior has been caused by confusion of the consumers to the symbols of the recyclability, contamination regulations, and sorting procedures in the localities. It has been shown that giving clear, consumer-focused instructions, like straightforward directions and uniform labels, increases sorting accuracy and reduces wish-cycling. In the case of cloud kitchens, to enhance recovery rates, a disposal guidance should be included in the packaging design and customer feedback, using QR codes and icons, as it can enhance the credibility of the environmentally-friendly practices, especially when the material has certain disposal needs.

Recent literature suggests that the decision on

sustainability in off-premises food services is a trade-off between cost and functional performance and environmental performance. A study of food-packaging circular economy shows that restaurants and consumers consider the convenience and functionality in relation to their readiness to pay more on greener alternatives. Also, life cycle assessment (LCA) studies indicate inconsistency in outcomes depending on assumptions and situations. In the case of cloud kitchens, and the need to manage the cost-eco trade-off, portfolio design is a successful approach that emphasizes meaningful changes and stable unit economics and customer experience to be adopted over time.

Local and seasonal sourcing is considered to be one of the ways to minimize food-miles and improve the short supply chains as it will positively impact the environment and local populations. To have meaningful sustainability, cloud kitchens should have a clear definition of local, include seasonal foods in the menu, and procurement in line with demand forecasting. Any inefficiencies in the last-mile delivery or emergency sourcing can undermine the gains. Systematic reviews indicate that the use of the term local + seasonal can have an effect on sustainability, but the results vary depending on multiple factors including production strategies and transportation, and thus valid sustainability claims require a strong measurement

The diet-related emissions, land use, and biodiversity pressures associated with higher plant-forward ingredient ratio with reduced red meat and dairy are connected, so a higher proportion of plant-based ingredients could be an effective environmental strategy of cloud kitchens. This is also the method that entails procedures such as procurement strategy such as utilization of diversified plant proteins and creation of vegetarian meals to enhance environmental performance and stabilize costs. Nevertheless, sustainability cannot be assured, but depends on the processing intensity and the sourcing geography. The most successful results are provided by the combination of plant-forwarding and local sourcing with waste-cutting strategies in the cloud kitchens.

Sustainability certification such as Rainforest Alliance and fair trade are reliable indicators of regulated environmental and social undertakings, which help cloud kitchens by improving the supply chain visibility. Such certifications can improve information asymmetry and create a culture of responsible procurement; however, their success depends on the level of adoption, the strength of audits, and traceability. In the case of cloud kitchens, the incorporation of certifications into the vendor selection requirements, regular verification of the suppliers and the reporting should be integrated as a key element to guarantee quantifiable effects.

THE ENVIRONMENTAL SUSTAINABILITY INITIATIVES ADOPTED BY CLOUD KITCHENS AS REPORTED IN PRIOR STUDIES

The activities of cloud kitchens in environmental sustainability are aimed at minimising the environmental impact of the food preparation and delivery processes. The literature emphasises the use of sustainable packaging materials, waste management programs, low-energy-consuming kitchen appliances, and responsible sourcing of ingredients. Numerous studies indicate that the increasing amount of food delivery online has contributed greatly to the consumption of plastic wrapping and food waste. Consequently, cloud kitchens are embracing environmentally friendly packaging, recycling, and energy-saving processes in order to reduce environmental degradation. The analysis of available literature will give an idea of how environmental sustainability practices are applied and how they help mitigate carbon footprints and ensure responsible resource use in the cloud kitchen business.

The concept of carbon-footprint awareness in sourcing is to convert green intent into actions that are measurable, e.g. by choosing the low-impact ingredient and asking suppliers to disclose their emissions. Cloud kitchens are vulnerable to lack of consistency in measurement because of the different datasets and accounting procedures. The literature of the past points out that it is necessary to have distinct scope and rules, and the recent research in hospitality proves that well-presented carbon information can affect consumers, depending on how information is framed and how much consumers trust the information.

Prep-stage waste is aimed at reducing the losses in food prior to delivery to customers; this is achieved by addressing the problems of waste and spoilage including poor FIFO/FEFO, over-preparation, and poor demand forecasts. The process design is closely related to the effective waste reduction in cloud kitchens which involves the standardized prep yields, batch sizing and better inventory management. It has been demonstrated that proper storage practices, production planning and operational discipline is of paramount importance in improving waste results. With the combination of these ideas and cloud kitchen forecasts, the environmental performance can be enhanced by managing the waste under control.

