



REVIEW ARTICLE

# A systematic literature review of cloud kitchen

Harini P<sup>1</sup>, A Rohini<sup>1\*</sup>, S Selvanayagi<sup>1</sup>, M Prahadeeswaran<sup>2</sup>, R Pangayar Selvi<sup>3</sup> & Shokila C<sup>1</sup>

<sup>1</sup>Department of Agricultural and Rural Management, Tamil Nadu Agricultural University, Coimbatore 641 003, Tamil Nadu, India

<sup>2</sup>Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore 641 003, Tamil Nadu, India

<sup>3</sup>Department of Physical Science and Information Technology, Tamil Nadu Agricultural University, Coimbatore 641 003, Tamil Nadu, India

\*Email: [rohinihariprakash@gmail.com](mailto:rohinihariprakash@gmail.com)

## OPEN ACCESS

### ARTICLE HISTORY

Received: 20 October 2024

Accepted: 25 October 2024

Available online

Version 1.0 : 25 January 2025



### Additional information

**Peer review:** Publisher thanks Sectional Editor and the other anonymous reviewers for their contribution to the peer review of this work.

**Reprints & permissions information** is available at [https://horizonepublishing.com/journals/index.php/PST/open\\_access\\_policy](https://horizonepublishing.com/journals/index.php/PST/open_access_policy)

**Publisher's Note:** Horizon e-Publishing Group remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

**Indexing:** Plant Science Today, published by Horizon e-Publishing Group, is covered by Scopus, Web of Science, BIOSIS Previews, Clarivate Analytics, NAAS, UGC Care, etc See [https://horizonepublishing.com/journals/index.php/PST/indexing\\_abstracting](https://horizonepublishing.com/journals/index.php/PST/indexing_abstracting)

**Copyright:** © The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited (<https://creativecommons.org/licenses/by/4.0/>)

### CITE THIS ARTICLE

Harini P, Rohini A, Selvanayagi S, Prahadeeswaran M, Selvi RP, Shokila. A systematic literature review of cloud kitchen. Plant Science Today (Early Access). <https://doi.org/10.14719/pst.6016>

## Abstract

The concept of cloud kitchens, or ghost kitchens, has emerged as a transformative trend in the food service industry, offering an economical and efficient model that eliminates the need for physical dining spaces and focuses solely on delivery and takeout. This approach provides several advantages, including reduced overhead costs, operational efficiency, scalability and expanded market reach through virtual platforms. However, market saturation, building brand visibility and maintaining food quality remain significant hurdles. Future trends may involve multi-brand operations within a single kitchen, advanced technology integration, eco-friendly practices and suburban and rural areas expansion. By addressing these challenges, ghost kitchens can capitalise on their innovative potential to reshape the food service landscape.

## Keywords

cloud kitchen; consumer choices; covid-19 pandemic; customer loyalty; ghost kitchen

## Introduction

As there is a shift in consumer preferences, technology outbreak and the increase of innovative business models, the food service industry has come across a drastic transition in recent times. One such new idea that become popular is the ghost kitchen, also referred to as virtual or cloud kitchens. These kitchens mainly focused on accepting orders and delivery of it on time through virtual platforms and other delivery providers, working without a physical existence (1, 2). There are various advantages of virtual kitchens to both customers and operators. By deduction of the need to pay rent, elaborate décor and a huge team of front-of-house employees, it also provides for cost savings (3). Ghost kitchens can now focus their resources on increasing the food preparation process, delivery system and quality control by focusing on professional cooking facilities (2). Additionally, by streamlining procedures and targeting only order delivery this model enhances operational efficiency and effectiveness and helps in implementing lean concepts and waste reduction methods (4, 5). The scalability of virtual kitchens is one of the key features. Ghost kitchens are now able to grow fast or reduce their operations concerning market demand, by allowing them to adapt to the constantly changing conditions of the food service industry (5, 6). And ghost kitchens can widen their client base by overcoming geographic barriers by utilizing virtual platforms and food delivery systems. this will enhance their market access, market reach and client loyalty (7). cloud kitchen is a significant trend in the food and beverages industry. particularly during the covid-19 pandemic. the pandemic has accelerated the shift towards online food ordering and it benefits cloud kitchen models. cloud kitchen has proven to be a promising strategy for culinary businesses, especially small and medium

enterprises during and after the pandemic. cloud kitchen use ai-driven analytics and iot integration to enhance efficiency and customer engagement. cloud kitchens leverage digitalization to improve service quality, resulting in increased customer satisfaction. this integration allows for secure data processing, digital analytics and decentralization of cloud storage to promote the cloud kitchen effectively. ghost kitchens have various advantages at the same time they have some drawbacks. as they are working in virtual mode, creating brand awareness and client interaction is hard. this draws attention to efficient marketing strategies and a strong virtual presence (8, 9). another important factor is preserving food quality and taste at the time of delivery, which requires a focus on packaging methods, temperature control procedures and delivery route mapping (10). in addition, ghost kitchen operators should deal with market saturation, tough rivalry and regulatory compliance (11, 12).

