

Sustainable Culinary Business Model in the Industrial Era 5.0: A Case Study of Kapau Anak Sultan Medan Restaurant with Technology Integration and Green Economy

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ABSTRACT

This research responds to the challenge of declining technological operational performance and low awareness of the green economy experienced by Kapau Anak Sultan Medan Restaurant in the midst of fierce competition in the culinary industry that increasingly relies on digital technology and environmental sustainability demands. This condition encourages the need to design an adaptive and environmentally friendly culinary business model in the transition period of modern industry that emphasizes collaboration between humans and technological sophistication as well as social environmental concerns. The research method used a quantitative approach by collecting data through questionnaires to loyal restaurant consumers and structural equation modeling analysis techniques based on PLS SEM to test the influence of technology integration and the application of the green economy on business sustainability. The results of the study confirm that the use of online ordering platforms connected to smart inventory systems, digitization of service processes, as well as sustainability practices such as strategic partnerships with local farmers, the use of renewable energy, and circular waste management systems make positive and significant contributions in strengthening operational efficiency, expanding market reach, increasing customer loyalty, and strengthening environmentally friendly brand image.

Keywords: Culinary Business Sustainability, Digital Marketing Strategy, Green Economy Practices, Partial Least Squares, Technological Integration

INTRODUCTION

The culinary business model in Indonesia is growing rapidly along with lifestyle changes and technological advancements. In the era of Society 5.0, a business must be able to keep up with the development of industry 4.0 and the transformation of society 5.0 in order to survive (Juwita & Handayani, 2022). Conventionally, many business actors rely on food stalls, restaurants, or street vendors as the main means of selling food based on physical location, word-of-mouth promotions, and cash transactions. However, the emergence of digital technology has brought significant transformation. Technology-based business models rely on online platforms such as food ordering apps, social media for marketing, and digital payment systems that speed up and simplify transactions. In addition, the concept of cloud kitchens and ghost kitchens has become popular, as it allows for operational cost efficiency without the need for physical dining locations. The combination of these two models is also widely found, where conventional business people utilize technology to expand market reach. Overall, the culinary ecosystem in Indonesia is becoming increasingly dynamic, competitive, and open to innovation.

In recent decades, the culinary sector has experienced rapid development driven by technology and sustainability demands. Industry 5.0 emphasizes the integration of

people and technology to create businesses that are more responsive and adaptive to the needs of the environment and society. According to Rezeki et al. (2024), technology integration also results from digital transformation which refers to the process and strategy of integrating technology into business operations to improve customer service and the quality of products and services offered.

Kapau Anak Sultan Medan Restaurant is one of the culinary businesses that tries to adapt the principles of industry 5.0 by integrating technology and green economy in its operations. This restaurant not only serves Vaka's signature dishes that are rich in flavor, but also implements innovations in the supply chain, the use of renewable energy, and digitalization in customer service. This approach aims to create a culinary business model that is not only financially profitable, but also has a positive impact on the environment and the surrounding community.

Kapau Anak Sultan Restaurant carries a culinary business model that combines the concept of fast food with a modern touch to traditional Minang cuisine, especially Kapuu rice. With a "modern-mix culture" approach, the restaurant offers innovative menus such as mentai sauce rendang and salted egg pop chicken, which are packaged in a practical and appealing way to young urban consumers. This strategy allows restaurants to reach a wider market through grab-and-go services and online booking. However, on its journey to sustainability, Kapau Anak Sultan faces challenges in the form of declining sales since the end of 2023 and low brand awareness amid fierce competition in the F&B industry. By adopting more aggressive and relevant marketing strategies, such as brand collaborations, social media promotions, and constantly updated menu innovations, the restaurant has the potential to strengthen its position in the market and achieve long-term sustainability. The following is the income table from Kapau Anak Sultan Medan Restaurant for the past 3 years:

