DEVELOPMENT OF A SMART FOOD RECIPE SYSTEM TO ENHANCE FOOD INNOVATION OPPORTUNITIES

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ABSTRACT

Many studies indicate that consumer eating behavior has a substantial impact on food acceptance or dietary choice. Eating behavior is associated with the psychographics of consumers such as socio-cultural influences, sensory preferences, and lifestyles. Consequently, food innovators need to understand the changing trends of these psychographic and demographic drivers. The Smart Food Recipe System (SFRS) has been developed to support food innovation communities in Thailand. The SFRS is designed as a Thai food recipe depository for trend monitoring and analysis with searchable and comparable functions. It also includes a dashboard to visualise the evolution of eating behavior through food preference trends and comparable recipe data from traditional and current cookbooks. The SFRS is expected to provide benefits such as insights and clues, potentially inspiring innovators to design future foods. This study aims to exhibit the development process of SFRS through the analysis of 5D innovation process and it's potential for commercialisation through analysis of the technology value chain and business model canvas.

Keywords: Eating Behavior, Food Preference, Food Innovation, 5d Innovation Development Process, Commercialization

INTRODUCTION

The diffusion of food innovation is related to eating behavior or hedonic experiences. The driving force of food acceptance or choice is influenced by individual or social group preferences (Pilgrim, 1957). Different societies have ways of choosing food depending on territorial behavior and chronological change. Thus, food innovation relies significantly on food technology or nutritional value, but it could also determine consumer behavior or socio-cultural characteristics affecting food choice such as sensory or physiological factors of the food consumed (Steenkamp, 1997). For example, a study on consumer acceptance of new cheese products (food product innovation) in Norway revealed that traditional eating habits have been the vital driver for consumers' food choice; therefore, authentic cheese products tend to be well-accepted (Almli et al., 2011).

Nazzaro, et al., (2019) presented that the acceptance or rejection of consumers towards food product innovation is reliant on consumers' willingness to pay. The study also exhibited that consumer psychographics such as sensory characteristics, cultural traits, and food intake lifestyle influenced customers' acceptance in food innovation (Nazzaro, Lerro, Stanco & Marotta, 2019). Furthermore, Higgs (2015) depicted that the eating behavior of society was influenced by their social group norms, defined as cultural practices and rules, actual behavior, and social group environments. Eating norms and food sensory has also been found to affect food choice and food intake (Higgs, 2015). Hence, eating behavior or hedonic experiences are underlined as important influences on consumers' acceptance or food choice.

The concept of food innovation aims to deliver a new value proposition to target customers and roll out different stages of innovation diffusion. Therefore, a deeper understanding of consumer needs is key to the success of innovation development. To achieve this aim, the Smart Food Recipe System (SFRS) was developed to help food innovation communities in Thailand address and overcome the challenges mentioned above. This paper aims to demonstrate the development approach of the SFRS by applying the concept of 5D innovation process, technology value chain, and Business Model Canvas (BMC).

LITERATURE REVIEW

The existing literature on food innovation reveals a strong relationship between consumer acceptance and consumer eating behavior. As the objective of this study aims to develop of the SFRS, the literatures were reviewed in four areas with the different focus;

- Food innovation: to identify opportunities and challenges involving food innovation,
- Innovation development process: to understand the systematic approach guiding innovation development
- Value chain analysis: to understand the potential for value creation
- Business Model Canvas: to design proper business model for enhancing commercialization opportunities.

Details of the literature review in each area are presented in the following sections:

Food Innovation

Several studies have indicated that the adoption of food innovation by consumers correlates with personality traits, lifestyles, and social norms (Higgs, 2015; Nazzaro et al., 2019). The excellent food innovation by society depends on lifestyle. According to Fischer & Van Loo (2021), eating behavior affects societal acceptance of food innovation adoption.

Specified as consumption with pleasure, eating behavior is recognised as a vital factor in consumer food acceptance. The perception of food acceptance involves physiological effects, sensory attributes, and environmental influences (Pilgrim, 1957). The influencing factors in consumer acceptance of food innovation were emphasised by Siegrist (2008) who explored the impact of psychological factors on the acceptance of food. He identified the psychological attitudes towards food innovation, such as personal knowledge, social perception, and others (Siegrist, 2008). In addition, habitual food sensory perception in a social group has also been found to affect consumers' choice even in an integrated culture of ethnicities (Asraf, Shahnaz & Siang, 2014).

