

Sustainable Zero-Waste Kitchen Operations in Hotels: Leveraging Robotics, Artificial Intelligence, and Service Automation (RAISA)

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Abstract: Hotel kitchens, often the heart of food operations, generate significant amounts of waste and consume considerable resources, posing critical challenges to sustainability. This theoretical paper explores how Robotics, Artificial Intelligence, and Service Automation (RAISA) technologies can enable sustainable, zero-waste kitchen operations in the hotel industry. Through a narrative literature review, the paper identifies innovative RAISA tools such as AI-powered inventory systems, smart appliances, and robotic chefs that reduce food waste, energy use, and operational inefficiencies. Despite the potential of RAISA in hotel kitchens, not many hotels adopt RAISA. Key barriers to RAISA adoption, such as high costs, lack of training, resistance to change, and technological integration challenges, are critically analysed. This paper proposes two conceptual models: one positioning RAISA as an enabler of the triple bottom line: people, planet, and profit, and another advocating internal and external stakeholder collaboration for successful RAISA adoption. The paper concludes by highlighting the need for future research to empirically validate the environmental and financial impact of RAISA, develop new metrics, and create accessible business models. This work contributes to both theory and practice by linking RAISA adoption to the UN Sustainable Development Goals and offering practical roadmaps for hotel managers and policy-makers.

Keywords: Artificial Intelligence, Robotics, Service Automation, Sustainability, Zero-Waste Kitchen

1. Introduction

The tourism industry needs to embrace sound environmental management practices, and sustainability must be the primary driver of tourism growth (Hall et al., 2013; Simão and Partidário, 2012). The hotel sector is one of the most important sectors of the tourism industry; however, it is also a major energy, water, and waste-intensive sector in its day-to-day operations (Han et al., 2018). Within this context, hotel kitchens represent a vital focal point for sustainability challenges, contributing disproportionately to food waste, inefficient energy and water usage, and unsustainable procurement practices (Jones et al., 2016). Achieving zero-waste kitchen operations requires a holistic approach that minimises food waste, maximises resource efficiency, and optimises operational processes (Tatlısu and Torusdağ, 2025).

Technology and technological innovation are often viewed as vitally important in enhancing efficiency across the sustainability spectrum and in facilitating sustainable growth (Jones et al., 2017). Robotics, Artificial Intelligence, and Service Automation (RAISA) offer transformative solutions for driving zero-waste kitchen operations. Robotics can automate repetitive tasks such as chopping and cleaning with precision (Ivanov and Webster, 2017). AI-powered systems enable advanced inventory management, demand forecasting, and menu optimisation, minimising food waste and ensuring efficient resource use (Gössling, 2020). Additionally, service automation technologies, such as the Internet of Things (IoT) enabled smart appliances, facilitate real-time monitoring and control of energy and water usage, driving greater efficiency in kitchen operations (Milton, 2024). So, Industry 4.0 technologies can enable a shift toward more sustainable and streamlined operations, supporting the sustainability agenda (Ben Youssef and Zeqiri, 2022). However, the adoption of RAISA in hotel kitchens is not without challenges. Financial concerns frequently emerge as a common obstacle in implementing technological changes (Sandberg and Aarikka-Stenroos, 2014). Moreover, integrating RAISA into existing operations requires skilled personnel capable of managing advanced systems, posing a challenge to workforce development and training (Ivanov and Webster, 2018). Additionally, resistance to change, stemming from concerns about job displacement and the complexity of technological integration, further impedes adoption (Raina, 2023).

Drawing on academic literature, newspaper articles, and industry reports, this theoretical paper explores the potential of RAISA technologies to revolutionise hotel kitchen operations and drive zero-waste kitchens. In addition, the paper examines the barriers to adopting RAISA. This is followed by a discussion of the findings to propose a model that may serve as a motivation to leverage RAISA in hotel kitchen operations. To mitigate the barriers to the adoption of RAISA, we then present another model which proposes a synergy among the key

stakeholders to leverage RAISA adoption for driving zero-waste kitchens. The paper concludes by outlining the contribution of this paper and the scope for future research on this topic.

2. Methodology

We decided to opt for a non-systematic or narrative review because the topic of RAISA for zero-waste kitchens is under-researched. A narrative review was chosen over a systematic literature review (SLR) because, though an SLR follow a concrete, replicable methodology, it may often discard many more studies than narrative reviews (Pautasso, 2019). Several combinations of keywords relevant to our topic, including zero waste, hotels, kitchens, operations, technology, robotics, artificial intelligence, service automation, and sustainability, were used to search various databases, such as Web of Science and Scopus. Backwards and forward snowballing were used on the initially selected papers. Backwards snowballing involved uncovering more sources by examining the references of the initially found articles, while forward snowballing helped explore newer articles that have cited the initially found articles. This helped to expand the pool of references for this paper. Furthermore, newspaper articles, industry reports on the topic and information on the websites of various RAISA solution providers were utilised to write this paper. The two review questions were:

RQ1: What are the different RAISA-driven technologies used in hotel kitchens to drive zero waste and attain sustainable operations?

RQ2: What factors may act as barriers or deter hoteliers from adopting RAISA technologies for kitchen operations?