## Materials and Methods

PRISMA flow chart (Fig. 1) is used for the inclusion/exclusion process. The PRISMA flow chart is crucial for displaying the study selection process, including inclusion and exclusion criteria. The PRISMA statement and its associated resources aim to enhance the clarity and transparency of systemic reviews and meta-analyses. The articles and data are selected from Scopus and Web of science database structures from which some articles are selected and some are excluded.

**Search strategy:** The word string used for the search of the literature is “cloud kitchens” or “ghost kitchens” or “virtual kitchen” and “hotel and restaurant” and “food industry” and “post covid trends” and “contactless delivery” and “consumer behaviour” and “online order”.

## Results

### Benefits of Cloud Kitchens

**Cost Savings:** Cloud kitchens can save money by reducing all costs related to real estate, ornate decor and a huge number of house workers. Traditional hotels regularly incur high overhead costs due to their locations, expensive interior decorations and their staff members who are working to provide better service to their customers. By working out of commercial cooking locations instead of a dine-in area cloud kitchens can save costs and thereby increase their profits (1, 2). The reduction in cost by removing the need for restaurant workers like servers, hosts and customer care agents helps cloud kitchen owners, concentrate and invest the saved money on other things or facilities required to improve their business. Comparing traditional restaurants with ghost kitchens, cloud kitchens can access cheaper labour costs as they are mainly operated by a small group of people who are concentrating on preparing food, packaging, minimizing food waste and delivering food on time. By reducing expenses of overhead and focusing their efforts on improving food preparation processes, delivery logistics and targeting efficient order delivery and quality checks of food, cloud kitchen operators can provide excellent services to their customers (3). All this can be achieved because of ghost kitchens and their cost-cutting strategy so that businesses can maintain a competitive advantage in the market while concentrating on their strengths (2).

**Operational Efficiency:** Ghost kitchens gain operational efficiency by simplifying procedures and focusing only on preparing and delivering food so that they can concentrate on meeting the various needs of the consumers (5). Compared to traditional restaurants, which take up various activities related to dine-in services, cloud kitchens can focus mainly on fulfilling orders. Cloud kitchens can simplify business activities and can now adopt lean principles by eliminating all the necessities of table service, maintaining ambiance and front-of-house

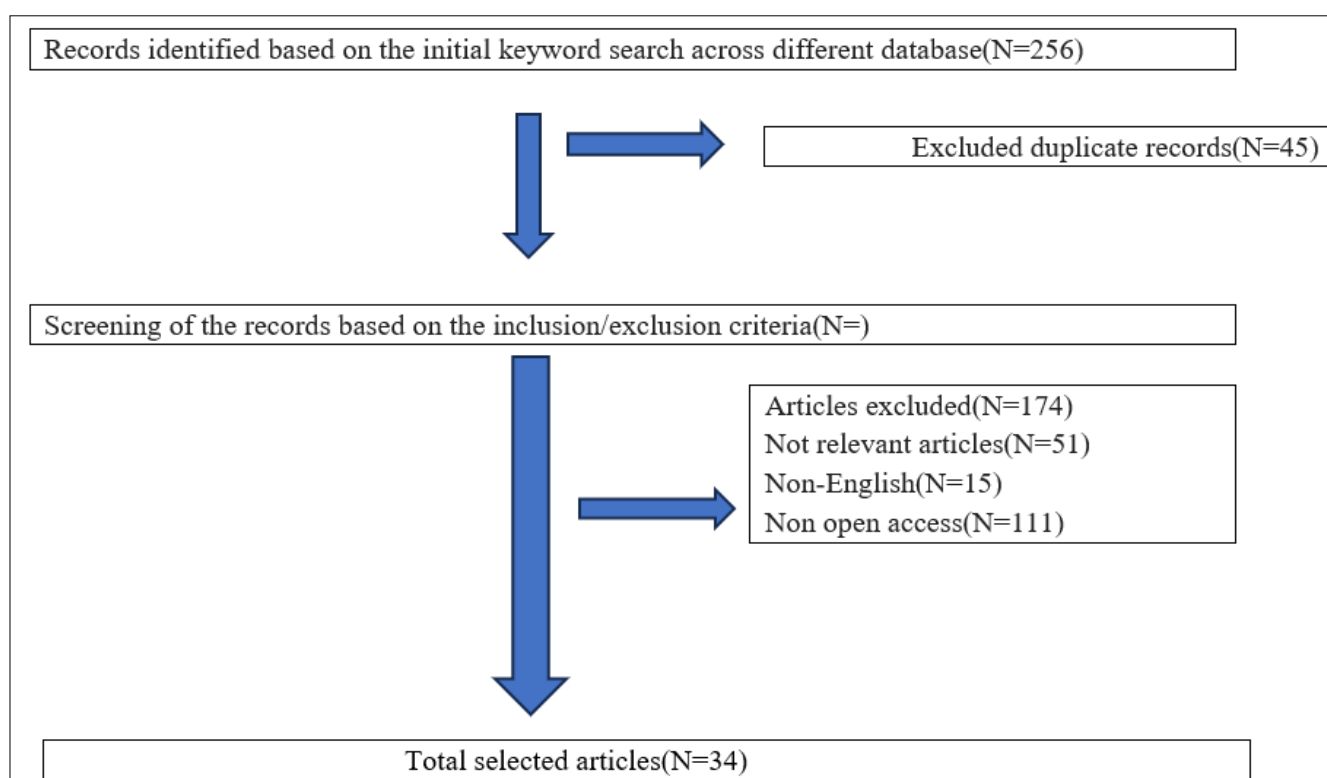


Fig. 1. PRISMA flow chart.

operations. Ghost kitchens will help reduce waste, increase productivity and frequently focus on increasing their operations with this strategy (4). By reducing waste and by using all available resources, cloud kitchens can gain a competitive advantage by managing inventory efficiently and effectively, using optimal kitchen layouts and by just-in-time production techniques. Ghost kitchens can use technology and data-driven methods to identify and solve operational bottlenecks, which will improve the overall efficiency and effectiveness of the business (12).