The level of food innovation and consumer perception was studied to analyse consumer acceptance; for example, Stolzenbach, et al., (2013) investigated traditional local honey and concluded that sensory perception affected the emotional responses of consumers. Understanding consumer perception was found to be important for guiding product development (Stolzenbach, Bredie & Byrne, 2013). While (Guerrero et al., 2009) studied innovation on traditional food and explored consumer lifestyles which emerged as essential requirements of the innovation process. Moreover, a study on the food preference of Americans for tomato paste explored that the authenticity of natural taste initiated a positive response from consumers. The food choice of consumers was found to rely on their preferences (Rozin, 2006). Indeed, innovation in the food sector has its challenges since the development process not only focuses on product technology but also monitors consumer behavior to align with their requirements. Understanding eating behavior, including lifestyles and socio-cultural influences, are critical to consumers' acceptance of novel food and provide essential benefits for food innovators in the design of future food.

Rudolph (1995) suggested that the food product development process is milestone-driven thereby reducing the project start-up time and facilitating accurate project planning. Three phases were found to be involved in the process: product definition, product implementation, and product introduction (Rudolph, 1995). In the meantime, few studies on food product development have adopted consumer co-creation or consumer-led evaluation involving the front-end phase to gather information on customer needs and desires under the significant concept of an innovative product (Filieri, 2013). This consumer co-creation was initiated from the open innovation model, involving different players outside the firm expressing valuable ideas, highlighting their contribution to new product development. Furthermore, lead users were included in the development process for understanding and empathy of the user's pain points.

Innovation Development Process

In the innovation development process, Booz, et al., (1982) proposed a BAH model consisting of seven steps of innovation development appropriate for small and medium enterprises (Booz, Allen, & Hamilton, 1982). Subsequently, Cooper & Kleinschmidt (2001) found gaps in the BAH model, namely that it lacked a screening gate between each step to assure readiness before moving on to the next step. Therefore, a stage-gate model was suggested to address this gap by adding a screening gate in each step to assure new product requirements (Cooper & Kleinschmidt, 2001). Furthermore, Tidd, et al., (2005) proposed a simple innovation development process applicable for all types of innovation to maximise customer value (Tidd, Bessant & Pavitt, 2005).

In the existing literature, most innovation development processes have focused on customer satisfaction, and some on the product development process. The 5D innovation development process is one such process, focusing on the voice of customers and quality. It has been widely applied to both product and service innovation (Gowanit, Thawesaengskulthai, Sophatsathit & Chaiyawat, 2015). The 5D innovation development process involves combining customer voices to the design and innovation of a screening gate in each step to assure the developed innovation meets customer requirements.

Value Chain Analysis

The value chain is an activity for identifying the added value for customers and can be used as a source of value creation activities for businesses. Value chain activities in technology can represent a combination of core technology and sub-technologies and clarify embodied technologies in each value stream. In addition, the value chain can have a profound impact on enhancing competitive advantage and attracting investment (Christensen, 2001; Porter, 1985).

As mentioned above, value chain analysis has been used to increase competitive strategy and maximise the value of innovation. In the meantime, innovation development can also be applied to increase efficiency in the development process. In addition, using a value chain strategy to enhance the new product development process can increase the entrepreneurial competitive advantage (Prasetyo & Dzaki, 2020). Moreover, the value chain could be utilised to reposition strategy in order to increase NPD capacity (Noke & Hughes, 2010).

Business Model Canvas (BMC)

The BMC was introduced by Osterwalder & Pigneur (2010) to bridge the gap between business strategy and activities in product innovation to communicate its value to customers. The BMC also supports businesses in capturing the value created by innovation (Osterwalder & Pigneur, 2010). The concepts of BMC consist of value creation, value delivery and value capture.

Regarding implementation of the BMC, Joyce & Paquin (2016) analysed sustainability-oriented innovation by modifying the BMC to include economic, environmental, and social layers to support a sustainable business model (Joyce & Paquin, 2016). Bonazzi & Zilber (2014) found that the BMC supported the company in understanding their innovation process and enhanced the value of the open innovation process (Bonazzi & Zilber, 2014).