Ethical procurement is an umbrella concept of sourcing that involves labor, fairness, anti-corruption and responsible supplier conduct, especially in fragmented food supply networks. The ISO 20400 is a guidance outline to incorporate sustainability in procurement practices, which in the case of cloud kitchens is creating supplier codes of conduct, risk-based due diligence, grievance pathways, and

contract clauses that deal with traceability, labor standards, and environmental compliance. The literature recommends that to use the standards effectively, they should be embedded in the procurement activities including supplier onboarding, audits, scorecards, and corrective action plans instead of viewing them as policy documents.

Traceability of ingredients in cloud kitchens helps to improve the capacity to check the origin of the product, minimize fraud risks, expand the possibility of recalling, and sustainability claims. This is maximized by end-to-end tracking, digital documentation, standard labelling, and verification of suppliers. According to research, traceability as a tool of governance is effective at monitoring and compliance especially in case of cloud kitchens collaborating with aggregators because it helps to address reputational risk by facilitating open communication and quick response to incidents.

The health-oriented menu design will increase the social sustainability by upgrading the quality of the diet and availability of healthier food in accessible dining spaces, especially cloud kitchens. This includes reformulation of meals to reduce sodium and sugar, healthful defaults, labeling and choice architecture to promote balanced meals. Guidelines regarding the public health support diversity, moderation, and nutrient sufficiency and combining it with evidence-based menu engineering can strengthen the legitimacy and avoid health-washing statements.

Ingredient and allergen disclosure is highly relevant to social sustainability as it improves consumer protection and confidence, especially in the case of delivery, where the interaction with staff is not involved. Studies have shown that there is inconsistency in the disclosure of allergens on restaurant menus and this reveals safety and inclusion problems. Regulatory advice, such as FDA allergen labeling, establish standards of clarity, and there is evidence to support structured methods of disclosure such as icons, ingredient lists and warnings on cross-contact in addition to staff training on recipe modification.

Culturally inclusive menus improve social sustainability as they respect the many identities and allow the incorporation of the wider community. This inclusivity can be fulfilled in cloud kitchens by the use of modular menus and customizable options, which will make sure that different cultures are represented. It has been shown that this inclusiveness creates a sense of belonging and contentment which can make customers loyal and refer to others favourably.

Social sustainability is determined by affordability and accessibility that influence the fairness of the food service

benefits allocation. In cloud kitchens, the prices and delivery charges may foster or enhance exclusion. Accessibility is regarded as a multidimensional concept, implying that the kitchens must track the affordability with the help of metrics and develop the accessible bundles outside of short-term discounts.

THE ROLE OF TECHNOLOGICAL INNOVATIONS IN ENHANCING SUSTAINABLE OPERATIONS IN THE CLOUD KITCHEN ECOSYSTEM

Technological innovation is extremely important in enhancing operational efficiency and sustainability in cloud kitchen ecosystems. According to literature, online ordering systems, artificial intelligence, data analytics, computerized inventory management, and online payment systems are some of the technologies that have revolutionized cloud kitchen management. The technologies are used to optimize demand forecasting, minimize food wastage, better inventory control, and customer service. Also, online services allow the effective interaction between the kitchens, delivery partners, and customers. Using the analysis of the past research, one will be able to comprehend how technological progress helps to maintain the sustainable functioning of the business and how it could enhance its productivity and generate a competitive edge of the cloud kitchen business in the quickly changing digital food service market.

Responsible marketing claims result in social sustainability because they eliminate deception and safeguard the interest of the population, especially the health and environmental claims. The greenwashing effect can occur in the food industry when the words such as ecological, natural, or even healthy are not supported by evidence. False advertising influences the perception of consumers and leads to regulatory actions. Best practices involve compliance frameworks and internal process of substantiation of claims to make them credible.

Portion control improves health by helping customers to regulate energy consumption and develop healthier eating patterns, especially where delivery scenarios are involved where the portion size can get bigger. It is found that increased portions result in increased intake, so the idea of portion-size regulation with standard sizes, smaller defaults, and clearly available information- is an efficient social sustainability instrument. Considerable designing of portions in cloud kitchens also helps reduce wastes and make them cost effective, which adds to its contribution to cross-dimensional sustainability as well as nutritional profiling and comprehensible menu descriptions.