3. Findings

This section is divided into two parts. The first part focuses on the different types of RAISA-driven technologies being used in hotel kitchens, and the second part synthesises the barriers to adopting RAISA in hotel kitchens.

3.1 RAISA for Sustainable Kitchen Operations

There are many technological devices in kitchen areas (Rodgers, 2009). To minimise spoilage by effectively monitoring and managing food storage, there are smart refrigerators with temperature control that allow for precise temperature regulation, ensuring optimal storage conditions for various food items (Raheja et al., 2024). Smart refrigerators often come with inventory management features, enabling chefs to track stock levels and plan accordingly (Singh and Jain, 2016). Additionally, AI-powered inventory management systems can analyse historical data, seasonal trends, and real-time demand to optimise stock levels and reduce food waste (Mitta, 2024). These systems utilise AI and IoT (Internet of Things) technologies to monitor stock levels in real-time and automate the ordering process when predefined thresholds are met (Daugherty et al., 1999). Similarly, Automated shelf-life tracking systems utilise advanced technologies like RFID (Radio Frequency Identification) and barcode scanning to monitor the expiration dates of food items, ensuring that only fresh and safe ingredients are used (Uysal et al., 2011). This reduces the risk of foodborne illnesses and food waste (Kärkkäinen, 2003).

Sustainable gastronomy is defined as “cuisine that takes into account where the ingredients are from, how the food is grown, and how it gets to our markets and eventually to our plates” (Cole et al., 2023, p. 11). As sustainability becomes a core focus, AI systems can help identify and track the usage of eco-friendly or locally sourced ingredients, aligning procurement with green practices (Alzoubi and Mishra, 2024). Furthermore, automated food ordering and replenishment systems are transforming how hotels manage their supply chains, promoting a seamless farm-to-fork model, which emphasises traceability, local sourcing, and sustainable practices across the food supply chain from production to plate. This approach not only enhances freshness and quality but also supports environmental goals by reducing transportation emissions and food waste (Mishra, 2023).

AI-powered dynamic menu optimisation systems adapt menus for maximum efficiency and sustainability. For example, they can suggest menu modifications based on fluctuations in ingredient costs or supply chain disruptions, helping hotels maintain profitability without compromising quality. Furthermore, they incorporate personalisation features, allowing chefs to cater to specific dietary requirements or regional preferences, enhancing guest satisfaction (CalcMenu, 2024). So, they predict demand patterns and identify the most popular or profitable dishes, ensuring that menus are tailored to guest preferences while minimising operational costs (Sawert, 2020).

AI-powered food waste recognition systems utilise advanced algorithms to sort and classify waste efficiently, determining its suitability for composting or other sustainable processing methods. For instance, Winnow Solutions, a UK-based company, has developed a digital system for tracking food waste. There are two versions of the system: the original Winnow Classic system and a more recently upgraded Winnow Vision system. The Winnow Classic system comprises a digital scale and a connected digital tablet that are retrofitted on existing trash cans in commercial kitchens. Whenever food is thrown away in a trash can, the weight of the item wasted is automatically recorded. The user is then manually prompted to identify the item via an easy-to-use menu of options available on the tablet and select the reason for the waste. The upgraded Winnow Vision system eliminates the need to manually identify the items wasted. It includes a digital camera that is inconspicuously mounted over the trash can. Using modern AI/image classification algorithms, the system automatically identifies what item is wasted to complement the weight measurement. Food waste is automatically categorised, with little need for manual input. Overall, using Winnow systems, kitchens can easily measure and stratify their food waste down to the level of each disposal transaction, classifying waste as different items at different stages of preparation and processing. The collected data is made available to kitchen managers in daily, weekly, and monthly site reports. Kitchen managers also have access to a portal that allows them to dig deeper into the data and conduct further analytics (Nu et al., 2024).

Mobile apps like 'Too Good To Go' help hotel kitchens and restaurants reduce food waste by allowing them to sell their unsold food at a discounted price through the app. Customers can browse participating businesses, purchase surprise bags of food at a reduced price, and then collect their bags at a specified time. This not only helps businesses avoid throwing away perfectly good food but also provides customers with affordable meals.

3D food printing is a technology that uses a 3D printer to create food in various shapes and designs. In terms of sustainability, 3D printing of food generates less waste and requires fewer materials than traditional methods, making it a more environmentally friendly option (SavorEat, 2023).

Robotic chefs are revolutionising precision and efficiency in food production. Systems, such as Moley Robotics' automated kitchen, employ advanced machine learning and robotic arms capable of replicating the techniques of human chefs, including ingredient chopping, seasoning, and precise cooking (Barakazi, 2022). Miso Robotics' Flippy can cook 19 different food types (Ramirez, 2020).

Automated portion control systems fitted with sensors enhance sustainability by minimising food overproduction and waste through precise measurement, ensuring consistency in portion sizes that align with predetermined recipes and customer expectations.

Despite high levels of technological innovation, significant challenges persist in adopting new technology (Sigala, 2011). Some barriers to the adoption of RAISA found in the extant literature base are presented below.