**Scalability and Flexibility:** This model provides high scalability and flexibility, which is beneficial for the present food service industry where consumer needs and market demands can change drastically overnight (5). Ghost kitchens can freely expand and reduce their business operations because of the changes in the demand-supply condition of the market when compared to traditional restaurants as a sudden change in market demand and supply will incur huge losses. Cloud kitchens can freely increase or decrease their delivery areas, menus and production capacity (6). This flexibility of cloud kitchens has provided businesses to adapt to the ever-changing conditions of the market and gain benefits. Hence cloud kitchens can lower the risks of overcapacity or lesser utilization of resources by guaranteeing optimum resource allocation and maximizing profits (4). Cloud kitchens can quickly increase their production activities in case of a rise in demand by employing more employees or by expanding their kitchen space. On the contrary, when demand in the market reduces, they can reduce their expenses by withdrawing activities, thereby cutting down the costs and reducing the incidence of risk and loss (10).

**Increased Reach and Market Access:** Cloud kitchens have gained customer loyalty and entered new markets by using online apps and food delivery services, overcoming the limitations of geographical barriers faced by the traditional food and beverage industry. Traditional restaurants are constrained by their physical locations, serving customers of those locations only, whereas cloud kitchens are addressing this barrier by partnering with various delivery services and by taking advantage of online platforms. This provides businesses with a wide range of customers and gets to know their variety of demands thereby gaining more customers irrespective of which locations they come from by this they can gain the loyalty of the customers. Cloud kitchens or Ghost kitchens can plan and locate their services in places where there is high demand and lesser operational or working costs, thereby increasing their market access and reach resulting in higher profitability. By using data analytics and market insights, ghost kitchens can know about areas that are not served properly and focus on it, or by knowing the new trends in the market they can reshape their operations which results in increasing their profits and gaining access to new opportunities available in the market thereby gaining competitive advantage. Ghost kitchens can leverage their online presence to reach customers from various geographic locations, resulting in a wider variety of cuisine options and catering to food choices or tastes that are not available in some locations (7).

#### **Case studies about Cloud Kitchen**

Cloud kitchens have emerged as a significant trend in the food industry and it operate in a hub-and-spoke model. Companies like Rebel Foods have adopted this technology platform to drive their operations to increase efficiency and customer engagement

(15). In Jaratka at least seven kitchen players exist with various market positions and strategies, including support from MSME empowerment. They typically receive orders through online platforms like Swiggy and Zomato. It offers opportunities for business growth and launching digital brands. The model's success relies on continuous market analysis and adaptation to changes with innovative strategies (13).

#### **Challenges and Considerations**

**Brand Visibility and Customer Engagement:** Ghost kitchens face numerous problems in developing customer interaction and brand awareness as they don't have a physical existence. Traditional dining establishments can create brand awareness and attract customer loyalty by utilizing their physical existence, atmosphere and face-to-face interactions (8). But ghost kitchen operations are virtual, creating a strong brand awareness and establishing relationships with customers is challenging. In these circumstances, the progress of ghost kitchens relies on creating a strong virtual presence and effective marketing strategies as a replacement for physical restaurants or hotels. It is advised to ghost kitchen owners to know the importance of creating interesting web content, allot resources for digital marketing programs, using social media platforms, search engine optimization and concentrating on online advertising to increase their brand awareness and attract loyal customers (9).

**Food Quality and Consistency:** Ghost kitchens should investigate the problems of preparing and looking into consistent meal quality and ensuring that it will be appetizing at the delivery time. In traditional restaurants, people used to eat food as soon as it was ready to consume, whereas ghost kitchens depend on delivery agents to deliver the food to customers' doorstep. At this time the food may encounter surrounding temperatures, jostling and other various factors that can affect its quality. Hence here comes the significance of appropriate packaging methods, temperature control precautions and proper delivery services to investigate this problem. The kitchen owners should focus on specialized packaging techniques, insulated delivery containers and optimized delivery routes to make sure the food is delivered to the customer's doorstep in a good stage, with good flavours, textures and appropriate visual appeal. There is a need for ghost kitchens to follow strict precautions related to quality control and to provide comprehensive training to their workers on food preparations, packaging and temperature maintenance at the time of the delivery process (10).

**Customer loyalty:** As these kitchens operate completely through virtual mode creating customer awareness and customer loyalty is hard (8). The major challenges faced are low brand visibility, tough competition on delivery apps, no face-to-face customer interactions and depending on third-party logistics. To create their own identities, the owners should adopt certain strategies like using social media marketing, ensuring products are of good quality, coming up with customer loyalty programs with personalized offers and crafting their brand identity. Online brands can perform well when these challenges are addressed on time with proper strategies (13).