Customer co-creation boosts social sustainability by increasing the voices of the stakeholders, creating a sense of perceived fairness, responsiveness, and inclusion. This

is accomplished in cloud kitchens by means of data-driven iteration and organized participation procedures such as feedback loops. The theory of co-creation focuses on the role of interaction in value creation, and recent research has helped to refine the mechanisms of this theory as well as to define it in terms of distinguishing between it and customization and to model it as a quantifiable phenomenon.

Social sustainability is a fundamental aspect that requires fair pay and benefits, which play an important role in influencing the living standards, retention and dignity of workers, especially the food-service sector. The monitoring of wages in the world indicates that workers perceptions of fairness and job security are influenced by real-wage pressures, inequality and the expenses of living. Well-thought-out pay structure and stable benefits are very important in cloud kitchens, where profit margins are low, and keeping the workforce stable and preserving the reputation of the employer is vital.

Social sustainability depends on safe working conditions, especially in such a setting as production-style kitchens where the problem of occupational hazards affects the wellbeing of workers and business sustainability. Safety governance is not just about compliance, it is a strategic way of reducing absenteeism, turnover and reputational risks. The ideal occupational health and safety (OSH) systems are concerned with identifying hazards, training, reporting incidents and the creation of preventive culture. The use of standardized operating procedures, protective equipment, and safety audits in cloud kitchens that value speed and volume as a risk factor would help in fostering the social sustainability.

Training and upskilling increase social sustainability through an increase in employability, quality of jobs and internal mobility coupled with a regularity in the quality of food and services. Structured training in hospitality is associated with better performance and capability in technological changes. In the case of cloud kitchens, micro-learning and standardized modules are essential to effective onboarding and mistakes minimization. Furthermore, upskilling also creates equity by creating prospects of growth, which helps in employee retention and also increases the feeling of organizational support.

The practices of workload and scheduling are important to social sustainability, affecting such variables as fatigue and work-life balance. High stress and turnover of staffs in the kitchen: High stress and staff turnover can occur in delivery-oriented kitchens when the variable demand is not controlled. The hospitality industry suggests that burnout and job commitment can be mitigated by providing stable schedules, sufficient breaks, and considerate work shift

planning. In the case of cloud kitchen, aligning the staffing to the projected demand and establishing achievable throughput objectives are the essential tactics of improving the welfare of the employees as well as their sustainability.

Value creation in the cloud kitchens depends on the welfare of delivery partners to mitigate the risks associated with road safety and lack of income stability. Last-mile delivery workers should be taken into consideration in social sustainability. A decent work entails decent payment, clear contracts and grievance provisions. Coordination of ethical work with aggregators is a way to be less stressed and gain service reliability.

Diversity and inclusion contribute to higher social sustainability through the reduction of discrimination, promotion of fairness, and expansion of opportunities of underrepresented populations. Psychological safety and employee retention in service-based industries such as cloud kitchens is achieved through inclusive HR practices such as equal hiring and anti-harassment policies. Also, D&I plays a crucial role in multi-lingual and multi-cultural teams, as it facilitates communication and conflict resolution, which eventually helps to promote the employer branding within competitive talent markets.

Grievance redressal is a social-sustainability tool by ensuring that workers can have good and secure channels of reporting their grievances like wage differences, harassment and unsafe working conditions without the fear of reprisal. Responsible-business guidelines recommend open, confidential and efficient mechanisms of handling complaints. Formal grievance systems can promote well-being and minimize latent conflict in cloud kitchens, where worker voice may be discouraged by speed and hierarchy, thereby reducing turnover, employee turnover, and reputational harm. Effective grievance systems also assist in constant improvement as they focus on the pain points and shape the training priorities.