Table 1. 3 years of income Kapau Anak Sultan Medan Restaurant

No	Year	Income
1	2022	2.860.000.000
2	2023	2.200.000.000
3	2024	1.540.000.000

Table 1 above shows the trend of declining income over the past three years. In 2022, total revenue reached 2 860 000 000 IDR, then decreased to 2 200 000 000 IDR in 2023 (a decrease of 23.1%), and further decreased to 1 540 000 000 IDR in 2024 (a decrease of 30.0%). This decline indicates challenges in maintaining market share and operational efficiency. This trend signals the urgent need to adopt digital integrations, such as the implementation of online ordering systems and AI-driven inventory management, to make operations more efficient and responsive to market demand. At the same time, the use of green economies such as switching to organic local raw materials, the use of energy-efficient equipment, and circular-based waste management can reduce long-term costs and strengthen the environmentally friendly image. The synergy between advanced technology and green economy principles is not only a solution to restore profit margins, but also a long-term strategy that positions the restaurant as a pioneer of sustainable culinary business in the era of Industry 5.0.

Sustainable Business performance appears to be weakening based on recorded financial and operational indicators: the annual revenue decline shown in Table 1, narrowing operating margins caused by a rising share of fixed and operating costs, and consumer survey results that show limited recognition of the restaurant's environmentally friendly attributes. In addition, inventory records and service complaints indicate frequent

stockouts of popular menu items, which reduce customer experience and repeat-purchase contribution.

The integration of technology in the business world, especially in the culinary sector, is increasingly relevant in the industry 5.0 era. Industry 5.0 is a phase of the industrial revolution that emphasizes harmonious collaboration between humans and advanced technologies such as artificial intelligence (AI), Internet of Things (IoT), and collaborative robotics. Unlike the previous era that focused on automation, Industry 5.0 places humans at the center of innovation, where technology plays the role of a partner to increase creativity, efficiency, and sustainability. In the context of the culinary business, the impact of technology is very felt, ranging from operational efficiency, reduction of human error, improvement of service quality, to ease of data-based decision-making. Technology also enables personalization of customer service and expands market reach through digital platforms. One of the real examples of the application of this technology can be seen in the Kapau Anak Sultan restaurant, which carries the concept of modern-mix culture with a contemporary Kapau rice menu such as rendang with mentai sauce and salted egg pop chicken. The restaurant utilizes online ordering services through apps such as GrabFood and ShopeeFood, as well as packaging its food in a practical and aesthetic design to support takeaway and delivery services. With this approach, Kapau Anak Sultan not only follows the trend of digitalization, but also creates culinary experiences that are relevant to the lifestyle of modern consumers.

Technology Integration appears to be suboptimal. Although the restaurant is listed on delivery platforms such as GrabFood and ShopeeFood, the share of online orders as a proportion of total sales remains relatively low according to partner reports and internal POS data. Manual reconciliation between online orders and the POS, the frequency of POS downtimes, the number of stockout incidents per month, and limited digital training for staff indicate operational gaps that hinder the effectiveness of digitalization and inventory efficiency.

Sustainability in the culinary business is a major concern for many business owners, especially in the face of changing consumption patterns and environmental regulations. Today's consumers are increasingly aware of the environmental impact of the products they consume, so restaurants must adapt by serving healthier menus, transparent in the origin of raw materials, and using environmentally friendly packaging. In the era of industry 5.0, technology plays an important role in supporting the sustainability of culinary businesses. The use of artificial intelligence (AI), the Internet of Things (IoT), and blockchain systems in the food supply chain can improve production efficiency, reduce waste, and speed up the distribution process with a lower carbon footprint. Restoran Kapau Anak Sultan Medan has begun to adopt this technology to increase transparency and efficiency in the management of raw materials and its operations. Research conducted by Heyes et al. (2018), shows that technology integration and economic turnaround have a significant impact on sustainable business models. Previous research also conducted by Gregori & Holzmann (2020), it shows that the integration of digital technology and the creation of environmental value have an effect on the sustainable business model of the business.

On the other hand, the green economic aspect is a key factor in encouraging the sustainability of the culinary business. The concept of a green economy includes responsible resource management, the use of renewable energy, and the creation of added value for the community. Restaurants that apply green economy principles not only contribute to the environment, but also improve the well-being of workers and the surrounding community through more ethical and sustainable business practices. Adoption of the Green Economy is also still limited. Purchase records show that the share of spending on local/organic farmers is not yet dominant, while there has been no

significant investment in renewable energy sources or a formal composting program, waste logs show monthly volumes of organic and packaging waste with only a small proportion diverted to composting/recycling. This situation reduces the restaurant's ability to cut long-term costs and to strengthen its eco-friendly image in the eyes of consumers.

