

# A Support System for Street Food Vending: Utilizing Urban Geoinformatics to Facilitate the Relocation of Food Stalls in Bangkok

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## Abstract

The study aimed to create a support system for street food sales in response to urban relocation patterns, focusing on the geospatial context of restaurants in Bangkok. Data science technology was utilized to develop a navigation map powered by an algorithm designed to help users find street food restaurants. The system operates within a 5-kilometer radius of the selected restaurant for table reservations. It requires access to the user's current location, integrating geospatial data such as maps and distance calculations. This information estimates the time needed to reach the restaurant, facilitating timely table reservations and minimizing wait times, thereby enhancing the convenience of advance bookings. The system was developed and tested on devices with the application installed to assess the efficiency of table reservations. The front end was built using the PHP framework Laravel 7, while the back end was developed with Flutter, with communication between the two achieved through a RESTful API. Performance and user satisfaction were evaluated by 23 experts and operators, yielding an average efficiency score of 4.15. Furthermore, feedback from 399 general users indicated a high level of satisfaction, with an average score of 4.21, confirming the system's practical usability.

**Keywords:** Big Data, Food Stall Relocation, Geoinformatics, Navigation Map, Street Food Vending

## 1. Introduction

Street food restaurants are abundant in Thailand, and the street food industry is a significant part of Thai food culture. Bangkok, in particular, has been recognized by the Cable News Network (CNN) as having the finest street food in the world for two consecutive years [1]. However, street food entrepreneurs face numerous challenges due to stringent government regulations. In Dhaka, the capital of Bangladesh, nearly 100,000 street vendors endure unstable working and living conditions. They face risks such as eviction by the police, local political extortion, and poverty, with two-thirds of them living below the poverty line [2]. In Thailand, there is growing awareness of the issues related to unregulated food stalls that obstruct walkways and traffic. Research has been conducted on factors influencing Thai consumers' opinions about street food, including product quality, safety, sensory appeal, and cleanliness [3], as well as modern

payment systems [4], public health [5], and safety [6]. In response to COVID-19 and related amendments, Thailand launched initiatives in 2021 to elevate street food standards and improve hygiene. The Ministry of Public Health introduced the "Street Food Good Health" program to enhance food safety across all provinces, aiming for each province to have at least one street food vendor that meets sanitary standards [7].

Currently, consumer behavior is shifting toward a greater reliance on digital platforms, prompting businesses from large corporations to SMEs to adapt their strategies to meet consumer needs effectively [8]. Consumers increasingly value and are interested in stores that provide comprehensive information on social media [9].

Therefore, it is essential to leverage existing technology to support street food vendors, enhancing their capabilities while creating opportunities for

entrepreneurs to access technology and increase their revenue without the need to invest in new stores or manage complex food delivery systems independently. Software that facilitates street food operations includes systems for menu management, ordering, navigation, queue management, table reservations, and billing. These tools are designed to address common requests, such as customers wanting to change their pickup location, modify their food orders, or adjust their selling point when vendors relocate (e.g., with food carts or trucks) [8].