RESEARCH METHODOLOGY

Development Process of the Smart Food Recipe System (SFRS)

The SFRS was developed following the 5D innovation development process, as presented in Figure 1. The SFRS development process started with user requirement gathering, system design and architecture, data structure and database, data visualisation, and exploitation. The SFRS can support food innovators in monitoring trends in consumer eating behavior and analysing data through searchable and comparable functions.

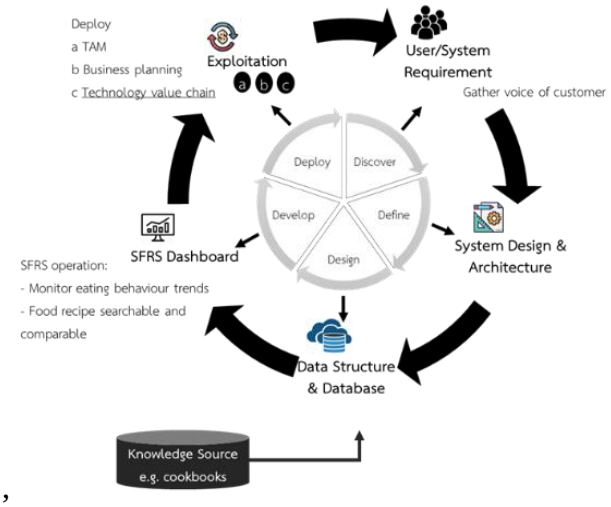

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FIGURE 1
DEVELOPMENT OF THE SMART FOOD RECIPE SYSTEM (SFRS)

The SFRS was designed with the mechanism to trace back the eating behavior of consumers by interpreting food recipes over a hundred years through the collection of traditional Thai cookbooks. Consumers' preferences were analyzed through the change of flavour and food ingredients over time. The SFRS can be used as a search engine for food recipes as well as the comparison across different recipes. For this project, there were more than 2,500 recipes collected from 20 written cookbooks published since 1782. The cookbooks are categorised into four periods, according to the archaeological eras of Thailand. Ten traditional Thai food experts determined which cookbooks could be represented to provide information on certain periods for transformation into practical eating behavior trends using a multitude of data.

The cookbooks were analysed to provide quantitative data and insight to help monitor consumer eating behavior trends, socio-cultural change, and food ingredient use. Food experts participated to verify the analysed data. To enhance visualisation, a dashboard from Tableau software was used to display behavior trends, which can be customised to meet the specific needs of food innovators. Trend monitoring can be drilled down to provide insight into the flavour, aroma, and food ingredients used for projecting food innovations. In addition, some clues regarding consumer eating behavior from the SFRS could reduce the time spent on identifying consumer food preferences. To

empirically test the proposed model, a case study was conducted. According to the increase in new emerging consumers of authentic Thai food, the innovation development of the SFRS in Thailand was purposively selected for this study with the design method divided into two phases. Phase 1 presents the innovation development process and Phase 2 the enhancement of commercialisation opportunities.

Phase 1: Innovation Development Process

The 5D process is applied in this study to drive the development of the SFRS. According to the complex nature of product development in the front-end stage, a qualitative approach is used in this study to provide a meaningful explanation. For the development of SFRS, the activity, methodology, and output in each step of the 5D process are presented in Table 1.

Table 1
5D INNOVATION DEVELOPMENT PROCESS FOR THE SFRS

5D process	Activity	Methodology	Output
Discover	Opportunity identification	- Literature review - Purposive sampling was applied to identify the target customers. The target customers consisted of three lead users with at least 20 years' experience, a food instructor, food stylist, and chef.	User/system requirements
Define	Innovation project planning	An innovation project charter was created to define the strategy for a new product.	System design and architecture
Design	Innovation concept creation	Customers' requirements were defined for the features of the product.	Data structure and database
Develop	Prototype development	Tableau software was used to manage the intelligent food recipe system.	SFRS dashboard
Deploy	Customer acceptance and business plan	a. Technology Acceptance Model (TAM) b. Technology value chain analysis c. Business analysis	Exploitation

Phase 2: Enhancing Commercialization Opportunities

To enhance commercialization opportunities, the Technology Acceptance Model (TAM) (Davis, 1985) has been used to collect information on customer satisfaction towards the SFRS. The technology value chain and the BMC were subsequently analysed to understand the correlation between technology and business.

