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BRIDGING POLICY AND BEHAVIOR: AN INTEGRATED FRAMEWORK FOR SUSTAINABLE FOOD WASTE MANAGEMENT IN THE THAI RESTAURANT INDUSTRY

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Abstract
Food waste in the restaurant sector poses a critical challenge to sustainable development in Thailand, yet comprehensive mechanisms that integrate policy and behavioral dimensions remain underexplored. This study investigates the determinants of effective food waste management and proposes policy-oriented guidelines for the Thai restaurant industry. Adopting a systematic literature review approach, the research develops an integrated conceptual framework combining the Policy Cycle Model and the Theory of Planned Behavior (TPB) to analyze the complex interplay between regulations and operator actions. The analysis reveals that operator awareness, consumer behavior, and regulatory clarity are pivotal drivers of waste management strategies, which in turn enhance policy adoption and business sustainability. The study identifies significant gaps in current legislation and highlights the need for active stakeholder engagement to ensure policy effectiveness. Key recommendations include implementing tax incentives, supporting digital waste-tracking technologies, and establishing standardized certification systems. Furthermore, the framework emphasizes fostering collaboration across government, private, and community sectors to transition from passive compliance to proactive sustainability. These findings offer actionable insights for policymakers and business operators, providing a strategic roadmap to mitigate food waste and align local restaurant practices with global sustainability goals.
Keywords: Sustainable Food Waste Management, Restaurant Policy Framework, Theory of Planned Behavior, Policy Cycle Model, Circular Economy Adoption

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Introduction

Food waste is a global issue with far-reaching environmental, economic, and social impacts. According to the State of Food and Agriculture 2019 report by the Food and Agriculture Organization of the United Nations (2019), approximately 14 percent of the world's food—valued at over USD 400 billion annually—is lost between the post-harvest and retail stages. The Food Waste Index Report by the United Nations Environment Programme (2021) reveals that an additional 17 percent of food is wasted at the consumer and retail levels, particularly in households. Combined, one-third of all food produced is either lost or wasted each year. In Thailand, municipal solid waste totaled 26.95 million tons in 2023, with food waste accounting for 38% of that figure (Pollution Control Department, 2024). Inefficient food waste management not only burdens waste disposal systems and generates methane— a greenhouse gas with 25 times the global warming potential of carbon dioxide—but also leads to the loss of valuable resources such as water, energy, and agricultural land (Intaratrakul & Pensupa, 2020). Although Thailand has outlined a national strategy for 2023-2027 to reduce food waste to no more than 28% of total municipal waste, there remains a lack of concrete mechanisms and policies to actively engage the restaurant sector—particularly to address behavioral drivers and ensure effective policy implementation. The Policy Cycle framework provides a lens to understand the sequential stages of policy development. At the same time, the Theory of Planned Behavior (TPB) highlights the roles of motivation, attitudes, and social influence in driving behavioral change toward food waste reduction (Silva & de Almeida, 2024). However, few studies in Thailand have integrated these two frameworks, especially in the context of restaurants, which are among the largest sources of food waste. Most existing research continues to focus on developed countries in Europe and North America (Food and Agriculture Organization of the United Nations, 2022), resulting in a knowledge gap regarding policy mechanisms and behavioral dynamics that support sustainable food waste management in the Thai restaurant industry.

To address this gap, this study analyzes both policy processes and behavioral factors influencing food waste management practices in Thai restaurants, applying the Theory of Planned Behavior and public policy analysis to generate actionable insights. The specific objectives of this research are to examine the behavioral factors influencing restaurant operators using the TPB framework, analyze the policy mechanisms and government support structures related to food waste reduction in Thailand, develop integrated policy recommendations that foster collaboration among government, private sector, and community stakeholders, and propose resource-efficient and environmentally sustainable strategies for restaurant operations.