The implementation of the green economy at Kapau Anak Sultan Medan Restaurant includes the use of local raw materials from farmers who implement organic farming, a waste management system based on a circular economy, and the use of energy-saving devices in daily operations. With these measures, restaurants seek to create a balance between business profits and social responsibility. Research conducted by Chen (2023) Shows that green economy and ethnic culture have an influence on sustainable business models.

The green economy in the culinary sector emphasizes the importance of environmentally friendly and sustainable business practices, including food waste management and carbon footprint reduction. Kapau Anak Sultan Restaurant, with a fast-food concept based on traditional Minang cuisine, has great potential to contribute to the green economy. One of the steps that can be taken is to minimize food waste through proper portion planning, comprehensive use of foodstuffs, and environmentally friendly packaging. In addition, the use of disposable packaging that is aesthetically pleasing but still produces waste is a challenge that needs to be overcome with solutions such as biodegradable packaging or recycling systems. Considering that the culinary sector is a significant contributor to carbon emissions, both from the production process, distribution, to food disposal, green economy practices are very important to reduce environmental impact. By adopting these principles, restaurants like Kapau Anak Sultan not only support environmental sustainability, but also improve brand image and appeal to consumers who are increasingly concerned about ecological issues.

However, while the integration of technology and the green economy offers many advantages, challenges remain in its implementation. High investment costs, lack of education about green technology, and evolving regulations are obstacles for many culinary businesses to fully adopt sustainable business models. In the culinary business, the implementation of the green economy is one of the main challenges in achieving sustainability. Restaurants that seek to adopt green economy principles often face high-cost constraints, especially in the use of organic raw materials and environmentally friendly technologies. The price of sustainable raw materials tends to be more expensive than conventional materials, so restaurants must look for strategies that can maintain a balance between profitability and sustainability. In addition, the supply of eco-friendly raw materials has not always been widely available, making restaurants have to incur additional costs to obtain materials that meet green standards.

On the other hand, waste management is also a challenge in the sustainability-oriented culinary business. The industry produces a lot of food waste and packaging, so an efficient management system such as recycling or composting is needed. However, the implementation of this method still faces various obstacles, such as limited facilities and lack of awareness among workers and customers. Another significant challenge is consumer preference and awareness of environmentally friendly products. Although environmental awareness is increasing, there are still many customers who consider low prices more than the environmental impact of the products they consume.

In addition, government regulations and policies related to the green economy in the culinary industry still do not fully support businesses that want to implement sustainability principles. A lack of incentives and support for restaurants investing in green technology can hinder the development of environmentally oriented businesses. Therefore,

restaurants need to develop innovative strategies by utilizing technology to improve operational efficiency, working with local farming communities, and designing marketing campaigns that can educate consumers about the importance of supporting environmentally friendly businesses. With the right approach, restaurants can answer the challenges of the green economy while creating a sustainable business model in the industry 5.0 era.

Previous research also conducted by Fernando et al. (2019) shows that the integration of technology and green economic innovation has an effect on the sustainable business model. Through this case study, the research aims to explore whether there is an influence of the integration of technology and green economy on the culinary business, especially in the Kapau Anak Sultan Medan Restaurant. This research also seeks to identify the challenges faced and formulate solutions that can be applied by other culinary businesses to be better prepared to face the challenges of industry 5.0.

LITERATURE REVIEW

SUSTAINABLE BUSINESS

Competitiveness is the ability of a society to continuously transform itself in response to economic, political, and technological changes (Nasution, 2024). Business sustainability is a condition when a company has sufficient funds to develop and develop its business (Aulia et al., 2021). Business sustainability is always related to bankruptcy. Business sustainability is a form of consistency of business conditions, where this sustainability is a process of business continuity, both including growth, development, strategies to maintain business continuity and business development where all of this leads to the sustainability and existence (resilience) of the business (Wijayanti & Hanandia, 2022). A sustainable business model is a business model that combines proactive multi-stakeholder management, monetary and non-monetary value creation for a wide range of stakeholders, and has a long-term perspective (Sebrina et al., 2024). Sustainable business is a business approach that integrates environmental sustainability considerations into the production, distribution, and consumption processes, with the goal of creating long-term well-being without leaving ecological and social risks for future generations (Kusumaningrum & Safitra, 2020). A sustainable competitive business model is something that every company, even every product in the competition it loves, is looking for (Mahanani et al., 2023). Thus, sustainable business is an outcome variable reflecting long-term organizational resilience and viability, demonstrated by financial stability, repeat patronage, efficient operations, and a reputation for social and environmental responsibility. Sustainable business has several indicators, namely environmental, economic, and social dimensions (Ibrahim et al., 2013).