3.2 Barriers to RAISA Adoption

RAISA technologies are associated with various financial costs (Ivanov and Webster, 2017). These include acquisition costs, installation costs, maintenance costs, software update costs, costs for hiring specialists to operate RAISA, and costs for training and insurance (Zhang et al., 2012). So, technologies that contribute to sustainability and reduce environmental impacts are also associated with the return on investment of these measures (e.g., Novacká et al., 2019; Dief and Font, 2012). In a survey of European hoteliers, Bohdanowicz (2005) found that the managers of chain-affiliated hotels were more likely to invest in environmental technologies than were independent operators. Small-scale service providers often face constraints in affording advanced technologies (Murphy et al., 2017), as the installation of technology typically requires substantial resources and space, along with significant initial setup and enhancement expenses (Zhang et al., 2012). Financial concerns frequently emerge as a common obstacle to implementing technological changes (Sandberg and Aarikka-Stenroos, 2014).

The implementation of automation technologies gives rise to concerns regarding potential job losses, where robots, AI, and other automation tools replace human workers (Dengler and Matthes, 2018; Li et al., 2019). For example, Robotic chefs are starting to replace human chefs in the restaurant industry (Zhu and Chang, 2020), so innovation and technological advancements introduce changes that can lead to the elimination of manual jobs and workforce redundancies, fostering resistance to such changes (Modrák and Šoltysová, 2020). Resistance to change by employees can hinder the advancement towards achieving a more intelligent workplace (Leung, 2019). Furthermore, the rapid expansion of AI-related technologies and their acceptance in the hospitality industry have exacerbated employees' anxiety, affecting employees' attitudes toward their jobs (Li et al., 2019).

The utilisation of RAISA technologies can heighten employees' perceived loss of autonomy (Barrett et al., 2015). This perception arises from the threat they feel as their expertise becomes increasingly overshadowed by the ever-evolving advancements in workplace technology. Consequently, they are prone to experiencing heightened levels of anxiety, sadness, and frustration (Gabriel and Pessl, 2016). Research has indicated that employees are more inclined to leave their jobs when they experience stress in competitive situations (Gim et al., 2015). So, Chui et al. (2015) argued that if companies persist in leveraging AI and robotics in the workplace, it may inevitably result in a potentially significant turnover rate across various occupations and industries. This ethical concern of job losses and churning may deter managers from investing in new technologies.

Another impediment to RAISA adoption listed in the literature is what is called the 'Vendor lock-in effect', which is the dependence of the customer (here, hotels) to a certain extent on a supplier (Sjoerdsma, 2016). When robotics components and software packages are not standardised and cannot be easily interchanged among manufacturers, the expenses associated with a hotel transitioning to a new robot supplier will rise. This could lead the hotel company to become locked into a vendor relationship and become overly reliant on a specific supplier (Simpson, 2019). So, the hotels may face a vendor lock-in situation when they rely on one particular robot supplier/manufacturer and cannot switch to another (Farrell and Klemperer, 2007).

Besides the high cost of installing and maintaining RAISA, the ethical concern of job losses, and the vendor lock-in effect, transitioning to a new data architecture necessitates overhauling legacy IT infrastructure (Shahid et al., 2019) and adhering to security and privacy policies (Tarafdar et al., 2019). Furthermore, obstacles to introducing new practices and technology may often emerge from limited management support and suboptimal organisational structures (Orzes et al., 2020). Many organisations lack a comprehensive AI strategy (Kruhse-Lehtonen and Hofmann, 2020), which is a great barrier to hotels' adoption of RAISA.

A shortage of competencies stands out as a major impediment to technology adoption (Rauch et al., 2020). To ensure data usability by AI applications, it's imperative to maintain a dedicated team of data scientists (Kar et al., 2021). Organisations face challenges in securing relevant talent within their region or struggle with budget constraints in attracting experienced AI specialists (Tarafdar et al., 2019).

Inadequate knowledge management may be another barrier to the adoption of RAISA because companies often encounter difficulties in implementing AI-based solutions due to their limited AI experience and knowledge (Pokorni et al., 2021). Inadequate knowledge may arise due to inadequate trainings to adapt the employees to their new job profile of collaborating, operating, controlling and monitoring automated technologies (Ivanov et al., 2020). Multiple trainings with flexible times are required to provide staff with new knowledge about technology systems (Tavitiyaman et al., 2022).

Hoteliers may also be discouraged by the relatively low level of guest interest in pro-environmental measures in hotel kitchens and restaurants, compared to their interest in sustainability initiatives within accommodation services (Han et al., 2020; Švec et al., 2023). This lack of engagement can act as a significant barrier to adopting RAISA technologies aimed at creating sustainable, zero-waste kitchen operations. Even when hotels invest in robotics, AI, and service automation to reduce food waste, optimise energy use, or implement circular practices, the impact is limited if guests do not participate or support these initiatives. For example, low guest willingness to accept smaller portion sizes, reuse meal packaging, or adapt to digital ordering systems can reduce the effectiveness of RAISA-enabled solutions and make hotels hesitant to fully implement them. Consequently, guest behaviour and expectations emerge as a critical external constraint, influencing both the pace and extent of RAISA adoption for sustainable gastronomy.