**Regulatory Compliance:** For ghost kitchens regulatory compliance plays a vital role, since these kitchens must follow laws and license requirements regarding labour standards, food hygiene and food safety. In case of failure to follow these

regulatory rules and guidelines may result in fines, legal repercussions and reputational damage to the company. Hence ghost kitchen operators must make sure that they are following all necessary health and safety measures, enforce strict food handling techniques and provide their employees the needed instructions on good food and safety practices. Hence cloud kitchen operators should be aware of all this regulatory compliance to sustain in the market for the long run failing to do this will result in damage to the brand image which will directly affect the business negatively and may also lead to the closure of the business (4).

**Competition and Market Saturation:** This is the most recurring threat, of the market reaching saturation and rivalry between brands affecting the business adversely. As ghost kitchen industries have fewer entry restrictions and the importance of cost reductions, a high number of competitors may end up in the market, resulting in oversaturation and tough competition for consumers' attention, loyalty and market share. Ghost kitchens need to overcome their competitors in a crowded market by delivering something unusual like focusing on customized services, running smoothly and adopting smart marketing methods. Ghost kitchens can get a competitive advantage in the market only by establishing unique menus, using data-driven insights to meet local needs and expectations and providing top-notch customer service. Cloud kitchens should regularly investigate the ever-changing demand of the markets and should adapt to it accordingly to stay long in the business (12).

#### **Future Trends and Prospects**

**Technology Integration:** Ghost kitchens are adopting technology at high speed to improve their customers' experiences resulting in customer satisfaction, expediting operations and improved delivery services. The roles of technology are crucial and automation, artificial intelligence (AI) and sophisticated analytics will play vital roles in increasing productivity and enhancing creativity in the cloud kitchen business model (8). Ghost kitchens are adapting data-driven strategies to know demand trends, customer preferences and operational challenges. Cloud kitchens are now able to investigate their production and resource allocation and set menus based on data received from online orders, delivery schedules and client reviews (14). Additionally integrating automation technology can increase productivity, reduce human errors and increase uniformity in food quality and standards. Examples: - robotic meal preparation systems and automated order management systems. Predictive analytics driven by artificial intelligence can assist ghost kitchens in predicting an increase or decrease in demand (1).

#### **Branding Strategies**

Cloud kitchen also known as ghost kitchens and it emerging has a promising business model in the food and beverage industry. Successful branding strategies for Cloud Kitchen include social media marketing and electronic word-of-mouth (e-WOM) to increase and build brand awareness and purchase intentions. Online applications and web advertisements play a major role in cloud kitchen marketing (16). Branding strategies help to tackle many challenges faced by the cloud kitchen.

**Multi-brand Strategy:** Some ghost kitchen operators are coming up with a multi-brand approach, combining various online

restaurant brands into a single location. This strategy enhances the usage of kitchen space allowing for variety and accommodating a wide range of clients' expectations. Operators can now target various clients' demographics and give a wide variety of dine-in alternatives by operating various virtual brands from a single ghost kitchen, reducing the necessity for separate physical stores. Ghost kitchens can now take benefit of new meal trends and specialized client tastes by adopting this technique to reach a wider customer base. And, by using the same kitchen resources and personnel to make and pack orders for numerous online brands, the multi-brand model helps effective and efficient sharing of resources. In addition to increasing the usage of kitchen resources, this also lowers the cost and helps in saving money (10).

**Sustainability and Eco-Friendliness:** Cloud kitchens will give prominence to sustainable practices because of an increase in environmental issues, like reducing food wastage, increasing in usage of eco-friendly packaging materials and implementing energy-efficient techniques (11, 15). This strategy aligns with the increase in customer demand for companies that focus on environmental sustainability. Waste management strategies include distributing extra food to poor or related working organizations or converting organic waste into compost or biofuel, which can later be utilized in their kitchens (16). Cloud kitchens can also use recyclable or biodegradable packing materials, to reduce the harmful impact on the environment. Additional methods to make ghost kitchen operations eco-friendly involve using energy-efficient cooking materials, renewable energy sources and sustainable supplies. Ghost kitchens can attract environmentally aware clients' attention and brand them as conscientious corporate citizens by implementing sustainable methods (17). Recently cloud kitchen has adopted eco-friendly technologies for food packaging. Biodegradable nanocomposite materials are being developed to reduce fossil fuel use and promote sustainability. To reduce carbon emissions by 63% cloud kitchen uses this type of packaging. Bio-based packaging technologies have shown promise in improving food safety and quality and meeting environment-friendly solutions. These technologies demonstrate the potential benefits of packaging foods by addressing environmental and improving operational efficiency.

**Expansion into Suburban and Rural Areas:** Even though ghost kitchens are operating majorly in cities, there are chances to enter suburban and rural areas. This will help grow and meet the high demand for fast food delivery services in these areas and attract new customers. Ghost kitchens can now take advantage of the increasing trend of using Android applications and virtual food delivery platforms to meet clients in suburban and rural areas where there will not be many options for traditional restaurants and hotels. Ghost kitchens will address the changing requirements of regional clients for easy accessibility and convenience so setting up strategic sites or collaborating with delivery agents. By providing a wide variety of options, this growth will reduce the problems faced with "food deserts," which are areas with very little access to fresh meals (7).