TECHNOLOGY INTEGRATION

Technology integration is a technology that is combined to present information, access information, complete routine tasks, assist with direct interactivity (direct feedback) and assist with various experiences in an environment both internal and external (Suprayekti, 2011). The integration of technology in this study is a combination of integration and technological transformation which includes providing means and utilization of technology to build interactions (Yaumi & Damopolii, 2019). Technology integration is the process of unifying or combining various components of information and communication technology into a system or operation to improve efficiency, effectiveness, and performance (Judijanto et al., 2025). Technology integration is one of the effective solutions in overcoming the world's critical issues (Samsiah et al., 2024). Digital technology integration refers to the use of computer-based digital systems and internet networks to process, store, and transmit information in various forms of media

(Gani et al., 2024). In Society 5.0, digital technologies such as artificial intelligence, big data, and the Internet of Things (IoT) are integrated into various aspects of human life to create innovative solutions to social problems (Rezeki et al., 2025). Thus, technology integration refers to how effectively a business embeds digital solutions into everyday operations to increase efficiency, reduce errors, improve responsiveness to demand, and enhance the customer experience. Technology integration has several indicators, namely substitution, augmentation, modification, redefinition (Muh, 2020).

GREEN ECONOMY

Green economy is an economic methodology that supports the harmonious interaction between human life and nature so that the needs of both can be met (Lumbanraja & Lumbanraja, 2023). A green economy also means a low-carbon or non-carbon dioxide emission economy and a natural resource-efficient and socially just environmental population (Wahyuni et al., 2022). The green economy is an economic paradigm that emphasizes sustainable and environmentally friendly development (Mulyani et al., 2023). The green economy is the ability of individuals or groups to utilize digital technology in an effort to improve economic well-being by considering the principles of sustainability and environmental protection (Regif et al., 2023). Green economy is the economic activity of the community in the activity of buying and selling goods and or services that bring income or income for a person (Ardianingsih & Meliana, 2021). Thus, green economy is the extent to which a firm adopts environmentally responsible strategies that lower ecological impact, create long-term cost savings, and strengthen an eco-friendly brand identity. The green economy has several indicators, namely a reduction in emissions, life expectancy, and open unemployment (Lumbanraja & Lumbanraja (2023).

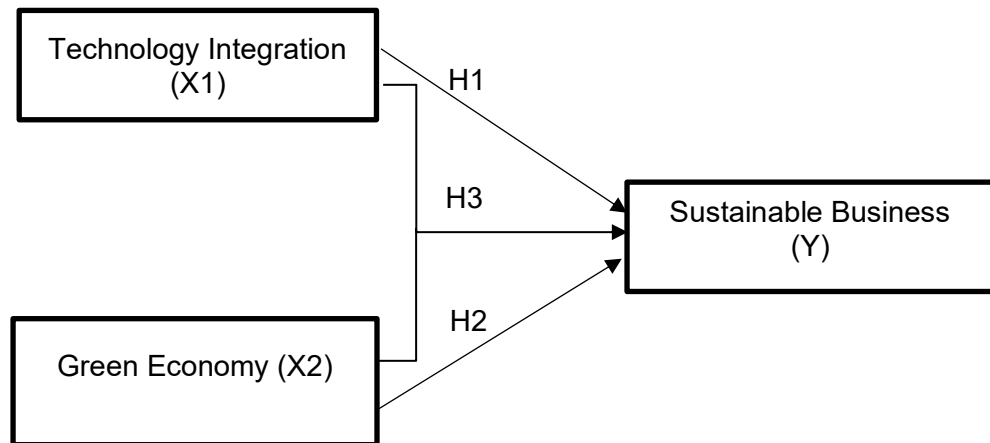


Figure 1. Theoretical Framework

The hypothesis in this study is:

H1: There is an influence of Technology Integration on Sustainable Business

H2: There is an Influence of the Green Economy on Sustainable Business

H3: There is an Influence of Technology Integration and Green Economy on Sustainable Business

RESEARCH METHOD

This research was carried out at one of the branches of Kapau Anak Sultan Restaurant located on Jalan Krakatau Ujung, Pulo Brayan Darat II Village, East Medan District, Medan City, North Sumatra, with the postal code 20154. The research implementation

time lasts from August to October 2025. This type of research is quantitative research by distributing questionnaires to consumers and data processing using the Structural Equation Modeling method based on Partial Least Squares (SEM-PLS). The population in this study is consumers of Kapau Anak Sultan Medan Restaurant. The population in this study is unknown. According to Sugiyono (2022:127), the sample is part of the numbers and characteristics possessed by the population. The sample criteria in this study are consumers from Kapau Anak Sultan Medan Restaurant. The sampling technique used in this study is incidental sampling. Sugiyono (2022:133) Defining incidental sampling as a sample determination technique based on chance, that is, anyone who happens to meet the researcher can be used as a sample, if it is seen that the person who happens to be met is suitable as a data source. Due to the unknown number of populations, we will use the hair formula where the number of samples is at least 5 times and the maximum is 10 times the number of indicators. In the study, there were 10 indicators, the number of indicators used was: Minimum sample = number of indicators x 5 = 10 x 5 = 50 respondents, Maximum sample = number of indicators x 10 = 10 x 10 = 100 respondents. In this study, the researcher determined the number of samples to be used was as many as 100 respondents from consumers in Kapau Anak Sultan Medan Restaurant.

RESULTS

Based on the convergent validity test, all loading factor values of the Technology Integration (IT1 – IT8), Green Economy (EH1 – EH6), and Sustainable Business (BB1 – BB6) variable indicators exceeded 0.50 each, so all items were considered to be convergently valid. The discriminant validity test also showed that the correlation of each indicator to its construct was higher than the correlation with other constructs, confirming the instrument's ability to distinguish between constructs well. With the fulfillment of these two criteria, it can be concluded that the research instrument has adequate validity.

In the reliability test, the Technology Integration variable obtained a Cronbach's Alpha value of 0.875 and Composite Reliability (ρ_c) of 0.902, the Green Economy variable recorded Cronbach's Alpha of 0.794 and ρ_c 0.850, while the Sustainable Business variable showed Cronbach's Alpha of 0.845 and ρ_c 0.886, with all values above the threshold of 0.70, it can be concluded that each construct has good internal consistency and this research instrument is reliable for measures these three variables.

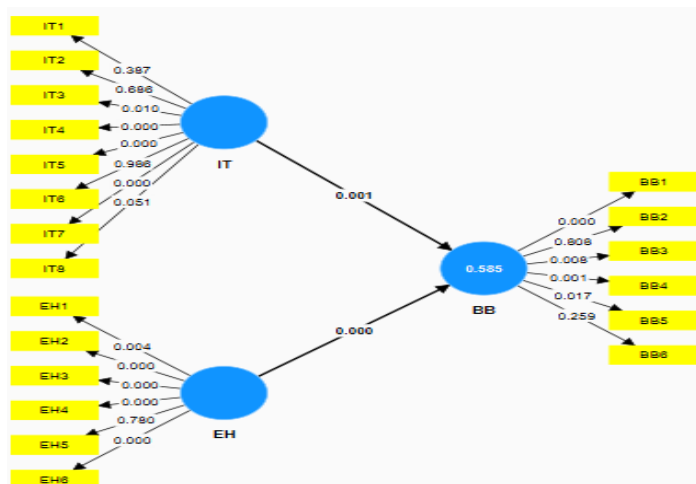


Figure 2. Overview Results

The R Square value of the Sustainable Business (BB) variable is 0.585, with adjusted R^2 0.577. This indicates that the variables of Technology Integration (IT) and Green Economy (EH) are able to explain the Sustainable Business (BB) variable of 58.5%. So it can be concluded that the model is considered moderate. A high R^2 value indicates excellent model strength.