To analyse commercialisation opportunity, a focus group was formed to evaluate the benefit of the value chain through the pre-post testing technique. Twelve participants were purposefully selected from various groups of food experts. The food experts in the focus group included a food scientist/R&D, food anthropologist, flavourist, chef, food instructors, and food entrepreneurs. As the inclusion criteria, each participant should have more than ten years' experience in the food domain. The focus group interviews began with a semi-structured questionnaire, based on the concept of TAM to test user satisfaction. The five-point Likert scale was used to test the satisfaction level, ranging from 1 for very dissatisfied to 5 for very satisfied. The questionnaire measured the participants' levels of innovation acceptance and intention to use the product and their perception of its value and innovation. The results of the technology value chain analysis were then presented to the focus group. Open-ended questions were used to gather the participants' intentions towards investment.

RESEARCH RESULTS

Phase 1: Innovation Development Process

Discovery Step, according to a summary of the lead user interviews, their voices illustrate their hidden expectations that food recipes should be collected in a knowledge bank, especially those from traditional cookbooks. Moreover, the lead users also revealed that the impact of eating behavior on consumer food choice could be easily monitored, and food recipes should be designed using a searchable and comparable system or application. Another requirement was that visualisation of the system should be uncomplicated and user-friendly.

After collecting information on customer needs, the relevant food recipe system was reviewed. From a review of food information technology, most of the developments appeared to focus on recipe recommendation systems, such as the use of food ingredient recognition to conduct real-time recommendations (Maruyama, Kawano & Yanai, 2012). Machine learning has also been used to understand user profiles and recommended appropriate food recipes (Vivek, Manju & Vijay, 2018). Recipe recommendation has also been developed to assist the health concerns of customers (Geleijnse, Nachtigall, Kaam & Wijgergangs, 2011). Conversely, an inverse cooking system recommended food ingredients by food image recognition (Salvador, Drozdzal, Giro-i-Nieto & Romero, 2019) while food recognition and recipe analysis has been used to monitor personal dietary habits (Herranz, Min & Jiang, 2018). The example of food information system on the web or mobile application such as Chef Watson from IBM, CookPad, and PunchFork.

Defining Step, the innovation project charter was defined to highlight the details of innovative intelligent food recipe systems as shown in Table 2. The objective of this development was the innovation of a food recipe system using information technology to satisfy customers' expectations resulting from the discover step. Chefs and food stylists were the primary customer target, while the secondary target customer included food instructors, restaurants, and culinary lovers. The project development period took about five months.

Design Step, the literature review and in-depth interview conducted in the discover step led to the creation of the innovation concept in compliance with customer requirements. In the design of the data structure and database, the customer requirements revealed that the system should have two significant dimensions: usability and data collection. The usability dimension includes user interaction, searchable recipes, and data comparison, while the data collection consists of categorisation and visualisation. To meet customer requirements, the product development team used their design capability to arrange innovative product features.

In conclusion, the following features have been included in the intelligent food recipe system e.g., search; the ability to search for food menus, ingredients, or names of cookbooks, compare; the ability to compare recipes, ingredients, analyze: the ability to analyze the changes of recipes, ingredients over time in order to reflect the trends and the changes of eating behavior, visualize: the ability to present the results in a user-friendly format allowing customers to understand and be able to gain insights from the identified pattern.

Development Step, the prototype of the SFRS was developed in this step, with the main features designed according to the customer requirements in the previous phase. The SFRS stores the recipe data but is also needed to contain searchable and comparable features. Tableau software was chosen as the analytic data engine since the software has been widely accepted for its ability to manage and analyse a vast dataset and transform it into interactive data visualisation with a dashboard-style design (Batt, Grealis, Harmon & Tomolonis, 2020). Moreover, Tableau can respond to user interaction with one click.

As the first step towards structuring the food recipe data, approximately 2,500 Thai food recipes from 20 cookbooks were inscribed on the database. These cookbooks are representative of

those dating from 1782 until the present day, categorised into four periods by Thai food experts according to the archaeology of a particular era in Thailand, namely the "Rattanakosin".