**Collaboration and Partnerships:** Ghost kitchens should enter joint ventures and strategic alliances with technological companies, food delivery platforms and other market agents. These collaborations will access new markets, which will enhance



operational capacities and give synergies. While working together with ghost kitchens will give certain benefits to the existing delivery partners and customer relationships of food delivery apps and expand their client base. Cloud kitchens can increase their order administration, tracking of delivery and linking the customer to communicate their operations by usage of these platforms. By collaborating with technological companies, ghost kitchens can take benefit of state-of-the-art automation, predictive analytics and inventory management techniques, which will enhance their operational effectiveness, efficiency and competitiveness. To create synergies and benefits, ghost kitchens investigate to collaborate with other industry participants like food producers, suppliers, or related companies (18).

### **The COVID-19 Pandemic's effects**

Every aspect of our lives was greatly impacted by the COVID-19 epidemic and the food and beverage business were no exception. Traditional dine-in restaurants, which were previously active areas of social exchange and delicious research, but during the pandemic focused on social distancing policies and the importance highlighted on contactless services. As consumers shifted towards safer choices out of fear of the high chances of exposure dangers with dining in-person, the pandemic helped as a major player in the expansion of ghost kitchens. With their primary focus on virtual ordering and delivery systems, ghost kitchens were the best choice for customers. With the help of this model, customers were enjoying restaurant-calibre cuisine with the comforts and security in their own homes. It was a practical and safer choice (19). Concerning changing customer tastes, the pandemic forced already-open establishments to change or face closure. Noted a critical trend as a survival strategy, traditional eateries are strategically shifting towards the ghost kitchen concept. Lockdowns and social distance protocols restrained these restaurants from providing dine-in service, but they can still serve their customers through ghost kitchens and provide delivery and takeout options. This move was a clever move that most restaurants increased sales; it also helped them to keep in touch with their customers through difficult times (20, 21). The covid influenced consumer behaviours that crossed beyond delivery choices. It draws attention to the increase in popularity of virtual meal ordering and delivery systems. Because of the avoidance of public gatherings/meetings and staying at home, virtual food delivery platforms become crucial for businesses and customers. Ghost kitchens were well-positioned to reap benefits from this as they mostly worked through these online platforms. Their importance on virtual ordering and delivery combined well with the "new normal" of remote employment and social alienation. Because of cloud kitchens, it was possible to have a world of culinary alternatives delivered right to the home with only a few phone taps during a crucial period when going out was dangerous (17). The ghost kitchen pandemic was with difficulties, though. Ghost kitchens faced various challenges despite their popularity, which included supply chain disruptions, changing customer demand because of lockdowns and economic concerns with the strict health and safety regulations (22). However, ghost kitchens exhibited incredible tenacity even during these difficulties. Operators of ghost kitchens came up with innovative ways to overcome these challenges like the Adoption of tamper-evident packaging, dedicated deliveries and contactless delivery

methods. Focusing on kitchen sanitization procedures became the top priority (23). At the time of the pandemic, ghost kitchens took advantage of their flexibility to Fastly modify menus and products to ever-changing client's preferences (24). Ghost kitchens offered food enterprises a sufficient choice by providing contactless delivery and utilizing their resources during a tough period of low dine-in traffic. The pandemic proved the importance of digital marketing to create brand awareness and customer interaction (25).

**Operations of Cloud Kitchen:** The significant ideology behind cloud kitchens refers to offering menus from numerous brands while centralizing the manufacturing and preparation process in a single location (6). This concept makes it possible to use resources effectively, thereby cutting overhead expenses and serving an array of customers by using a variety of virtual restaurant brands. They signify the importance of automated cooking tools, an easy order management structure and a well-optimized workflow process to ensure timely order delivery-a fundamental component of cloud kitchen operations (24). They believe that a smooth order administration can be obtained if the cloud kitchens rely on online ordering platforms and integrated point-of-sale (POS) systems. This use of technology leads to efficient communication between the kitchen and delivery staff, thereby allowing customers to book orders via different mediums including websites, smartphone apps and third-party delivery platforms. The overall process of order fulfilment is streamlined by this error-free technological integration, enhancing both operational effectiveness and customer happiness (26). Making an effective usage of data analytics and consumer feedback to filter out menu options, pricing schemes and delivery areas is one of the main advantages of Cloud Kitchen. Their operators are bound to well-versed judgments regarding inventory management, ingredient procurement and menu curation by studying consumer preferences and trends of the orders. In addition, this data-driven phenomenon succours cloud kitchens to remain ahead of the time to increase productivity and decrease the amount of food waste, by foreseeing and meeting changing client needs (13).