Literature Reviews

Policy Cycle Model for Food Waste Management

The Policy Cycle Model, originally developed by Lasswell (1956) and later refined by Jann & Wegrich (2006), divides the policy process into five stages: 1) agenda setting, 2) policy formulation, 3) policy adoption, 4) implementation, and 5) evaluation. In this study, The Policy Cycle Model is applied to analyze the key factors influencing food waste management in the business context. These include: 1) regulatory frameworks encompassing legal mandates, incentives, and penalties; 2) policy acceptance, reflected through stakeholder cooperation and contextual alignment; and 3) policy effectiveness, measured by actual outcomes in comparison to intended goals (Catalano et al., 2024; Kattiyapornpong et al., 2023; Namdech et al., 2023). These three factors are interrelated. For instance, clear and consistent regulations are more likely to promote policy acceptance and lead to effective implementation (Shen et al., 2024). In the Thai context, however, the lack of specific legislation and weak enforcement remain significant challenges. Therefore, policy design must be flexible and

responsive to the realities of the business sector in order to advance sustainable food waste management.

Theory of Planned Behavior (TPB) and Food Waste Management Behaviors

The Theory of Planned Behavior (TPB), proposed by Ajzen (1985), explains the intention to reduce food waste through three core components: 1) attitude, 2) social pressure (subjective norms), and 3) perceived behavioral control. TPB has been shown to effectively predict food waste-reduction behavior, particularly among individuals with positive attitudes and strong self-efficacy (Çetin & Çetin, 2024; Nguyen & Nguyen, 2025). However, TPB has limitations in translating intention into actual behavior, especially when external support—such as legal frameworks or enabling policy structures—is lacking (Silva & de Almeida, 2024). To address this limitation, the present study integrates TPB with the Policy Cycle Model to capture both the behavioral dimensions and the structural-policy context. This integrated approach provides a more comprehensive foundation for designing effective food waste management policies tailored to Thailand's restaurant industry realities.

Food Waste Awareness and Food Waste Management Strategies

Food waste awareness refers to an individual's recognition of the social, economic, and environmental impacts of food waste, along with a sense of responsibility to reduce it. This awareness is shaped by various personal factors, such as age, income, household size, and daily behaviors (Ananda et al., 2023; Lin & Guan, 2021). Although food waste awareness stems largely from personal and social factors, the use of Industry 4.0 technologies—such as big data and digital platforms—enhances operational visibility, enabling better decision-making and indirectly supporting waste-reduction strategies (Arshad et al., 2025). Many businesses have responded by offering employee training and implementing policies for surplus food donation (Sundin et al., 2023). However, awareness alone is insufficient to drive behavioral change without external motivation or support mechanisms—such as assistance from local authorities or universities—that help turn intention into action (Silva & de Almeida, 2024). Beyond awareness and attitudes, factors such as behavioural control, knowledge of the impacts of food waste, and psychological closeness to the issue also influence food waste behaviour and help foster sustainable habits (Hatab et al., 2022), as proposed in Hypothesis 1 in Figure 1.

H1: Food Waste Awareness has a positive influence on Food Waste Management Strategies.

Consumer Behavior and Food Waste Management Strategies

Consumer behavior is a critical factor contributing to food waste, particularly in developing countries, where it is shaped by individual, household, and societal influences. Attitudes, knowledge, income, values, and cultural norms all shape consumers' intentions to reduce food waste (Damanik et al., 2025; Shen et al., 2024; United Nations Environment Programme, 2024). In Thailand, buffet restaurants often generate significant food waste because customers take more food than they can eat. Additionally, hotel catering services have been reported to produce food waste accounting for up to 96.28% of total waste (Hayeebueraheng & Phanthuwongpakdee, 2024; Srijuntrapun & Sukwong, 2024).

Reducing food waste requires a multifaceted approach that integrates communication strategies addressing environmental, health, and food security concerns, coupled with awareness-raising campaigns, behavioral incentives, and policy-based controls—all aligned with Sustainable Development Goal (SDG) 12.3 (Etim et al., 2025). In developing countries, especially, targeted measures should address consumer behavior directly. These include source separation of waste, promoting environmental responsibility, providing economic incentives, and adopting recycling technologies (Rahman et al., 2024). Consumer behavior is not only a root cause of food waste but also a key determinant of businesses' strategic direction. This relationship is captured in Hypothesis 2 in Figure 1.

H2: Consumer behavior has a positive influence on food waste management strategies.