The SFRS dashboard facilitates the comparison of ingredients in the same food recipe from various cookbooks, while recipes from various cookbooks can be searched for using ingredient keywords. Furthermore, the SFRS also provides trends in food preferences together with the flavours of ingredients. The following section provides an example of the SFRS displaying the trends in eating behavior as shown in Figure 2 as well as the comparison of food recipes presenting the differences in flavour and ingredients as shown in Figures 3 and 4.

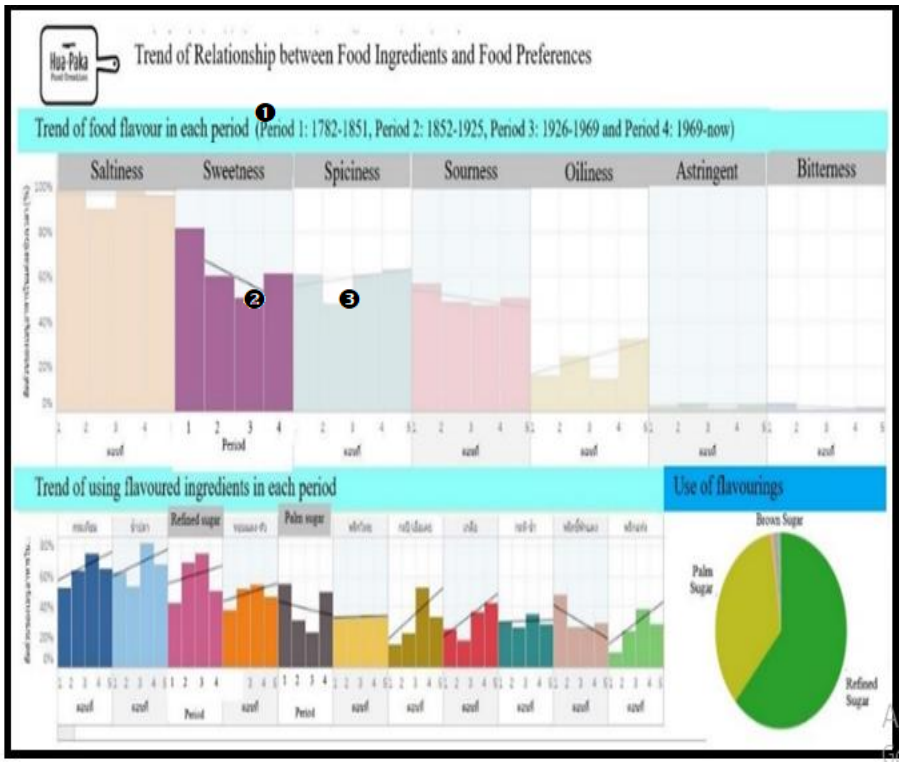

FIGURE 2
SFRS DASHBOARD: TRENDS IN RELATIONSHIP BETWEEN FOOD INGREDIENTS AND FOOD PREFERENCES

In Figure 2, the eating behavior trend presents the trend of food preferences and use of flavour ingredients. At point 1 in Figure 2, the result shows that the sweetness trend has been gradually decreasing over time. This finding is also in-line with the existing health-conscious trend towards low-sugar consumption. Moreover, the pie chart of sweet flavourings illustrates that almost two-thirds is refined sugar, with about one-third palm sugar, while the remaining small proportion consists of brown sugar. According to point 2 of the refined sugar graph, a sharp increase is indicated between the first and third periods, with the numbers subsequently decreasing dramatically in the current period. When compared to the palm sugar graph at point 3, the trend is shown to move in the opposite direction. This graph shows that the use of refined sugar has recently been replaced by palm sugar due to its health benefits, which aligns with the current consumer trend of health-conscious behavior.