**Streamlining Operations through Technology:** Technology's pivotal role in cloud kitchen operations, with a focus on the essentials of cloud kitchen management software (CKMS). They claim that the potential to handle numerous virtual brands, orders and delivery operations from a lone platform has made CKMS a wonderful tool. Special features like inventory control, customer relationship management (CRM), real-time order tracking and analytics for data-driven strategy are frequently included in these software packages. Cloud kitchens may effectively automate and optimize a range of activities through the integration of these technologies, leading to more efficient operations and improved decision-making (27). Technology's importance in cloud kitchen operations can be achieved by emphasizing the use of online ordering platforms and connected point-of-sale systems. These tools offer smooth communication between the kitchen and delivery person, allowing customers to place orders via a variety of channels- that includes websites, mobile apps and third-party delivery platforms. This technological integration minimizes unwanted delays and ensures on-time order delivery without degrading the customer experience (26).

**Supply Chain Management and Partnerships:** To meet the demands of various virtual brands and manage the bulk of orders, it is essential to keep a continuous supply of high-quality ingredients and packaging. It helps in quick delivery, controls inventory levels and reduces the importance of collaborations with outside delivery aggregators like Grubhub, DoorDash and Uber Eats for cloud kitchen success. Through these partnerships, cloud kitchens can reach a wide user base and capitalize on the platforms' well-settled delivery networks and marketing resources. Cloud kitchens may catalyse their visibility, reach a wider spectator and offer clients a flawless delivery experience by utilising these collaborations, which will eventually lead to an increment in numbers of sales and profitability (28).

**Quality Control and Food Safety:** They say that strong quality control processes are essential as these facilities look after bulk orders and serve a variety of virtual brands. This entails putting in place stringent food handling procedures, upholding hygienic guidelines, carrying out periodic inspections and ensuring the right temperature during the preparation and delivery processes. By following strict food safety and quality guidelines, cloud kitchens may win over clients' faith and develop a solid name in the industry (13, 26). The function of cutting-edge technology in regulating and preserving ideal cooking conditions, temperature control and food safety factors, such as Internet of Things (IoT) sensors and automation systems. By giving cloud kitchens access to real-time data and its analytics, this software enables them to detect and resolve possible issues, guaranteeing continuously high standards of food safety and quality (13). The value of employee training initiatives in cloud kitchen management. Cloud kitchens can enhance food safety by requiring personnel to complete extensive training and abide by standard procedures. Not only do well-trained employees help to uphold strict guidelines for food safety and quality, but they also enhance operational effectiveness and consumer happiness altogether (26).

#### **Effective management and growth strategies for Cloud kitchens**

**Location Selection:** The importance of selecting the best area for cloud kitchen facilities takes into consideration variables like population density, demand trends and distance from delivery locations. They claim that these elements are crucial to guarantee on-time deliveries and effective operations, both of which are important parts of the ghost kitchen business model. Cloud kitchen owners can optimize their reach, lessen delivery times and ultimately improve customer satisfaction by properly selecting strategic locations (26).

**Brand Portfolio Management:** They highlight that while selecting which brands to keep in their portfolio, ghost kitchen operators need to consider aspects like demand in the market, competitiveness and chances for expansion. By adopting a systematic approach to brand management, ghost kitchens are being competitive in the market by meeting the needs of a variety of customers and staying relevant (24).

**Marketing and Customer Engagement:** Play an important role in social media platforms, loyalty programs and customized services that have in developing consumer loyalty and establishing successful marketing services. In the highly competitive market, these activities are important to draw the attention of consumers and maintain consumer loyalty. Ghost

Kitchens may develop a loyal client base, create brand awareness and enhance their exposure by using digital marketing channels and customer-centric techniques (29).

**Expansion and Scalability:** When the ghost kitchen's popularity increases, they go to organize for scalability and strategic expansion. Suggesting operators expand their operations into new markets, framing agreements with franchises, or seeing into other channels of income like retail product lines or catering. Ghost Kitchens can lock new chances, widen their customer base and increase revenue by taking an appropriate approach to growth and diversification (13).

**Data-driven decision-making:** Business intelligence and data analytics tools play important roles in the ghost kitchen market. Using these technologies to get updates on market trends, client choices and operational effectiveness is essential for being competitive and making wise choices. Ghost kitchen operators can be competitive in the fast-changing food service industry by optimizing their operations, customizing services according to customer's needs and preferences and using data-driven decision methods (27).

**Talent Acquisition and Development:** The importance of drawing attention and maintaining top-level chefs, delivery staff and operational managers to ensure reliable quality and efficient and effective operations in ghost kitchens. To maintain high-quality standards of service and products - which are important for maintaining reputation and building customer loyalty in the ghost kitchen industry and investment for acquisition and development activities are important (22).

#### **Consumer behaviour**

**Consumer Attitudes and Preferences:** The importance of understanding consumer attitudes and preferences regarding ghost kitchens varies based on demographics. Their opinions are mainly dependent on marital status and gender because single individuals and males showed highly positive attitudes when compared with married individuals and females. Hence ghost kitchen operators need to focus on customization like coming up with offers and marketing plans to effectively target diverse demographic customers (30).

**Purchase Intention and Behaviours:** "Perceived risk, perceived usefulness and perceived ease of use significantly influence consumer purchase intention and behaviours toward cloud kitchens"(31). This shows the consumer attitude towards deciding to buy or not and to make a purchase the process should be simplified (15).