Regulatory Factors and Food Waste Management Strategies

Public policy plays a vital role in addressing food waste, a global issue that threatens food security, the environment, and the economy. Successful cases from France and South Korea demonstrate the effectiveness of proactive policies, including legislation mandating supermarkets to donate unsold food and systems for recycling food waste into compost or bioenergy (Lee et al., 2024; Sarangi et al., 2024; Shen et al., 2024). In contrast, Indonesia still lacks specific legislation and enforcement mechanisms, leaving most initiatives at the pilot project stage (Catalano et al., 2024). Effective policies should integrate regulatory mandates with incentives, such as tax deductions, technological support, and public education (Pilone et al., 2023). These measures should be reinforced through public-private collaboration and the incorporation of circular economy principles (Saiphet & Kunta, 2023; Sarangi et al., 2024). However, countries such as India, Thailand, and New York City continue to face regulatory challenges, including the absence of dedicated food waste laws, inconsistent enforcement, and weak inter-agency coordination (Ali, 2024).

Regulatory factors not only serve as control mechanisms but also act as strategic drivers that shape policy direction and practical implementation at all levels. This relationship is reflected in Hypothesis 3 in Figure 1.

H3: Regulatory factors have a positive influence on food waste management strategies.

Regulatory Factors and Policy Adoption

Policy acceptance in the business sector is a complex process that depends on the clarity, stability, and alignment of regulations with business operations. This is particularly relevant for small and medium-sized enterprises (SMEs), which tend to respond more positively when they are given opportunities to engage with government agencies, build networks, and adopt innovative practices (Abbas et al., 2024; Collison, 2024). Clear government policies enhance strategic alignment within business organizations. This clarity enables firms to adapt to policy environments and fosters collaboration between the public and private sectors in achieving shared strategic goals (Dhlamini, 2022). Policies that align with organizational objectives, involve relatively low compliance costs, and allow for business participation from the policy design stage are more likely to be accepted (Min, 2023). A notable example from South Korea demonstrates that policies that support technology adoption and create space for business engagement lead to more systematic and widespread policy acceptance (Lee et al., 2024).

In contrast, many restaurant businesses in Thailand still lack clear waste management guidelines due to inconsistent governmental engagement at the operational level and a disconnect between national and local policy implementation (Sawangpol & Sangpikul, 2023). As a result, policy acceptance requires multiple enabling factors, including robust support structures, effective inter-agency coordination, and accessible policy communication that reaches the operational level. This relationship is reflected in Hypothesis 4 in Figure 1.

H4: Regulatory factors have a positive influence on business policy acceptance.

The Relationship between Food Waste Management Strategies and Policy Adoption

Effective food waste management can significantly facilitate the acceptance and implementation of public policies, particularly within organizations with well-structured management systems and a strong awareness of the economic and environmental impacts of food waste. Such organizations are generally better able to adapt to and comply with government measures (Hemphill, 2023; Mundo-Rosas et al., 2024). Businesses with systematic waste management strategies are often more responsive to public policy initiatives (Awino & Apitz, 2024), and companies with environmentally oriented CSR strategies tend to be more supportive of government policies than those lacking a clear direction (Bhat et al., 2024). However, this linkage between internal strategy and policy compliance requires reinforcement through macro-level support. Key drivers include promoting eco-innovation, establishing

national waste-reduction targets, and advancing a circular economy agenda (Phonthanukitithaworn et al., 2024).

Therefore, food waste management strategies not only reflect an organization's readiness for policy compliance but also serve as an active mechanism for driving policy acceptance—both voluntary and regulatory. This relationship is captured in Hypothesis 5 in Figure 1.

H5: Food waste management strategies have a positive influence on business policy acceptance.

Policy Adoption and Policy Effectiveness

The business sector's acceptance of government policies is a crucial factor influencing policy effectiveness—particularly in enhancing organizational competitiveness and development. When policies align with business priorities, such as promoting innovation or transitioning toward a digital economy, operational efficiency tends to improve (Karnsomdee, 2021). During the COVID-19 crisis, measures such as tax relief and fiscal restructuring played a key role in enhancing business resilience and maintaining macroeconomic stability (Yujuan et al., 2022). However, a highly centralized administrative system that lacks flexibility can hinder policy acceptance. In contrast, decentralization and greater participation from local agencies in the design and implementation of policies can help reduce resistance and foster stronger cooperation from the private sector (Pasco & Bendezu, 2024). Even well-designed policies may underperform in practice if the administrative structure is not inclusive or does not actively encourage business engagement, as reflected in Hypothesis 6 in Figure 1.

H6: Business policy acceptance has a positive influence on policy effectiveness.