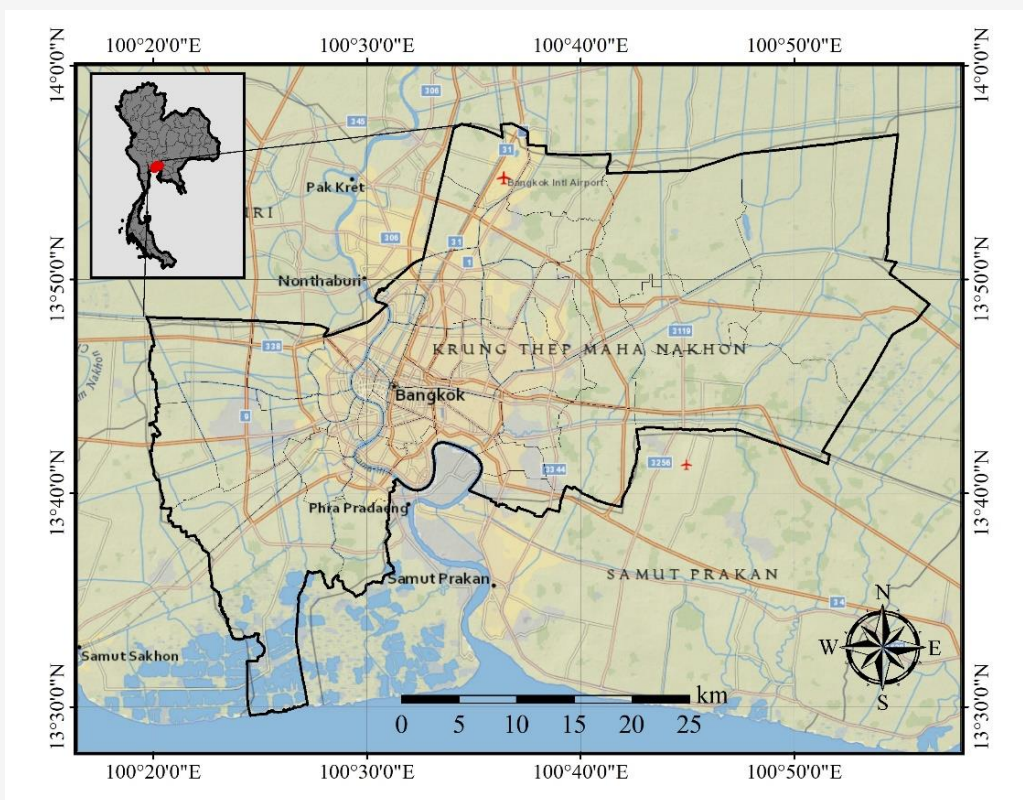
According to research on street food restaurant operators' neighborhoods, most business owners reside within a one-kilometer radius of their eateries to facilitate travel [10]. The research also indicates that consumers choose to eat at street food restaurants to break away from their routine lifestyles [11] and seek variety in their meals [12] and [13]. To support the operation of street food enterprises in Thailand, the researcher developed a street food sales support system designed to accommodate restaurant relocations based on Bangkok's urban geographic information. This system uses geographic information technology to align with the context of restaurant relocations and to provide consumers with

information about nearby restaurants. It generates a navigation map utilizing algorithms to verify the user's location, with checks limited to a radius of no more than 5 kilometers from the targeted street food outlet.

## 2. Methodology

### 2.1 Study Area

Bangkok, the vibrant capital of Thailand, is strategically located in the central region of the country, at the convergence of the Chao Phraya River and the Gulf of Thailand (Refer to Figure 1). This geographical positioning has historically made it a significant trade and cultural hub, influencing its development as a bustling metropolis. Spanning over 1,500 square kilometers, Bangkok is characterized by a mix of modern skyscrapers, historic temples, and extensive canal systems, known as "klongs." The city is bordered by Nonthaburi to the north, Nakhon Pathom to the west, and Samut Prakan to the south, making it an integral part of the Greater Bangkok Metropolitan Region. The conceptual framework for the structural design of the system is illustrated in Figure 2.



**Figure 1:** Bangkok, Thailand

## 2.2 Population and Sample

Street food restaurant operators along tourist routes in Bangkok who are prepared to implement the street food support system and big data systems. The sample used in this research consists of street food consumers in Sai Mai District, Bangkok. The sample size was calculated to be 399 individuals. This sample was reached through various publicizing channels to promote and enhance the accessibility of the street food support system. An assessment form was used to evaluate the experience of buying and selling through the street food support system.

## 2.3 Instruments

The instruments used in this study consist of 2 parts as follows:

### 2.3.1 Technologies used in system development

The system's front-end development uses the PHP Framework (Laravel 7), while Flutter is employed for back-end development. Communication between the front end and back end is facilitated through a RESTful API.

### 2.3.2 Questionnaire

The questionnaire is divided into three sections as follows:

- Part 1: Factors considered by stakeholders in the use of the street food support system by street food restaurant entrepreneurs.
- Part 2: Evaluation of system efficiency by experts and entrepreneurs who have used the system, including feedback from system experts and street food restaurant operators.

- Part 3: Satisfaction evaluation form for users of the street food support system. The criteria were used to determine the weight of the assessment on a 5-level scale according to the Likert method.