**The Role of Technology:** Website design, mobile app usage, virtual ordering systems and unified delivery platforms greatly influence consumers' views and buying decisions regarding ghost kitchens. This shows the importance of investing in integrated, user-friendly technology solutions to enhance customer satisfaction levels (32).

**Online Purchasing Intention:** During covid dependency on online food delivery systems increased. To increase customer loyalty and encourage repeat online purchases, cloud kitchen operators should focus on creating trust with customers and ensuring a smooth online purchasing experience (33).

**Post-Pandemic Consumer Behaviours:** Because of the easy usage and security system, ghost cooking services become

popular during a pandemic. Cloud kitchen operators should focus on providing diverse menu options, increasing food quality and hygiene and depending on technology to increase overall customer satisfaction to match these shifting patterns of consumer behaviour (34).

## Conclusion

The food service industry so gained many advantages from the ghost kitchen concept, which provides a unique value proposition that suits the changing client's preferences and working requirements. The concept involves drawbacks, but they are overcome by the potential advantages. These drawbacks consist of brand visibility, food quality and consistency, client loyalty, regulatory compliance and market saturation. Ghost kitchens have benefited from these trends as consumer behaviours and technology change continuously. This can be met by integration of automation, data analytics, multi-brand approach, sustainability initiatives and strategic alliances. Ghost kitchens became more popular during the COVID-19 epidemic because people were in search of fast and safe food delivery options. Ghost kitchen operators should stay flexible, innovative and focused on the preferences of customers to be competitive to gain the advantage of the market condition and meet the ever-changing market demands.

## Acknowledgements

The authors thank the Department of Agricultural and Rural Management, Tamil Nadu Agriculture University, Coimbatore, for providing valuable guidance and technical support throughout this research.

## Authors' contributions

HP carried out experimentation and drafted the manuscript and AR planned, supervised and edited the manuscript. All authors were involved in planning and analysis and provided critical feedback on the manuscript. All authors read and approved the final manuscript.

## Compliance with ethical standards

**Conflict of interest:** Authors do not have any conflict of interest to declare.

**Ethical issues:** None

## References

- Vaughan J. The cloud kitchen: Market innovation and a vertical disintegration: Webster University; 2022.
- Pan MS. Concept of cloud kitchen-a new trend in Indian restaurant industry. *EPRA International Journal of Research and Development*. <https://doi.org/10.36713/epra2016>
- Wankhede MND, Fernandes M, Deore MG. A study on sustainability of cloud kitchen in Mumbai region. *Kalyan Bharati*, ISSN. 2021(0976-0822).
- D'souza DJ, Kumar A. Cost impact on cloud kitchen business post COVID-19. *International Research Journal of Modernization in Engineering Technology and Science*. 2023;5(3):1747-54. <https://doi.org/10.1177/22786821231166790>
- Gosai KM, Palsapure D. A Study on cloud kitchens as an emerging food and beverage industry. *International Journal of Advance Research in Science and Engineering*. 2020;9(9).
- Sarangdhar MP, Mohite V, Kharde S. A study on emerging concept of cloud kitchen in India. *UGC Care Journal*. 2021;44(1):2249-6661.
- John KT. Digital disruption: the hyperlocal delivery and cloud kitchen driven future of food services in post-COVID India. *International Hospitality Review*. 2021(ahead-of-print). <https://doi.org/10.1108/IHR-06-2021-0045>
- Moyeenudin H, Anandan R, Bindu G. A research on cloud kitchen prerequisites and branding strategies. *International Journal of Innovative Technology and Exploring Engineering*. 2020;9(3):983-7. <https://doi.org/10.35940/ijitee.C8188.019320>
- Chhabra N, Rana A. Rise and the future of cloud kitchens in India: a consumer study. *International Journal of Research in Engineering, Science and Management*. 2021;4(7):158-65. <https://doi.org/10.24941/ijcr.41199.05.2021>
- Ghazanfar U, Kaluvilla BB, Zahidi F. The post-COVID emergence of dark kitchens: a qualitative analysis of acceptance and the advantages and challenges. *Research in Hospitality Management*. 2023;13(1):23-30. DOI:10.1080/22243534.2023.2239574
- D'souza MDJ, Kumar A. Evaluate customer awareness of cloud kitchen in Mangalore city. *International Journal of Case Studies in Business, IT and Education (IJCSBE)*. 2022;6(1):470-505. <https://doi.org/10.56726/IRJMETS34530>
- Kulshreshtha K, Sharma G. From restaurant to cloud kitchen: Survival of the fittest during COVID-19 An empirical examination. *Technological Forecasting and Social Change*. 2022;179:121629. DOI:10.1016/j.techfore.2022.121629
- Lahiri S, Bose I, Majumdar A. Rebel foods' cloud kitchen technologies: food for thought? *Communications of the Association for Information Systems*. 2024;54(1):4. <https://doi.org/10.17705/1CAIS.05407>
- Shekhar R, Vartika M, editors. Artificial intelligence in online food delivery: exploring advantages, opportunities and challenges ahead. *Proceedings of MOL2NET'22, conference on molecular, biomedical & computational sciences and engineering, 8th ed-Mol2net: from molecules to networks* <https://doi.org/10.3390/mol2net-08-12635>; 2022. <https://doi.org/10.3390/mol2net-08-12635>
- Chatterjee R, Singh A, Singh V. Ethical and Sustainable Perceptions on Cloud Kitchen Business-A Study of Consumers and Stakeholders during the Covid-19 Pandemic. *International Journal of Hospitality and Tourism Systems*. 2022;15(COVID-19 Issue):76.
- Li C, Miroso M, Bremer P. Review of online food delivery platforms and their impacts on sustainability. *Sustainability*. 2020;12(14):5528. <https://doi.org/10.3390/su12145528>
- Telaumbanua BB, Wiriasubrata F, Wulandari KTC, Husniah NF, Khairana I, Nuraisyah A. transforming consumer behavior through cloud kitchen and digitalization boosting msme sustainability in the F&B. *Business Review and Case Studies*. 2023;4(3):313-. DOI:10.17358/brcs.4.3.313
- Alazzaz A, Almulawwith S, Almazroa M, Alroudian H, Maqsood M, AboAlsmh HM et al. Evolving restaurants'business models: benefits of cloud kitchen. *Academy of Strategic Management Journal*. 2023;22(2):1-7.
- Sherkar A, Fernandes M, Zagade S. Rise of cloud kitchens amidst the covid 19 pandemic. *Kalyan Bharati Journal*. 2021;36:237-43.
- Beniwal T, Mathur VK. Cloud Kitchens and its impact on the restaurant industry. *International Research Journal on Advanced Science Hub*. 2022;4:12. <https://doi.org/10.47392/irjash.2022.076>
- Piccioni F. Cloud Kitchens: a novelty in the restaurant industry after COVID-19 2022. (Doctoral dissertation).2022.