The effect of Technology Integration (IT) on Sustainable Business (BB) of 0.173 is considered moderate. Meanwhile, the Influence of Green Economy (EH) on Sustainable Business (BB) of 0.592 is considered strong.

In the hypothesis test, the results of the path estimation showed that Technology Integration had a positive and significant effect on Sustainable Business with a path coefficient of 0.307, t-statistic of 3.201 (>1.96) and p-value of 0.001 (<0.05). Meanwhile, the Green Economy also has a positive and significant effect on Sustainable Business and the Green Economy has a greater impact with a coefficient of 0.567, t-statistic 6,954 and p-value 0.000 (<0.05).

The Q^2 value is $0.492 > 0$ and is in the strong category, so the model has predictive relevance or exogenous latent variables, namely Technology Integration (IT) and Green Economy (EH) are very good (very suitable) as explanatory variables that are able to predict the endogenous variable, namely Sustainable Business (BB).

DISCUSSION

The Influence of Technology Integration on Sustainable Business

The results show that technology integration has a positive and significant effect on sustainable business with a path coefficient of 0.307, a statistic of 3.201, and a pvalue of 0.001, indicating that operational digitalization and online ordering systems significantly improve restaurant sustainability performance. The implementation of inventory management and service digitization needs to be prioritized to reduce empty stock, reduce operational costs, and increase customer satisfaction as part of the sustainability strategy. However, the effect size here is moderate, which mirrors Nasution (2024) who note that digital adoption alone does not guarantee large gains unless accompanied by staff capability and process integration. In Kapau Anak Sultan's case, operational gaps (manual reconciliations, POS downtime, limited staff training) likely constrained the full potential of technology, explaining why the technology effect is meaningful but not dominant

The Influence of the Green Economy on Sustainable Business

The green economy has a positive and stronger influence on sustainable businesses with a path coefficient of 0.567, a statistic of 6.954, and a pvalue of 0.000, indicating that eco-friendly practices (local farmer partnerships, renewable energy, circular waste management) make a major contribution to the resilience and brand image of restaurants. This result is consistent with Chen (2023) and Fernando et al. (2019), which demonstrate that green practices and environmental innovation materially improve sustainable business outcomes.

The Influence of Technology Integration and Green Economy on Sustainable Business

The combined model shows that the two exogenous variables explain 58.5% of the variation in sustainable business ($R^2 = 0.585$), with a Q^2 predict of 0.492 indicating strong predictive relevance; the combination of technology and green practices provides a meaningful synergistic effect on the resilience of culinary businesses. This combined effect confirms that technology is not only an instrument of efficiency but also a

strengthening of the implementation of the green economy. This synergy supports Gregori & Holzmanna (2020) and Fernando et al. (2019), who argue that digital tools enable and amplify green innovations (e.g., smart inventory reduces waste, traceability increases transparency for local sourcing). In Kapau Anak Sultan's context, technology's role appears instrumental for operationalizing green practices like a better inventory forecasting and integrated ordering reduce food waste and enable reliable procurement from local suppliers.

CONCLUSION

Both technology integration and green-economy practices significantly improve the restaurant's sustainable business performance, but green practices have a substantially larger impact than technology alone. Technology contributes meaningfully (through digitized ordering and inventory processes) but its effect is moderate likely constrained by operational gaps whereas green initiatives (local sourcing, renewable energy, circular waste management) provide stronger, more immediate gains in resilience, cost control, customer loyalty, and brand image. As a suggestion in the future, Kapau Anak Sultan Medan Restaurant should optimize technology integration by implementing an online ordering platform that is directly connected to an artificial intelligence-based inventory system to minimize depleted stock and accelerate response to demand. Furthermore, the recommendations for Kapau Anak Sultan Medan Restaurant is they should to strengthen the green economy by forging exclusive partnerships with organic local farmers, switching to renewable energy sources in the kitchen, and implementing circular waste management systems to reduce long-term costs and improve the eco-friendly image. Combine these two initiatives in an aggressive digital marketing campaign through educational content on social media and loyalty programs based on green principles and develop an integrated KPI dashboard to monitor the effectiveness of each program in real time, so that restaurants can strengthen product differentiation, increase profit margins, and build solid business sustainability in the industry 5.0 era.

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