## 2.4 Study of the Physical Infrastructure of the Area

The researcher conducted a study of the research area based on the sample group to collect data and analyze shortcomings in order to provide information to improve the support system for street food vendors.

## 2.5 Design of a Street Food Support System

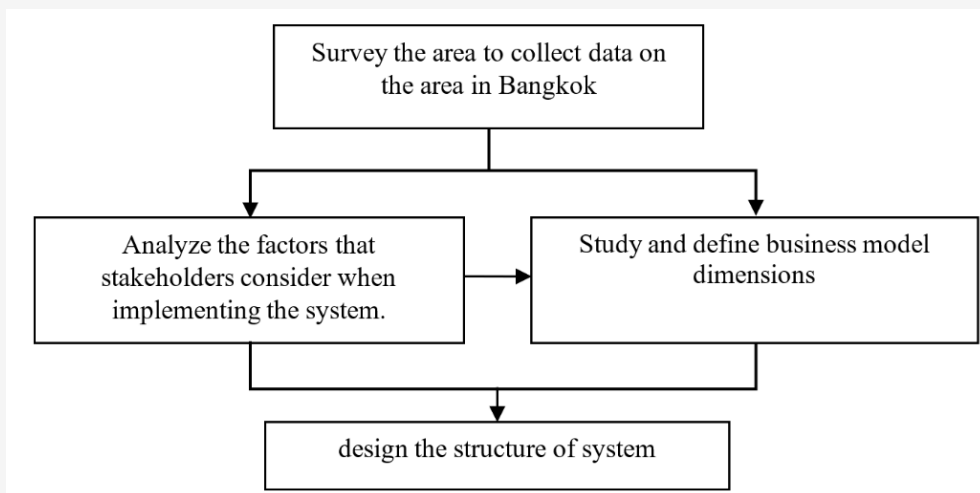
Based on urban geoinformatics, a support system for street food vending in Bangkok was designed to allow food stall relocations. An overview of street food support system development is depicted in Figure 3.

## 2.6 Data Analysis

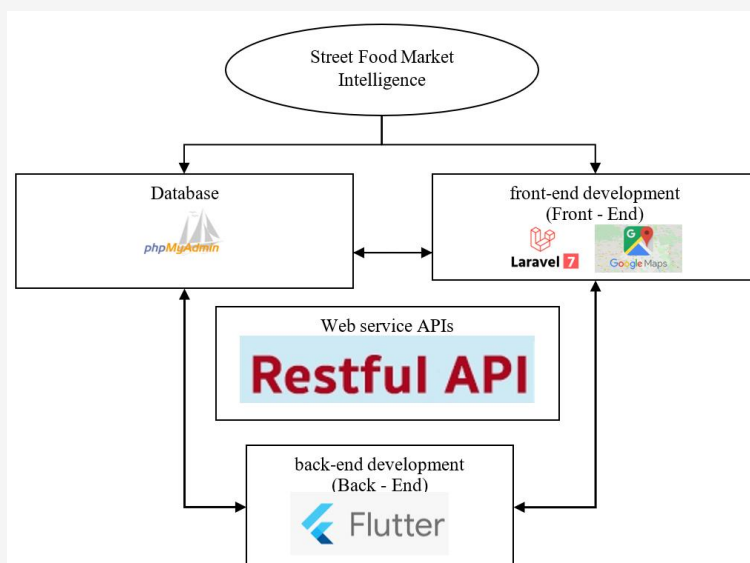
Statistical data analysis was conducted using a statistical software package. Data collected from the questionnaire were converted into numerical codes and entered into the software for analysis. The analysis included the calculation of the mean and standard deviation.

## 2.7 Ethical Consideration

This research proposal has been reviewed by the Suan Sunandha Rajabhat University Ethics Committee, and the certificate number is COE 2-025/2021. The Ethics Committee has approved the implementation of this research proposal.