All the above and many other unreported barriers to the adoption of RAISA for sustainable kitchen operations may make the zero-waste kitchens look far-fetched, but we believe that an integrated collaborative effort by the various key stakeholders can make RAISA-driven zero-waste kitchens a reality even for small hotel owners. We propose two models for the same, which are being discussed.

4. Discussion

By maximising all three bottom lines (social, environmental, and economic), organisations are more likely to have a positive impact on the world (Elkington, 1994). Sustainability is frequently associated with three interdependent and mutually reinforcing pillars: social development (people), environmental concerns (planet), and economic growth (profits) (Aras and Crowther, 2013), as well as the UN Sustainable Development Goals (SDGs) (Alamouh et al., 2021). The use of RAISA within hotel kitchens can support all three pillars of sustainability: people, the planet, and profits, thereby driving a win-win situation for all stakeholders, including

hotel owners/managers and employees. For instance, Robotics can automate repetitive tasks such as chopping, cooking, and cleaning with precision (Ivanov and Webster, 2018), which can help improve working conditions for kitchen staff, thereby supporting the people or social pillar of sustainability. AI-powered systems enable advanced inventory management, demand forecasting, and menu optimisation, minimising food waste (Gössling, 2020), which can enhance profits and bolster the economic or profit pillar of sustainability. Additionally, efficient resource use through real-time monitoring and control of energy and water usage (Milton, 2024) can contribute to reducing carbon footprints and strengthen the environmental aspect of sustainability or the planet's realm of sustainability. Strengthening the social, environmental, and economic realms of sustainability by adopting RAISA may, in turn, support the United Nations Sustainable Development Goals (UNSDGs). Considering these factors, we propose a model for sustainable zero-waste hotel kitchen operations, which may serve as an enabler/facilitator/motivator to the hotels' adoption of RAISA. This model views RAISA as an enabler of zero-waste kitchens and visualises its strength in contributing towards the three pillars of sustainability and, thus, towards UNSDGs. This conceptual model is presented in Figure 1 below.

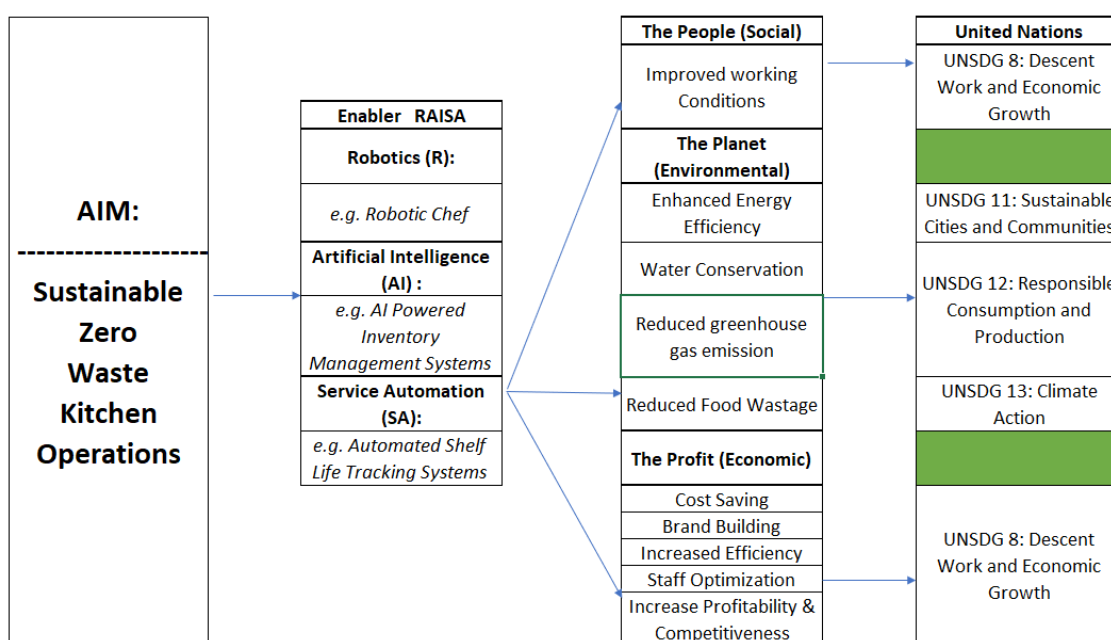


Figure 1: RAISA as an enabler to sustainable zero-waste kitchen operations

To address the barriers hindering the adoption of RAISA in achieving sustainable hotel kitchen operations, we propose fostering a synergistic relationship between internal stakeholders, such as hotel owners, managers, and employees, and external stakeholders, including government bodies, technology providers and the universities. Such collaboration is essential to drive concentrated efforts toward making zero-waste kitchens a reality for all hotels, including smaller hotels with limited resources. For instance, the internal stakeholders, such as hotel employees, should be receptive to changes and the upskilling or downskilling required to work alongside RAISA technologies. Hotel owners and hotel managers must provide all necessary support, including proper, timely training to their employees, to ensure that the introduction of RAISA does not cause any technological stress among employees. External stakeholders, such as Government bodies and policymakers, could play a pivotal role by offering financial incentives, such as grants or low-interest loans, to hotels seeking to implement RAISA technologies for sustainable kitchen transformations. Technology providers can offer free consultation and training programs on using and effectively integrating RAISA into kitchen operations. Lack of training and hardship in finding the right skill set to work with RAISA may be mitigated by efforts from the universities to revamp hospitality management curricula to include hands-on training with RAISA technologies. Figure 2 below illustrates this proposed model. In this figure, the yellow box represents the current level of adoption of RAISA, and the green box at the top represents the future level, which can be attained by synergy between internal and external stakeholders.