TABLE: LITERATURE REVIEW WITH KEY FINDINGS SUMMARISED ACADEMICALLY

Key Author (Year)	Key Findings
Camps-Posino & Batlle-Bayer (2021)	The paper emphasises that environmental impact in food delivery services can be minimised through sustainable packaging materials like recyclable or bio based substitutes. Nevertheless, they can only be effective when they are compatible with the available waste collection and recycling systems. Cloud kitchen delivery packaging requires proper material selection in order to be functional, heat resistant and leak proof.
Versino, Ortega & Monroy (2023)	Studies focus on the fact that sustainable food packaging should strike a balance between environmental performance, and practical needs like durability and leakage protection. The paper recommends that the packaging materials used should be in accordance with the local recycling systems, otherwise, the materials would be disposed in landfills as a result of contamination or absence of proper waste management facilities.
Yadav, Silvenius & Katajajuuri (2024)	Food packaging systems that are reusable have the capability to dramatically decrease the environmental effects in case of effective reverse logistics and recycling. The adoption rates are enhanced by the deposit-return systems, standardized container designs, and incentives. In cloud kitchens, it is important to work with logistics partners and involve consumers to implement them successfully.
Silva & Molina-Besch (2023)	Lightweight packaging can lead to the decrease of material use and emissions during transportation but can affect the product protection, which can cause the increased food waste. To control the quality of products in the process of food delivery operation, the authors suggest a multi-criteria method to balance carbon footprint, recyclability, and durability.
Dolci, Dominici & Fantin (2024)	The use of sustainable packaging plans must focus on the integrity of the products and food safety in delivery. Right-sizing, mono-material packaging and material substitution are some of the techniques that can enhance sustainability without reducing the performance of packaging or raising the chances of product damage.
Turan et al. (2024)	Such functional packaging as leak-proof closure and thermal retention are critical in minimizing the food waste and customer satisfaction. The research points out that the problem of packaging failure during delivery may result in waste, operational inefficiency in cloud kitchen enterprises.
Yokokawa et al. (2021)	Studies on the design of food-delivery packaging show that a better sealing system and hygienic material can be used to prevent food contamination and spillage. These enhancements increase operational efficiency and make it sustainable by minimizing the product losses and returns.
Arana-Landín & Heras-Saizarbitoria (2025)	Certifications on environmental management like the ISO 14001 enhance transparency and accountability in the supply chain. In the case of cloud kitchens who purchase packaging packages through the services of third parties, the certifications are useful in standardizing their environmental practices and enhance their ability to monitor sustainability performance.
Norton, Oloyede & Lignou (2023)	Misunderstanding of recycling labels and waste disposal rules among the consumers contributes a great portion to the packaging recovery rates. Digital instructions like QR codes, standardized symbols, and clear labeling can help to increase compliance levels among the consumer and improve environmental sustainability in food delivery services.
Allison et al. (2024)	Research reports on the disposal behavior of packaging indicate that consumer education is an important aspect in enhancing the accuracy of waste sorting. Easy labeling systems and clear instructions minimize contamination of recycling streams, and enhance the believability of sustainability efforts that have been implemented by food service providers.

Cruecha-Em, Hossain & Nuansri (2025)	Sustainability in food services decision-making entails the choice between the environmental performance and operational costs/convenience to customers. The strategy of a circular economy in packaging can enhance sustainability, yet it requires the affordability and functionality of the packaging strategies in practice.
Bher & Auras (2024)	The Life-cycle assessment studies have shown that, environmental advantages of sustainable packaging are conditional on the operational circumstances and supply chain variables. Sustainability strategies based on portfolios enable cloud kitchens to implement green packaging solutions without putting the economic sustainability at risk.
Vargas, de Moura & Deliza (2021)	Local and seasonal sourcing decreases the food miles and improves the local chain of supply. Sustainability gains are however conditional on effective logistics and proper demand forecasting. Cloud kitchens need to be keen on how they source strategies so that they can be assured of real environmental change.
Food and Agriculture Organization (2024)	The FAO studies emphasize the need to have sustainable food systems and responsible sourcing practices to minimize environmental effects. Local sourcing, seasonal foods and sustainable production are some of the ways of enhancing sustainability in food supply chains.
Poore & Nemecek (2018)	International studies indicate that plant-based food systems have a significant impact on greenhouse gas emissions, land use, and the loss of biodiversity in relation to meat-based food systems. Cloud kitchens could enhance environmental sustainability through the implementation of vegetarian approaches to menus and diversified sources of proteins.
Carey et al. (2023)	Plant-based and sustainable sourcing menu innovations are used to minimize the environmental footprints, but remain cost-effective. Plant-based menu strategies coupled with waste reduction initiatives increase sustainability performance of food service businesses.
Wenda & Nken (2024)	Sustainability standards like Rainforest Alliance and Fair Trade increases the transparency and accountability in procurement in the supply chains. The certifications assist cloud kitchens in achieving ethical sourcing as well as enhancing consumer confidence in sustainable food processes.
Wiedmann & Minx (2008)	The measurement of carbon footprint gives a guideline that helps in assessing environmental effects of sourcing and food production. Carbon footprint accounting of procurement decisions can be used in cloud kitchens to facilitate environmentally friendly sourcing strategies of ingredients.
Tomaszewska et al. (2024)	The minimization of food waste at the preparation phase is a key factor in enhancing food service operations sustainability. The effective management of inventory, demand prediction, and standardised production processes greatly minimise wastage and enhance efficiency in operational processes in cloud kitchens.
Fajriah et al. (2025)	The discipline in operations and storage strategies are very important in reducing food spoilage and food waste in food preparation setting. Data-based demand prediction together with inventory management systems is an approach that improves the environmental performance of cloud kitchens.