22. Maurya A, Subramaniam G, Dixit S, editors. Laying the table from the cloud during Lockdown: Impact of Covid crisis on Cloud Kitchens in India. 2021 2nd International Conference on Computation, Automation and Knowledge Management (ICCAKM); 2021: IEEE. <https://doi.org/10.1109/iccakm50778.2021.9357768>
23. Kaavya K, Andal V. Cloud kitchen—a overview. *NeuroQuantology*. 2022;20(7):50. <https://doi.org/10.14704/nq.2022.20.7.NQ33005>
24. Sharma AJ, Dey D. One stop kitchen: managing a multi-brand cloud kitchen. *Emerald Emerging Markets Case Studies*. 2021;11(4):1-17. <https://doi.org/10.1108/EEMCS-03-2021-0070>
25. Nagadeepa C, Jaheer Mukthar K, Ramirez-Asis E, Huaranga-Toledo H, Espinoza-Maguiña M, Mory-Guarnizo S. A reinforcer to become a foodpreneur through cloud kitchen: sustainable technology-driven business model during pandemic. *Technological Sustainability and Business Competitive Advantage*: Springer; 2023. p. 401-13. [https://doi.org/10.1007/978-3-031-35525-7\\_25](https://doi.org/10.1007/978-3-031-35525-7_25)
26. Nedumaran DG, Ritha M. Cloud kitchen-the next big thing in future. Available at SSRN 4510452. 2023. <https://doi.org/10.2139/ssrn.4510452>
27. Sharma J, Verma S. Kitchen in cloud: an analysis of the food tech industry in India. *International Journal of Public Sector Performance Management*. 2021;8(1-2):190-204. <https://doi.org/10.1504/IJPSPM.2021.117720>
28. Sharma B, Arora R, Sharma G. Food Industry: Experiencing positive impact after goods and service tax implementation. *Materials Today: Proceedings*. 2022;52:1726-32. <https://doi.org/10.1016/j.matpr.2021.11.341>
29. Abdullah SINW, Teng PK, Heng BLJ, Subramaniam K, Yuling J, Shoep AMA, editors. Effect of marketing mix strategies on the buying behaviour of organic products: comparison between consumers in Malaysia and China. *IOP Conference Series: Earth and Environmental Science*; 2023: IOP Publishing. <https://doi.org/10.1088/1755-1315/1165/1/012007>
30. Pookulangara S, Wen H, Bharath J. Consumer attitudes toward ordering from cloud kitchens: a gender and marital status perspective. *International Journal of Contemporary Hospitality Management*. 2023;35(5):1859-79. <https://doi.org/10.1108/IJCHM-03-2022-0310>
31. Mathur P, Mathur VK. Consumer purchase intention and behavior toward cloud kitchen (pandemic opportunity) with reference to India: An empirical examination. *Jindal Journal of Business Research*. 2023;12(2):194-208. <https://doi.org/10.1177/22786821231166790>
32. Idris NS, Zulkifly MA, Safuan M, Latip A. New trends of cloud kitchen technology and consumers' purchase decisions: a conceptual study. *Voice of Academia*. 2023;19(2):114-26.
33. Sultana S, Debnath D, Habib M. Consumers' Online Purchasing Intention During Pandemic and Post-Pandemic: A Comparative Study. *Journal homepage: www.ijamac.com*. 2021;1(1). <https://doi.org/10.5281/zenodo.5749078>
34. Sarbhai A, Khare V. Post Pandemic Shift of Consumer Behavior & Cloud Kitchen. *International Journal for Research in Applied Science & Engineering Technology*. 2023;11. <https://doi.org/10.22214/ijraset.2023.55044>