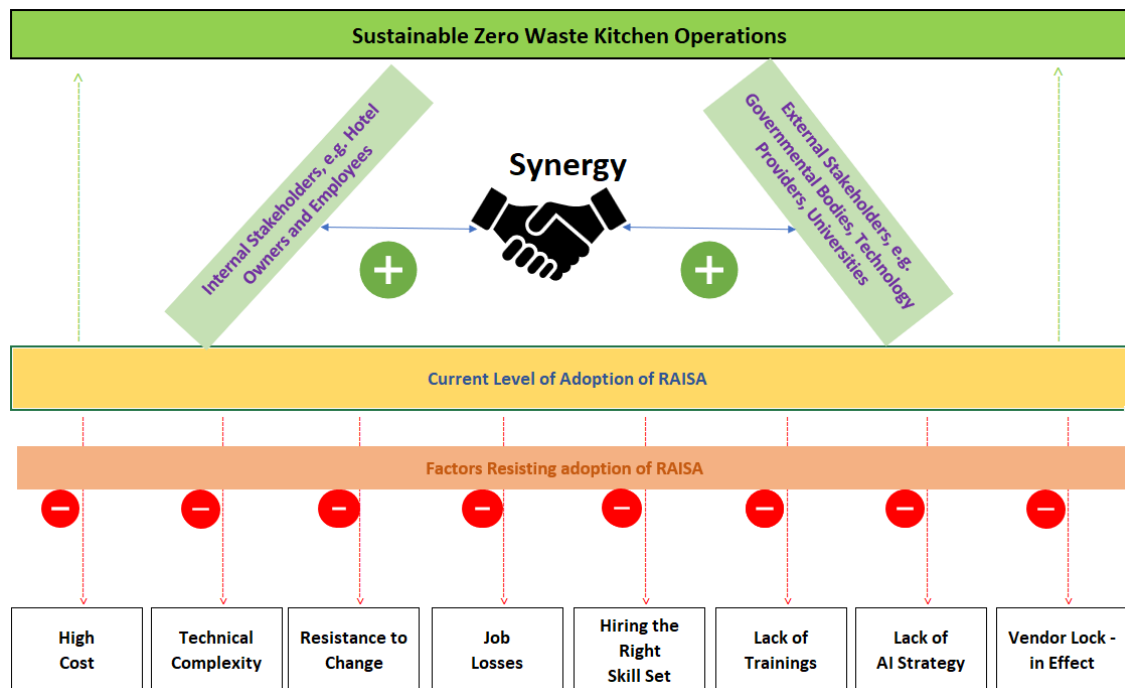


Figure 2: Synergy between internal and external stakeholders can facilitate RAISA adoption

5. Contributions

This paper makes several important contributions. Theoretically, it extends the conversation around sustainable hospitality by integrating the application of RAISA technologies with the principles of the Triple Bottom Line (TBL), as proposed by John Elkington (1994). It demonstrates how RAISA may support all three pillars of sustainability: People through improved working conditions and employee support; Planet via reductions in food waste and resource consumption; Profit by improving operational efficiency and long-term savings. This framing helps clarify how RAISA can align with global sustainability objectives like the UNSDGs and move beyond simple efficiency gains.

Practically, the two conceptual models proposed in this study offer a roadmap for hotel managers, owners, and policymakers. They outline how technology can be applied in resource-constrained environments, while promoting collaboration across key stakeholders such as government bodies, technology vendors, and universities. In addition, these models may provide a foundation for decision-making, skills training, and curriculum development within hospitality education.

6. Limitations and Future Research

There are a few limitations that we acknowledge in this literature review. Firstly, being a narrative review and not a systematic literature review, this review is non-replicable. Secondly, we could have used more search keywords; however, we made a deliberate choice to limit the number of search keywords to prevent overwhelming search results. Publication bias stands as a constraint in this literature review, stemming from the tendency of researchers and journals to favour the publication of 'positive' results, while less noteworthy or 'insignificant' findings are often neglected or withheld (Mlinaric et al., 2017). Research has affirmed that 'significant and positive' research is more prone to publication (Egger et al., 2008, p. 121). Consequently, less significant findings have limited visibility and face challenges in being incorporated into literature reviews. This challenge is commonly referred to as the 'file-drawer' problem (Franco et al., 2014). So, publication bias due to the file drawer problem is a limitation of this paper. As a theoretical paper based on a narrative literature review, this study has inherent limitations of lacking empirical data. While this paper proposes conceptual models, these frameworks require validation through field data and real-world implementations. Despite these limitations, we believe that this paper contributes valuable insights to the field of adoption of RAISA in the hotel sector by synthesising existing knowledge and identifying avenues for future research presented in the next paragraph.