RESEARCH GAP

The available literature on cloud kitchen is rather one-sided in terms of market expansion, customer ordering patterns and rivalry in the platform and there is a relative lack of interest in what factors contribute to operational sustainability. Literature that addresses the issue of sustainability is predisposed to focus on environmental or technological concerns specific to it, however, the welfare of the workforce, packaging responsibility, sourcing discipline, and digital capability are not brought to an integrated model. Moreover, the emerging markets such as India lack empirical studies, yet platforms dependency and proliferation of cloud kitchen is high in the region. There are few studies that apply primary data and strong statistical validation to research the impacts of such operational practices on the different dimensions of sustainability. In addition, the interaction between people-oriented practices and technology-based operations is not well researched. The paper addresses these gaps by developing and empirically testing a unified framework, which links welfare, packaging, sourcing, and technology adoption with social, environmental, and technological

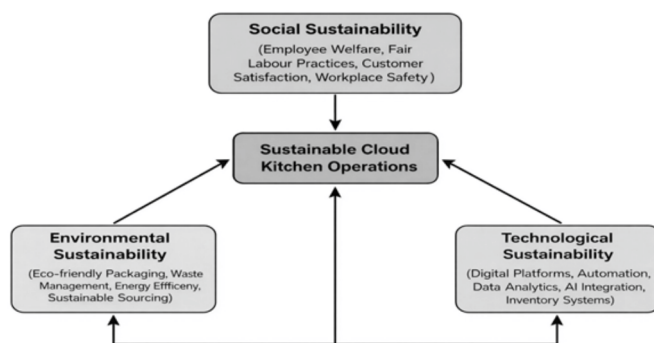


FIG: CONCEPTUAL FRAMEWORK

REFERENCES

- Advertising Standards Authority. (2025). Less healthy food and drink: Advertising guidance, <https://www.asa.org.uk/resource/less-healthy-food-and-drink-advertising-guidance.html>.
- Allison, A. L., et al. (2024). Label-based interventions and waste-sorting accuracy: Evidence and implications for sustainable disposal (article). *Frontiers in Sustainability*, <https://doi.org/10.3389/frsus.2024.1376519>.
- Arana-Landín, G., Heras-Saizarbitoria, I. (2025). ISO 14001 and environmental performance outcomes: A meta-analytic or synthesis-based evidence update (article). *Corporate Social Responsibility and Environmental Management*, <https://doi.org/10.1002/csr.2994>.
- Aroonsrimorakot, S. (2024). ISO 20400 guidance standard for sustainable procurement: Concepts and implementation insights. *Journal of Thai Interdisciplinary Research (or linked journal source)*, <https://ph02.tci-thaijo.org/index.php/jtir/article/view/251911>.
- Aung, M. M., & Chang, Y. S. (2024). Traceability in food supply chains: Mechanisms and control outcomes. *Food Control*, 153, 109725, <https://doi.org/10.1016/j.foodcont.2023.109725>.
- Bellows, A. L., et al. (2024). Environmental sustainability of food environments and implications for healthy choices. [Journal in PMC], <https://pmc.ncbi.nlm.nih.gov/articles/PMC11263746/>.
- Bher, A., & Auras, R. (2024). Life cycle assessment of packaging systems: A meta-analysis to evaluate the root of consistencies and discrepancies. *Journal of Cleaner Production*, 476, 143785, <https://doi.org/10.1016/j.jclepro.2024.143785>.
- Camps-Posino, L., Battlle-Bayer, L. (2021). Potential climate benefits of reusable packaging in food delivery services: A Chinese case study. *Science of the Total Environment*, 794, 148570, <https://doi.org/10.1016/j.scitotenv.2021.148570>.
- Carey, C. N., et al. (2023). The environmental sustainability of plant-based dietary patterns: A systematic review. *The American Journal of Clinical Nutrition*, <https://doi.org/10.1016/j.ajcnut.2023.??>
- Carruba, M. O., et al. (2023). Role of portion size in the context of a healthy, balanced diet. *International Journal of Environmental Research and Public Health*, 20(6), 5230, <https://doi.org/10.3390/ijerph20065230>.
- Chartered Institute of Personnel and Development. (2024). Diversity and inclusion at work, <https://www.cipd.org/uk/knowledge/factsheets/diversity-inclusion-factsheet/>.
- Cruecha-Em, M., Hossain, M. J., Nuansri, A. (2025). Circular economy of food packaging: Cost and functional preferences of Thai consumers and restaurants in off-premises food services. *Sustainable Futures*, 9, 100754.
- Dolci, G., Dominici, A., & Fantin, V. (2024). How does plastic compare with alternative materials in the circular economy? *SAGE Publications (article)*, <https://doi.org/10.1177/0734242X241241606>.
- Elkington, J. (2018). 25 years ago I coined the phrase “triple bottom line.” Here’s why it’s time to rethink it. *Harvard Business Review*, <https://hbr.org/2018/06/25-years-ago-i-coined-the-phrase-triple-bottom-line-heres-why-im-giving-up-on-it>.
- Ertz, M. (2024). Co-creation. [MDPI journal article], <https://www.mdpi.com/2673-8392/4/1/12> (DOI shown on article page).
- Fairwork India. (2024). Fairwork India ratings: Labour standards in the platform economy, <https://fair.work/en/india/>.
- Fajriah, E., et al. (2025). Restaurant food waste management strategy in Asia: Focus on kitchen preparation phase. *BIO Web of Conferences*, https://www.bio-conferences.org/articles/bioconf/pdf/2025/04/bioconf_icnf2024_04006.pdf.
- Food and Agriculture Organization of the UN. (2024).