The Relationship between Food Waste Management Strategies and Business Sustainability in the Restaurant Business

A systematic approach to food waste management helps reduce costs, enhance operational efficiency, and improve brand image among environmentally conscious consumers—ultimately contributing to the long-term sustainability of businesses. Buffet restaurants in Thailand that implement clear waste management measures have successfully reduced waste and enhanced their brand image through CSR initiatives aligned with the Sustainable Development Goals (SDGs) (Hayeebueraheng & Phanthuwongpakdee, 2024). In Malaysia, systematic waste management practices have enabled SMEs to adapt and remain competitive (Othman et al., 2021). Common strategies include donating surplus food, reusing ingredients, and planning production—practices that positively impact profitability and cost-effectiveness. Investing in waste management systems has proven to deliver economic returns for five-star hotels, while also strengthening organizational culture and stimulating the local economy (Somlai, 2023). Although these strategies offer environmental and business benefits, their implementation requires careful planning, the application of the 3Rs (Reduce, Reuse, Recycle), and appropriate technology. Nevertheless, limitations remain, including cost concerns, the convenience of alternative materials, and knowledge gaps at the community level (Andrighetto et al., 2024). To scale these practices more broadly, government support through incentive mechanisms is essential, as illustrated in Hypothesis 7 in Figure 1.

H7: Food waste management strategies have a positive influence on restaurant business sustainability.

Policy Effectiveness and Business Sustainability in the Restaurant Business

Effective government policies play a critical role in promoting the sustainability of restaurant businesses across economic, environmental, and social dimensions—particularly when supported by clear structures such as education programs, subsidies for clean technology, or tax incentives (Namdech et al., 2023). Local-level policies can drive changes in both consumer behavior and business practices, such as regulating advertisements targeting children or encouraging the adoption of healthier menu options (Barbour et al., 2022). The integration of technology to simultaneously reduce operational costs and environmental impacts has also

proven beneficial (Atashov et al., 2025). However, unclear, inconsistent, or fragmented policies may hinder strategic planning and the transition toward sustainability. Effective policy frameworks should demonstrate clarity, alignment with business contexts, and practical support mechanisms that facilitate real-world application. Such policies enable restaurants to reduce waste, develop healthier menu options, and operate sustainably. Therefore, well-designed policies must not only reflect governmental intentions but also be feasible in practice and responsive to the operational realities of the restaurant industry, as reflected in Hypothesis 8 in Figure 1.

H8: Policy effectiveness has a positive influence on restaurant business sustainability.

From the literature review, the conceptual framework can be drawn as shown in Figure 1.