**Figure 2:** Conceptual framework for studying the physical infrastructure of the area



**Figure 3:** An overview of the use of various techniques and computer languages to develop a street food support system

### 3. Results

#### 3.1 Basic Information of Respondents and Demand Factors in the Street Food Support System

The researcher collected demand factor questionnaires regarding the street food support system to analyze the factors affecting its usage by street food operators. The system is designed and developed to meet the needs of stakeholders in the street food sector in Bangkok as comprehensively as possible. The researcher selected 10 potential stakeholders based on their popularity and reputation in the Sai Mai District (Figure 4), as identified through a selection survey. The selected stakeholders are:

1. Daeng Racha Sai Mai Restaurant
2. Rad Na Sai Mai
3. Chaew Hon Nong Khai Restaurant
4. Krua Sai Mai Restaurant
5. Khao Tom Pla 164 Restaurant
6. Sang Duck Stew
7. Phak Wan Noodles Restaurant
8. Jae Ad Porridge, Pork Blood Soup, Fish Porridge
9. Nai Ow, Fish Ball
10. Khao Mun Restaurant, Wedge Cob Chicken

The researcher collected questionnaires on the system's needs, which were divided into four parts:

1. General information about the respondents

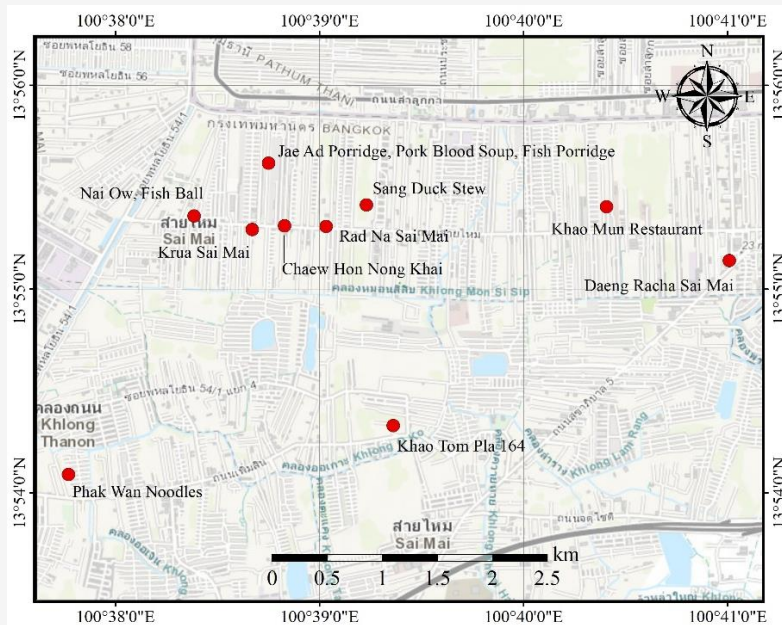
2. Attitudes of stakeholders towards the development of the street food market system
3. Factors considered in applying the street food market system
4. Opinions on other issues and suggestions for developing the street food market system.

#### 3.2 Information on the needs of Stakeholders for Street Food Support System

Based on the assessment of stakeholders' needs for the street food support system presented in Table 1, most respondents indicated a high demand for the development of the dining reservation system, with a mean score of 4.70. This was followed by the need for a data analytics system for buying and selling street food, which received a mean score of 4.50.

#### 3.3 Factors Considered by Stakeholders in Using the Street Food Support System

The researcher collected questionnaires from stakeholders to assess the factors they consider when using the street food support system. The inquiries were categorized into three key factors: (1) System efficiency in the operation of the street food market system, (2) Accuracy of the system's operations during implementation, and (3) Convenience and usability of the system for users. Table 2 summarizes the factors that stakeholders need to consider when utilizing the street food support system.



**Figure 4:** Selected street food stalls in the Sai Mai district

**Table 1:** Requirements of stakeholders for the street food support system

Needs of Stakeholders for the Development of a Street Food Support System	Mean	Std. Deviation
1. Need for a data analytics system for buying and selling street food.	4.50	0.688
2. Need for a food delivery system	4.30	0.754
3. Requirements for Restaurant Reservation System*	4.70	0.733
4. The requirement to popularize the store through online systems	4.20	0.951
<b>total</b>	<b>4.35</b>	<b>0.705</b>