We noticed that existing studies are limited in scope, focusing primarily on the technical capabilities of RAISA rather than on its broader implications for sustainability. For instance, there is a dearth of academic papers which link RAISA to the United Nations Sustainable Development Goals (UNSDGs). Furthermore, there is also a lack of research that links RAISA implementation directly to quantifiable sustainability metrics such as reductions in carbon emissions, water usage, or energy consumption. For instance, very few researchers have measured the actual reduction in the hotel kitchens' carbon footprint due to the use of RAISA. To address these gaps, the paper underscores the need for further research into the development of sustainability metrics tailored to hotel kitchens, lifecycle assessments of RAISA solutions and the exploration of innovative business models that make RAISA technologies more accessible. Few studies explore employee sentiment, skill transitions, or mental health in environments where service automation has been introduced. Future research could address these gaps by conducting case studies across diverse hotel types and geographies, developing standardised indicators to measure sustainability outcomes from RAISA, evaluating the long-term economic impact on return on investment (ROI), and exploring employee perceptions, role redesign, and reskilling initiatives through qualitative and mixed-methods research. By expanding this field with evidence-based assessments, future work can help integrate sustainability and automation in hospitality more effectively and equitably.

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Ethics Declaration

Since no participant-level data is discussed in this paper, we do not need ethical approval for this piece of research.

AI Declaration

No AI tools were used to create the content of this paper. However, AI tools were used to improve the grammar and the English language dialect in the paper, as the first author is not a native speaker of the language.

References

- Alamouh, A. S., Ballini, F., and Ölçer, A. I. (2021). Revisiting port sustainability as a foundation for the implementation of the United Nations Sustainable Development Goals (UN SDGs). *Journal of Shipping and Trade*, 6, 1-40
- Alzoubi, Y. I., and Mishra, A. (2024). Green artificial intelligence initiatives: Potentials and challenges. *Journal of Cleaner Production*, 468, 143090.
- Aras, G., and Crowther, D. (2013). Sustainable practice: the real triple bottom line. In *The governance of risk* (pp. 1-18). Emerald Group Publishing Limited.
- Barakazi, M. (2022). The use of Robotics in the Kitchens of the Future: The example of 'Moley Robotics'. *Journal of Tourism and Gastronomy Studies*, 10(2), pp.895-905.
- Barrett, M., Davidson, E., Prabhu, J., and Vargo, S. L. (2015). Service innovation in the digital age. *MIS quarterly*, 39(1), 135-154.
- Ben Youssef, A., and Zeqiri, A. (2022). Hospitality industry 4.0 and climate change. *Circular Economy and Sustainability*, 2(3), 1043-1063.
- Bohdanowicz, P. (2005). European hoteliers' environmental attitudes: Greening the business. *Cornell hotel and restaurant administration quarterly*, 46(2), 188-204.
- CalcMenu. (2024). The Trusted Recipe Management Software for Professional Kitchens. Available at <https://www.calcmenu.com/>
- Chui, M., Manyika, J., and Miremadi, M. (2015). Four fundamentals of workplace automation. *McKinsey Quarterly*, 29(3), 1-9.
- Cole, A., Pethan, J., and Evans, J. (2023). The role of agricultural systems in teaching kitchens: An integrative review and thoughts for the future. *Nutrients*, 15(18), 4045.
- Daugherty, P. J., Myers, M. B., and Autry, C. W. (1999). Automatic replenishment programs: an empirical examination. *Journal of Business Logistics*, 20(2).
- Dengler, K., and Matthes, B. (2018). The impacts of digital transformation on the labour market: Substitution potentials of occupations in Germany. *Technological Forecasting and Social Change*, 137, 304-316.
- Dief, M.E. and Font, X., 2012. Determinants of environmental management in the Red Sea hotels: Personal and organizational values and contextual variables. *Journal of Hospitality & Tourism Research*, 36(1), pp.115-137.
- Egger, M., Smith, G. D., and Altman, D. (Eds.). (2008). *Systematic reviews in health care: meta-analysis in context*. John Wiley and Sons.