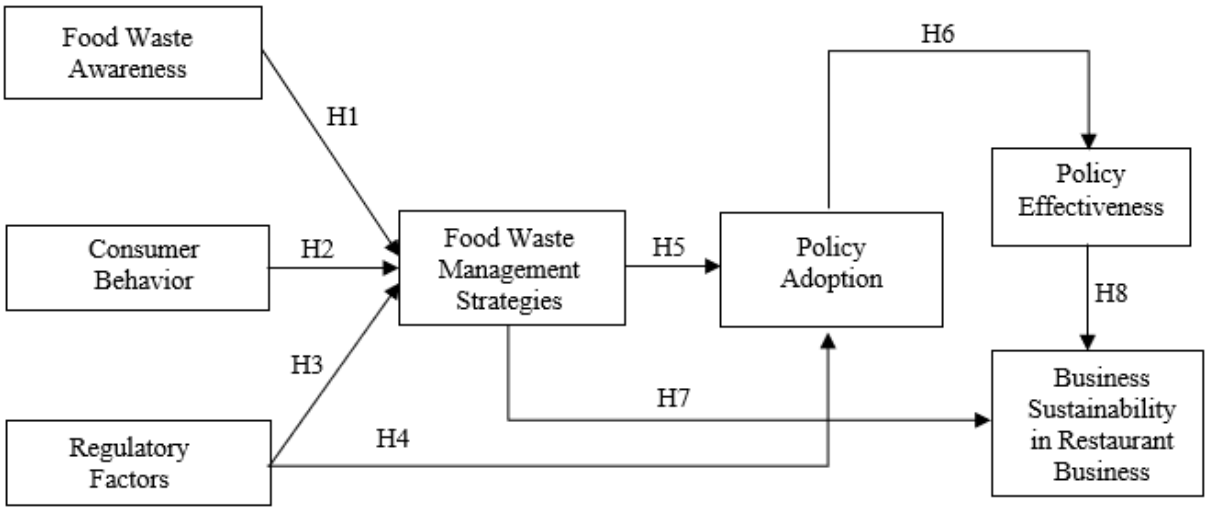

Figure 1 Conceptual Framework

Research Methodology

This study aims to analyze food waste management policies within Thailand's restaurant industry by applying an integrated conceptual framework that combines the Policy Cycle Model and the Theory of Planned Behavior (TPB). The framework is used to explain. The interrelationships among food waste awareness, consumer behavior, regulatory factors, management strategies, policy acceptance, and business sustainability. The research addresses two key questions: 1) What factors influence food waste management strategies in the restaurant sector? Moreover, 2) What policy approaches are most effective in promoting food waste management practices in Thailand?

Data collection was conducted between February and March 2025 through a systematic literature review using databases including Scopus, Web of Science, TCI, and Google Scholar. Search terms were aligned with the study's focus, and the review covered publications from 2021 to 2025. Selection criteria included: 1) relevance to the restaurant business context, 2) publication in peer-reviewed journals, and 3) explicit discussion of either the Policy Cycle or TPB. Articles deemed irrelevant or duplicates were excluded, resulting in a final set for content analysis and synthesis. The findings are expected to provide policymakers, business operators, and stakeholders with valuable insights for developing mechanisms to support sustainable food waste management in Thailand.

Research Results

The systematic literature review revealed several key factors influencing food waste management in Thailand's restaurant industry. One major factor is operator awareness, which shows a positive correlation with effective waste management strategies, such as ingredient

planning, technology use, and food waste valorization (Akkaş & Gaur, 2022; Arshad et al., 2025). Consumer behavior, particularly in buffet restaurants—where waste accounts for up to 96.28% of total food waste—can be improved through environmental communication and awareness-building campaigns (Srijuntrapun & Sukwong, 2024). Clear regulatory frameworks, including penalties and tax incentives, are also essential. Countries lacking enforcement mechanisms often fail to achieve sustainable outcomes (Catalano et al., 2024; Lee et al., 2024; Shen et al., 2024). Having a well-defined management plan and aligning with CSR initiatives further enhances policy acceptance and strengthens organizational image (Bhat et al., 2024). In addition, business participation in policy design can significantly improve implementation effectiveness (Karnsomdee, 2021; Pasco & Bendezu, 2024). The study also highlights the need to consider operational differences among restaurant types—such as fast food, fine dining, and buffet establishments—when designing policy and management approaches (Kinnares, 2024). A case from the JW Marriott Hotel in Bangkok illustrates how technology and circular economy principles can effectively reduce costs, enhance brand image, and support long-term sustainability (Chaiyasain, 2021). These successes, however, depend on government support, such as tax incentives and certification schemes, as well as collaboration with the private sector, communities, and academic institutions (Saiphet & Kunta, 2023; Landín, 2024). If Thailand were to adopt proven international approaches—such as tax deductions for food donation costs and transportation, and liability exemptions for good-faith donations—food waste could be reduced by up to 40%. In the Thai context, this could reduce food waste by an estimated 30-40% and significantly lower operating costs (Landín, 2024).

External Context Analysis Affecting Food Waste Management in Thailand's Restaurant Industry

This study applies the PESTLE framework to analyze external factors influencing food waste management in Thailand's restaurant industry across six key dimensions. In the political and legal dimension, Thailand currently lacks specific legislation on food waste and tax incentives to support food donation or waste reduction (Saiphet & Kunta, 2023; Shen et al., 2024). This legal gap has direct implications for the economic dimension, where ineffective food waste management increases operating costs for restaurants—particularly in terms of raw material expenses and waste disposal fees (Hayeebueraheng & Phanthuwongpakdee, 2024). From a social perspective, overconsumption—especially in buffet restaurants—remains a major cause of food waste, while public awareness of its environmental and social impacts is still relatively low (Srijuntrapun & Sukwong, 2024). Legally, there are still no direct incentive mechanisms such as tax deductions for restaurants that donate food or reduce waste (Shen et al., 2024). These issues are intertwined with the technological dimension: large enterprises mostly adopt innovations that help reduce food waste, while small restaurants struggle to access them. In terms of the environmental dimension, food waste significantly contributes to greenhouse gas emissions from landfills. Promoting a circular economy has thus emerged as a key strategy to mitigate these impacts (Namdech et al., 2023). Understanding these interconnected external factors systematically can support the formulation of more context-sensitive and actionable policies for food waste management in Thailand.