**Table 2:** Factors considered by stakeholders in adopting the street food support system

Key Considerations for Implementing a Street Food Support System	Mean	SD
<b>1. System Efficiency (Performance)</b>		
1.1 System Stability	4.20	0.696
1.2 Performance of the System	3.95	0.826
1.3 System Response Speed	4.05	0.826
1.4 Security and Authentication for System Access*	4.20	0.696
<b>Total</b>	<b>4.10</b>	<b>0.581</b>
<b>2. Accuracy in System Operation (Function)</b>		
2.1 Accuracy and Completeness of Restaurant Information	3.75	0.786
2.2 Accuracy and Completeness of Restaurant Menu Information	3.95	0.826
2.3 Accuracy and Completeness of Restaurant Address Information	4.00	0.795
2.4 Accuracy and Completeness of the Restaurant Reservation System *	4.25	0.851
<b>Total</b>	<b>3.99</b>	<b>0.547</b>
<b>3. System Convenience and Usability (Usability) *</b>		
3.1 Convenience in Accessing Restaurant Information	4.35	0.826
3.2 Appropriateness of Displaying Restaurant Menu Information	4.25	0.789
3.3 Appropriateness of Image and Text Sizes	4.35	0.933
3.4 System Usability *	4.35	0.887
3.5 System Appearance and Usability	4.20	0.834
<b>Total</b>	<b>4.34</b>	<b>0.771</b>

**Table 3:** System evaluation results by experts and operators

Assessment Items	Guest user	Meaning
System Performance	$\mu = 4.15$ $\sigma = 0.48$	Good
Accuracy of System Operation	$\mu = 4.17$ $\sigma = 0.93$	Good
Convenience and Ease of Use	$\mu = 4.31$ $\sigma = 0.76$	Good
Overall	$\mu = 4.15$	Good

**Table 4:** System evaluation results by general users

Assessment Items	Guest user	Meaning
System Performance	$\mu = 4.04$ $\sigma = 0.51$	Good
Accuracy of System Operation	$\mu = 4.33$ $\sigma = 0.59$	Good
Convenience and Ease of Use	$\mu = 4.23$ $\sigma = 0.77$	Good
Overall	$\mu = 4.21$	Good

Based on the analysis of the factors involved in the street food support system, it was found that convenience and ease of use (usability) is the most critical factor for stakeholders when adopting the system, with a mean score of 4.30. This is followed by system efficiency (performance), which has a mean score of 4.10. The accuracy of the system's operation (function) is the least emphasized factor, with a mean score of 3.99. The research identified the following key areas of concern for each factor: (1) Convenience and Ease of Use (Usability): Stakeholders are primarily concerned with the ease of accessing and viewing restaurant information, as well as the security and identity verification processes in the system. (2) System Efficiency (Performance): The main concerns are system stability and overall ease of use. And (3) Accuracy of the System's Operation (Function): The focus is on the accuracy and completeness of the restaurant reservation system. In developing the system, attention should be given to these critical factors to ensure that it meets the needs of street food operators as effectively as possible.

### 3.4 Testing and Evaluation

**System Testing:** The system was tested for operational accuracy, including functionality in both the front-end and admin interfaces. Tests were conducted to identify and address errors caused by user input, verify the validity of the system login, and ensure the accuracy of data processing. **System Evaluation:** The efficiency of the system was

evaluated through questionnaires completed by experts and entrepreneurs who have used the street food support system. Potential stakeholders were selected based on a survey of their reputation and expertise in the Sai Mai area. A total of 23 system development experts assessed the system using a questionnaire that covered three aspects: system efficiency, operational accuracy, and convenience and ease of use. The evaluation results were divided into two groups: Experts and operators (Table 3), and General users (Table 4).

Satisfaction was assessed among 399 general users through a questionnaire covering three aspects: system performance, accuracy of system operation, and convenience and ease of use. The research hypothesis is that the efficiency of the overall system is at a good level ( $H_0: \mu \leq 3.50$  and  $H_1: \mu > 3.50$ ). The research results align with the established objectives. The evaluation of system efficiency by experts and entrepreneurs who have utilized the street food support system demonstrates high levels of performance. The researcher selected ten potential stakeholders from the Sai Mai area based on their reputation and taste, as well as 23 system development experts. The evaluation revealed that:

- **System Efficiency:** Experts and entrepreneurs rated the system's efficiency for users at a high level, with an average score of 4.15. The management system for stores was similarly rated highly, also with an average score of 4.15.