- Elkington, J. (1994). Towards the sustainable corporation: Win-win-win business strategies for sustainable development. *California management review*, 36(2), 90-100.
- Farrell, J., and Klemperer, P. (2007). Coordination and lock-in: Competition with switching costs and network effects. *Handbook of industrial organization*, 3, 1967-2072.
- Franco, A., Malhotra, N., and Simonovits, G. (2014). Publication bias in the social sciences: Unlocking the file drawer. *Science*, 345(6203), 1502-1505.
- Gabriel, M., and Pessl, E. (2016). Industry 4.0 and sustainability impacts: Critical discussion of sustainability aspects with a special focus on future of work and ecological consequences. *Annals of the Faculty of Engineering Hunedoara*, 14(2), 131.
- Gim, G. C., Desa, N. M., and Ramayah, T. (2015). Competitive psychological climate and turnover intention with the mediating role of affective commitment. *Procedia-Social and Behavioral Sciences*, 172, 658-665.
- Gössling, S. (2020). Technology, ICT and tourism: from big data to the big picture. *Journal of Sustainable Tourism*, 29(5), pp.849-858.
- Hall, C. M., Scott, D., and Gössling, S. (2013). The primacy of climate change for sustainable international tourism. *Sustainable Development*, 21(2), 112-121.
- Han, H., Lee, J. S., Trang, H. L. T., and Kim, W. (2018). Water conservation and waste reduction management for increasing guest loyalty and green hotel practices. *International Journal of Hospitality Management*, 75, 58-66.
- Han, H., Moon, H. and Hyun, S.S., 2020. Uncovering the determinants of pro-environmental consumption for green hotels and green restaurants: A mixed-method approach. *International Journal of Contemporary Hospitality Management*, 32(4), pp.1581-1603.
- Ivanov, S. H., and Webster, C. (2017). Adoption of robots, artificial intelligence and service automation by travel, tourism and hospitality companies—a cost-benefit analysis. *Artificial intelligence and service automation by travel, tourism and hospitality companies—a cost-benefit analysis*.
- Ivanov, S., and Webster, C. (2018, December). Perceived appropriateness and intention to use service robots in tourism. In *Information and Communication Technologies in Tourism 2019: Proceedings of the International Conference in Nicosia, Cyprus, January 30–February 1, 2019* (pp. 237-248). Cham: Springer International Publishing.
- Ivanov, S., Seyitoğlu, F. and Markova, M. (2020). Hotel managers' perceptions towards the use of robots: a mixed-methods approach. *Information Technology and Tourism*, 22(4), pp.505-535.
- Jones, P., Hillier, D., and Comfort, D. (2016). Sustainability in the hospitality industry: Some personal reflections on corporate challenges and research agendas. *International Journal of Contemporary Hospitality Management*, 28(1), 36-67.
- Jones, P., Hillier, D., and Comfort, D. (2017). The sustainable development goals and the tourism and hospitality industry. *Athens Journal of Tourism*, 4(1), 7-18.
- Kar, S., Kar, A. K., and Gupta, M. P. (2021). Modeling drivers and barriers of artificial intelligence adoption: Insights from a strategic management perspective. *Intelligent Systems in Accounting, Finance and Management*, 28(4), 217-238.
- Kärkkäinen, M. (2003). Increasing efficiency in the supply chain for short shelf life goods using RFID tagging. *International Journal of Retail and Distribution Management*, 31(10), 529-536.
- Kruhse-Lehtonen, U., and Hofmann, D. (2020). How to define and execute your data and AI strategy. *Harvard Data Science Review*, 2(3).
- Leung, R. (2019). Smart hospitality: Taiwan hotel stakeholder perspectives. *Tourism Review*, 74(1), pp.50-62.
- Li, J. J., Bonn, M. A., and Ye, B. H. (2019). Hotel employee's artificial intelligence and robotics awareness and its impact on turnover intention: The moderating roles of perceived organizational support and competitive psychological climate. *Tourism management*, 73, 172-181.
- Milton, T. (2024). Artificial Intelligence Transforming Hotel Gastronomy: An In-depth Review of AI-driven Innovations in Menu Design, Food Preparation, and Customer Interaction, with a Focus on Sustainability and Future Trends in the Hospitality Industry. *International Journal for Multidimensional Research Perspectives*, 2(3), pp.47-61.
- Mishra, C. V. (2023). From farm to fork: An in-depth review of sustainable practices in gastronomy. *International Journal for Multidimensional Research Perspectives*, 1(2), 47-61.
- Mitta, N. R. (2024). Leveraging AI for smart inventory management in retail: developing machine learning models for predictive replenishment, stock optimization, and demand-supply balancing. *Austral J Mach Learn Res Appl*, 4, 113-46.
- Mlinaric, A., Horvat, M., and Smolicic, V. (2017). Research integrity corner negative results. 27(3), 1–6.
- Modrák, V., and Šoltýsová, Z. (2020). Development of an organizational maturity model in terms of mass customization. In *Industry 4.0 for SMEs: Challenges, Opportunities and Requirements* (pp. 215-250). Cham: Springer International Publishing.
- Murphy, J., Hofacker, C., and Gretzel, U. (2017). Dawning of the age of robots in hospitality and tourism: Challenges for teaching and research. *European Journal of Tourism Research*, 15(2017), 104-111.
- Novacka, L., Pícha, K., Navrátil, J., Topaloglu, C. and Švec, R., 2019. Adopting environmentally friendly mechanisms in the hotel industry: A perspective of hotel managers in Central and Eastern European countries. *International Journal of Contemporary Hospitality Management*, 31(6), pp.2488-2508.
- Nu, Y., Belavina, E., and Girotra, K. (2024). Using artificial intelligence to reduce food waste. Available at SSRN 4826777.