Identifying Stakeholders and Designing Incentive Plans for Food Waste Management in Thailand's Restaurant Sector

Effective food waste management requires a strategic plan grounded in a clear stakeholder mapping process, along with the design of appropriate incentive mechanisms tailored to the specific roles of each stakeholder group, as illustrated in Table 1 Stakeholder Mapping for Food Waste Management in Thailand's Restaurant Industry.

Table 1 Stakeholder Mapping for Food Waste Management in Thailand's Restaurant Industry

Stakeholder Group	Roles / Relationships	Primary Interests	Influence on the Systems
Government	Policy design, legal enforcement, resource allocation	Environmental impact reduction, achievement of SDGs	High
Private Sector	Waste management operators, investment or donation decision-makers	Cost reduction, image enhancement, and profitability	High
NGOs / Non-profit Organizations	Receive food donations, communication, and advocacy	Reducing inequality, food security	Medium
Consumers	Waste generators, consumer behavior influencers	Health, value for money, and environmental concerns	Medium
Research Institutes / Universities	Generate data, provide policy advice	Knowledge development, systemic impact	Medium

The government should implement supportive policies and tax incentives to encourage environmentally responsible restaurant practices. The private sector should be motivated through certification systems and funding for technological innovation. Nonprofit organizations require logistical support to handle food redistribution effectively. Consumers can be encouraged through awareness campaigns promoting sustainable behaviors, while academic institutions should offer policy recommendations aligned with the socio-economic context. Collaboration among all stakeholders under a national coordination mechanism is essential to achieving efficient food waste management aligned with the Sustainable Development Goals (SDGs) (Landín, 2024; Lee et al., 2024; Saiphet & Kunta, 2023).

Conclusion and Discussion

Findings from this study suggest that effective food waste management in Thailand's restaurant sector requires an integrated approach encompassing operator awareness, consumer behavior, and a well-defined regulatory framework. These factors collectively influence management strategies and the level of policy acceptance among businesses. The use of technology—such as waste monitoring systems, surplus food processing, and staff training—plays a key role in enhancing brand image and operational efficiency. A case in point is JW Marriott Bangkok, which reduced food waste by 42 tons within four months and significantly cut carbon emissions. The adoption of circular economy principles and fiscal measures—such as the enhanced tax deduction models used in the United States and Portugal—can serve as effective incentives, encouraging businesses to donate surplus food rather than discard it. Nonetheless, Thailand's current food waste management system faces structural limitations, including weak enforcement mechanisms, poor inter-agency coordination, and insufficient support for small businesses.

Policy design must therefore be tailored to the characteristics of different restaurant types and to Thailand's broader socioeconomic context to foster long-term behavioral change. Based on this research, three key recommendations are proposed:

Policy Recommendations: Government agencies should revise existing legislation and design incentive schemes that align with the realities of the restaurant sector. This includes tax deductions for food donations or investments in waste-reducing technologies. The enhanced

tax deduction model—which allows businesses to deduct up to 15% of taxable income—could be adapted to encourage socially beneficial behavior. Cross-agency collaboration among the Revenue Department, the Pollution Control Department, and local administrative bodies should be strengthened to ensure effective implementation at the local level.

Business Management Recommendations: Restaurant operators should recognize both the economic returns and reputational benefits of efficient food waste management. Strategies should be tailored to the type of establishment—for example, portion-size control in fast-food outlets, waste-reduction initiatives in buffet restaurants, and the use of smart technologies in fine-dining settings. Businesses should also systematically assess the return on investment (ROI) of such initiatives.

Recommendations for Future Research: Empirical studies using mixed methods should be conducted to collect data across different types of restaurants, supported by in-depth interviews. This would allow for validation of the integrated TPB-Policy Cycle framework using Structural Equation Modeling (SEM) in real-world contexts. Particular attention should be given to comparing urban and rural areas, which differ in economic and cultural conditions. In addition, policy simulation tools should be employed to assess the potential impacts of proposed measures before national-level implementation. This will help ensure that future policies are more precise, practical, and aligned with the capacities of businesses across all levels in Thailand.

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