- **User Satisfaction:** Among 399 general users, satisfaction with the street food support system was also high, with an overall average score of 4.21, representing 84.2 percent. Users expressed the highest satisfaction with the system's functionality, which received an average score of 4.33, followed by convenience and ease of use with a score of 4.23, and system performance with a score of 4.04.

The key areas where users expressed the greatest satisfaction were:

- 1) **Ease of Use:** The system's usability was highly appreciated.
- 2) **Accuracy and Completeness of Restaurant Address Information:** Users valued precise and complete address details.
- 3) **Accuracy and Completeness of Restaurant Menu Information:** Users found the menu information to be accurate and comprehensive.
- 4) **Accuracy and Completeness of the Restaurant Reservation System:** The accuracy and completeness of the reservation system were also highlighted.

Overall, the results confirm that the street food support system effectively meets stakeholder needs and user expectations, providing significant value in terms of functionality, usability, and performance.

#### 4. Discussion

Based on the study of research and relevant information on the development of a street food support system, as well as satisfaction assessments from users of the Riverside Restaurant Support System, the researchers can discuss the objectives of the research. The details are as follows:

The street food support system serves as a public relations channel that enhances access to street food and allows customers to reserve tables, helping to reduce congestion and queuing. By emphasizing accuracy and speed, this system provides an effective way to reach consumers directly. In contrast to the traditional street food sales methods employed by entrepreneurs in the Sai Mai area, where vendors primarily sell through storefronts, there remains a lack of a structured sales channel that incorporates restaurant management and online table reservations.

Street food vendors find the system highly convenient and easy to use, especially given the impact of the COVID-19 pandemic on street food sales. The system responds to changes in consumer behavior, as people increasingly avoid crowded places. This street food support system helps boost sales in the post-COVID-19 era by providing table reservations and gathering review information. Restaurant menu reviews are analyzed by sorting customers into groups and assessing their service usage. This data is then used to create targeted promotions aimed at increasing sales for street food vendors.

Most vendors maintain high food sanitation standards in both shophouses and street stalls. Additionally, two key success factors were identified: ease of access and food taste [14]. Furthermore, the research by [9] found that interactive online media play a significant role in influencing consumers' choices. Consumers are more likely to be attracted to vendors who provide complete store information on social media. This mechanism aligns with this research, which can track customers who book tables within a 5-kilometer radius to avoid errors in queue tracking. In the future, the system will be able to use location tracking and notifications via Line, in addition to notifications through the system.

The development of the street food support system has met the research's scope and objectives. According to the user satisfaction assessment of the Riverside Restaurant Support System, the system's performance was rated at a good level. This demonstrates that the street food support system enhances accessibility, promotes purchases, and simplifies table reservations for street food vendors, in line with the research objectives.

#### 5. Conclusion

In conclusion, the development of the street food support system represents a significant advancement in facilitating access to street food in Bangkok, particularly in the Sai Mai district. The system addresses the challenges faced by street food vendors and consumers alike by enhancing operational efficiency, enabling table reservations, and promoting a structured sales channel.

User satisfaction assessments indicate that the system meets the needs and expectations of both vendors and customers, as evidenced by high ratings in functionality, usability, and overall performance. The integration of modern technology, such as data analytics and location tracking, not only improves the consumer experience but also empowers street food entrepreneurs to adapt to changing market dynamics, especially in a post-COVID-19 environment. This approach aligns with existing research highlighting the importance of accessibility and sanitation in the street food industry. As consumer behavior continues to shift towards digital platforms, the street food support system offers a timely solution that benefits all stakeholders involved. Moving forward, continued enhancements and user feedback will be essential in refining the system further, ensuring that it remains relevant and effective in meeting the evolving demands of the street food market. Ultimately, this research underscores the potential of leveraging technology to transform traditional street food practices, fostering a more organized and customer-friendly environment that can significantly boost sales and enhance the overall street food experience in Bangkok.

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