Sustainable food systems (topic portal/report resources), <https://www.fao.org>.

- Imran, N., et al. (2025). Exploring consumer behaviour on carbon-labelled food and the role of footprint awareness in food systems. [Journal on ScienceDirect], <https://www.sciencedirect.com/science/article/pii/S2666154325003084>.
- International Labour Organization. (2023). A call for safer and healthier working environments, <https://doi.org/10.54394/HQBQ8592> (<https://www.ilo.org/publications/call-safer-and-healthier-working-environments>).
- International Labour Organization. (2024). Safety and health at work, <https://www.ilo.org/topics-and-sectors/safety-and-health-work>.
- International Labour Organization. (2024). Global wage report 2024–25: Is wage inequality decreasing globally?, <https://doi.org/10.54394/CJQU6666> (https://www.ilo.org/sites/default/files/2024-11/GWR-2024_Layout_E_RGB_Web.pdf).
- International Organization for Standardization. (2023). ISO/IEC 20000-1: IT service management systems Requirements, <https://www.iso.org/standard/70636.html>.
- Koytak, H. Z. (2024). Ethnicity on the table: A content analysis of online reviews for dining experiences. *Sociology Compass*, <https://doi.org/10.1111/soc4.13195>.
- Liu, B., et al. (2025). A systematic review of food accessibility in food supply chains. [Journal on ScienceDirect], <https://www.sciencedirect.com/science/article/pii/S2949863525000494>.
- Long, J. W., et al. (2023). Portion size affects food selection and intake. *Appetite*, <https://www.sciencedirect.com/science/article/abs/pii/S019566632302514X> (DOI listed on article page).
- Nahle, R., et al. (2025). Food allergy labelling and disclosure practices on restaurants' online menus in Toronto, Canada. *Journal of Food Protection*, <https://doi.org/10.1016/j.jfp.2025.100533>.
- Norton, V., Oloyede, O. O., Lignou, S. (2023). Understanding consumers' sustainability knowledge and behaviour towards food packaging to develop tailored consumer-centric engagement campaigns: A Greece and the United Kingdom perspective. *Journal of Cleaner Production*, 408, 137169, <https://doi.org/10.1016/j.jclepro.2023.137169>.
- Nowak, M., et al. (2024). Co-designing carbon label interventions in restaurants (shows how co-designed interventions depend on context and segments—relevant to inclusive menu communication). *Scandinavian Journal of Hospitality and Tourism*, <https://doi.org/10.1080/15022250.2024.2427776>.
- Nugraha, W. S., et al. (2024). Greenwashing in the food industry: A systematic review exploring the current situation and possible countermeasures, <https://www.sciencedirect.com/science/article/pii/S2666784324000603>.
- Organisation for Economic Cooperation & Development. (2023). OECD guidelines for multinational enterprises on responsible business conduct, <https://doi.org/10.1787/81f4b06b-en>.
- Organisation for Economic Cooperation & Development. (2023). OECD guidelines for multinational enterprises on responsible business conduct, <https://doi.org/10.1787/81f4b06b-en>.
- Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science*, 360(6392), 987–992, <https://doi.org/10.1126/science.aag0216>.
- Prahalad, C. K., & Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. *Journal of Interactive Marketing*, 18(3), 5–14, <https://doi.org/10.1002/dir.20015> (or ScienceDirect record: <https://www.sciencedirect.com/science/article>).