- Orzes, G., Poklemba, R., and Towner, W. T. (2020). Implementing industry 4.0 in SMEs: a focus group study on organizational requirements. In *Industry 4.0 for SMEs: Challenges, Opportunities and Requirements* (pp. 251-277). Cham: Springer International Publishing.
- Pautasso, M. (2019). The structure and conduct of a narrative literature review. *A guide to the scientific career: Virtues, communication, research and academic writing*, 299-310.
- Pokorni, B., Volz, F., Zwerina, J. and Hämmerle, M. (2021). Development of a holistic method to implement artificial intelligence in manufacturing areas. In *Advances in Artificial Intelligence, Software and Systems Engineering: Proceedings of the AHFE 2020 Virtual Conferences on Software and Systems Engineering, and Artificial Intelligence and Social Computing*, July 16-20, 2020, USA (pp. 3-8). Springer International Publishing.
- Raheja, R., Rathaur, P., and Faiz, M. A. (2024). A Review on IOT Based Smart Refrigerators. *The Academic*, 2(2).
- Raina, A. (2023). Artificial Intelligence Automation and Job Insecurities in the Hospitality Industry: An Employees and Management Perspective. In *International Handbook of Skill, Education, Learning, and Research Development in Tourism and Hospitality* (pp. 493-506). Singapore: Springer Nature Singapore.
- Ramirez, V. (2020). A new and improved burger robot's on the market. Available at <https://singularityhub.com/2020/11/06/flippy-the-fast-food-robot-just-went-commercial-and-its-selling-like-crazy/>
- Rauch, E., Vickery, A. R., Brown, C. A., and Matt, D. T. (2020). SME requirements and guidelines for the design of smart and highly adaptable manufacturing systems. In *Industry 4.0 for SMEs: Challenges, Opportunities and Requirements* (pp. 39-72). Cham: Springer International Publishing.
- Recuero Virto, N., and López, M. F. B. (2019). Robots, artificial intelligence, and service automation to the core: remastering experiences at museums. In *Robots, artificial intelligence, and service automation in travel, tourism and hospitality* (pp. 239-253). Emerald Publishing Limited.
- Rodgers, S., (2009). The state of technological sophistication and the need for new specialised tertiary degrees in food services. *International Journal of Hospitality Management*, 28(1), pp.71–77.
- Sandberg, B., and Aarikka-Stenroos, L. (2014). What makes it so difficult? A systematic review on barriers to radical innovation. *Industrial Marketing Management*, 43(8), pp.1293-1305.
- Santiago, J., Borges-Tiago, M. T., and Tiago, F. (2024). Embracing RAISA in restaurants: Exploring customer attitudes toward robot adoption. *Technological Forecasting and Social Change*, 199, 123047.
- SavorEat, (2023). 3D food printing: all you need to know. SavorEat (Blog). Available at: <https://savoreat.com/the-world-of-3d-food-printing/>
- Sawert, A. (2020). Dynamic Menu Management Utilizing the Relationship Between Preparation Time and Monetary Revenue: A Simulation Approach to the Food and Beverage Industry.
- Shahid, N., Rappon, T., and Berta, W. (2019). Applications of artificial neural networks in health care organizational decision-making: A scoping review. *PLoS one*, 14(2), e0212356.
- Sigala, M. (2011). eCRM 2.0 applications and trends: The use and perceptions of Greek tourism firms of social networks and intelligence. *Computers in Human Behavior*, 27(2), 655-661.
- Simão, J. N., and Partidário, M. D. (2012). How does tourism planning contribute to sustainable development? *Sustainable Development*, 20(6), 372–385. <https://doi.org/10.1002/sd.495>.
- Simpson, P. (2019). Buying hospitality technology in the future. *Hotel Yearbook 2020. Special edition on technology*, 14-16.
- Singh, D., and Jain, P. (2016). IoT based smart refrigerator system. *International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE)*, 5(7), 5.
- Sjoerdstra, B. (2016). Dealing with vendor lock-in (Bachelor's Thesis, University of Twente).
- Švec, R., Pícha, K., Martínát, S. and Navrátil, J., 2023. Direct or indirect energy savings in food and beverage services? Visitors' preferences in hotel restaurants. *Heliyon*, 9(7).
- Tarafdar, M., Beath, C. M., and Ross, J. W. (2019). Using AI to enhance business operations. *MIT Sloan Management Review*, 60(4).
- Tatlısu, N. B., and Torusdağ, G. B. (2025). Digital Strategies and Technological Developments for Commercial Kitchens With a Zero Waste Kitchen Approach. In *Community Resilience and Climate Change Challenges: Pursuit of Sustainable Development Goals (SDGs)* (pp. 109-134). IGI Global Scientific Publishing.
- Tavitiyaman, P., So, C. Y. A., Chan, O. L. K., and Wong, C. K. C. (2022). How task technology fits with employee engagement, organizational support, and business outcomes: Hotel executives' perspective. *Journal of China Tourism Research*, 18(6), 1212-1238.
- Uysal, I., Emond, J. P., and Bennett, G. (2011, September). Tag testing methodology for RFID enabled temperature tracking and shelf life estimation. In *2011 IEEE International Conference on RFID-Technologies and Applications* (pp. 8-15). IEEE.
- Zhang, J. J., Joglekar, N., and Verma, R. (2012). Pushing the frontier of sustainable service operations management: Evidence from US hospitality industry. *Journal of Service Management*, 23(3), 377-399.
- Zhu, D. H., and Chang, Y. P. (2020). Robot with humanoid hands cooks food better? Effect of robotic chef anthropomorphism on food quality prediction. *International Journal of Contemporary Hospitality Management*, 32(3), 1367-1383.