- Saito, H., Ruhanen, L. (2024). Training in hospitality and tourism: A systematic review. *International Journal of Hospitality Management*, 114, 103955, <https://doi.org/10.1016/j.ijhm.2024.103955>.
- Saito, H., Ruhanen, L. (2024). Training in hospitality and tourism: A systematic review. *International Journal of Hospitality Management*, 114, 103955, <https://doi.org/10.1016/j.ijhm.2024.103955>.
- Silva, N., & Molina-Besch, K. (2023). Replacing plastic with corrugated cardboard: A carbon footprint analysis of disposable packaging in a B2B global supply chain—A case study. *Resources, Conservation and Recycling*, 191, 106871, <https://doi.org/10.1016871>.
- Silvennoinen, K., Nisonen, S. (2024). [Work systems and waste/operations linkages in food service contexts]. *Waste Management*, 176, 321–331, <https://doi.org/10.1016/j.wasman.2023.11.012>.
- Stangl, B., Woodside, A. G. (2024). Transferable skills in tourism and hospitality: A systematic review. *Annals of Tourism Research*, 106, 103751, <https://doi.org/10.1016/j.annals.2024.103751>.
- Tomaszewska, M., et al. (2024). Sustainable food waste management in food service establishments: Practices and determinants. *Sustainability*, 16(15), 6631, <https://www.mdpi.com/2071-1050/16/15/6631>.
- Turan, D., et al. (2024). Food packaging technology considerations for designers (review article). *Comprehensive Reviews in Food Science and Food Safety*, <https://doi.org/10.1111/1541-4337.70058>.
- U.S. Food and Drug Administration. (2025). Frequently asked questions: Food allergen labeling guidance for industry. <https://www.fda.gov/food/food-allergensgluten-free-guidance-documents-regulatory-information/frequently-asked-questions-food-allergen-la>, <https://www.fda.gov/food/food-allergensgluten-free-guidance-documents-regulatory-information/frequently-asked-questions-food-allergen-labeling-guidance-industry>.
- Vargas, A., de Moura, A., Deliza, R. (2021). The role of

local seasonal foods in enhancing sustainable food consumption: A systematic literature review. *Foods*, 10(9), 2206, <https://doi.org/10.3390/foods10092206>.

- Versino, F., Ortega, F., Monroy, Y. (2023). Sustainable and bio-based food packaging: A review on past and current design innovations. *Foods*, 12(5), 1057, <https://doi.org/10.3390/foods12051057>.
- Wenda, B. D. S., & Nken, J. (2024). Rainforest Alliance-UTZ cocoa certification scheme adoption: Determinants and financial implications for cocoa production in Cameroon. *PLOS Sustainability and Transformation*, <https://doi.org/10.1371/journal.pstr.0000115>.
- Wiedmann, T., & Minx, J. (2008). A definition of “carbon footprint” (working paper/book chapter version widely cited), <https://wiki.epfl.ch/hdstudio/documents/articles/a%20definition%20of%20carbon%20footprint.pdf>.
- World Health Organization. (2023). Healthy diet (fact sheet/guidance), <https://www.who.int/news-room/fact-sheets/detail/healthy-diet>.
- Yadav, P., Silvenius, F., Katajajuuri, J.-M. (2024). Life cycle assessment of reusable plastic food packaging. *Journal of Cleaner Production*, 448, 141529., <https://doi.org/10.1016/j.jclepro.2024.141529>.
- Yokokawa, N., et al. (2021). Design assessment framework for food packaging integrating consumer preferences and environmental impact. *Journal of Cleaner Production*., <https://doi.org/10.1016/j.jclepro.2021.128131>.