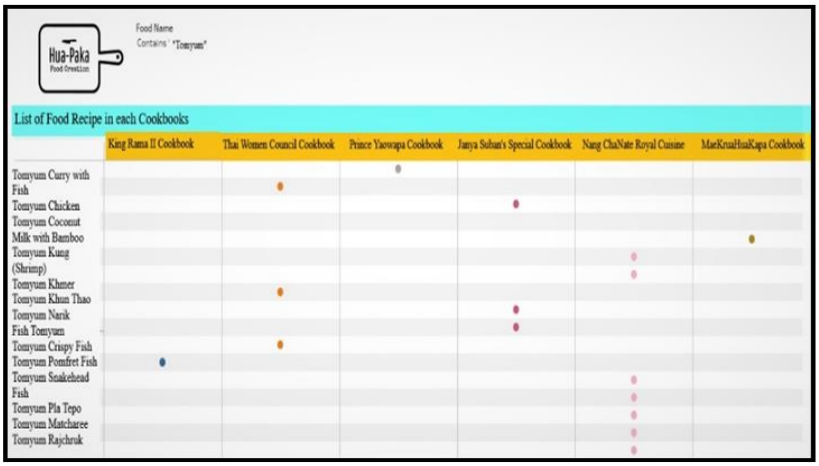

FIGURE 3
SFRS DASHBOARD: PERFORMING A KEYWORD SEARCH FOR "TOMYUM" (1)

Figure 3 demonstrates the performance of the SFRS using the keyword search. The name of a famous Thai dish "Tomyum" (hot and sour soup) is used for the search and the SFRS dashboard displays the names of food recipes including the word "Tomyum" (the first column) and illustrating all cookbooks containing the relevant recipes (yellow row). In addition, each category of Tomyum's recipes will be displayed based on the comparable feature. Details of the food flavours and ingredients are exhibited in Figure 4.

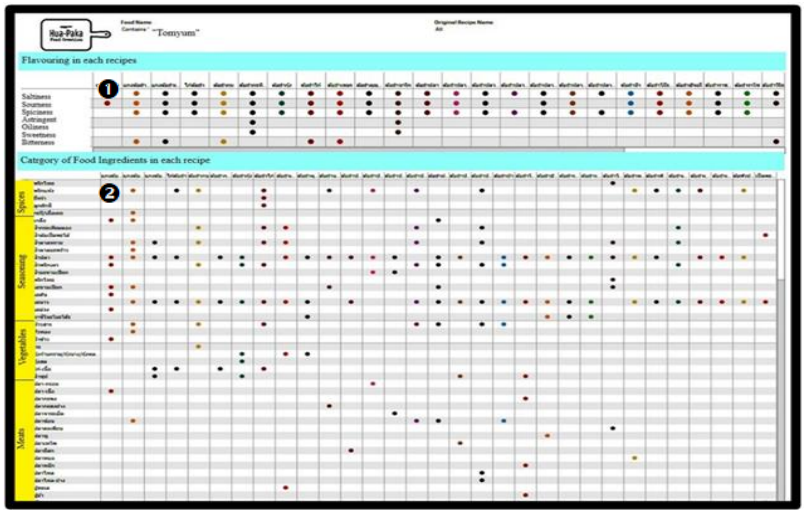

FIGURE 4
SFRS DASHBOARD: PERFORMING A KEYWORD SEARCH FOR "TOMYUM" (2)

The SFRS dashboard results in Figure 4 show the flavourings used in each recipe (point 1), with Tomyum recipes mostly containing salty, sour, and spicy flavours; therefore, consumers can experience these flavours across different Tomyum recipes. Any food innovator wishing to introduce a new Tomyum recipe should consider these flavours as the base and then added a special flavour to make the new recipe unique. Furthermore, the bottom of the dashboard (point 2) illustrates the comparable food ingredients in each recipe. The food ingredients have been categorised for the convenience of the user into spices, seasoning, vegetables, meat, etc. This food ingredients comparison can be used to determine the choice of alternative ingredient combination.

Deployment Step, this phase focuses on customer satisfaction and business planning. The gathering of data on customer satisfaction was deployed by TAM and the business strategy conducted using business planning and the BMC. The details of these are depicted in Phase 2: enhancing commercialisation opportunities.

Phase 2: Enhancing Commercialisation Opportunities

Technology value chain analysis, is analysed in this phase to clarify the opportunity for adding value in the future. The technology value chain is categorised into upstream, middle stream, and downstream, as shown in Figure 5. The existing value chain starts from the source of data from the collection of Thai recipes in the upstream. The SFRS presents in the middle stream, while the downstream contains the target market, divided into business-to-business (B2B) and business-to-customer (B2C). The B2B target represents food businesses, food industry, culinary schools, restaurants, while B2C refers to food stylists and culinary lovers.

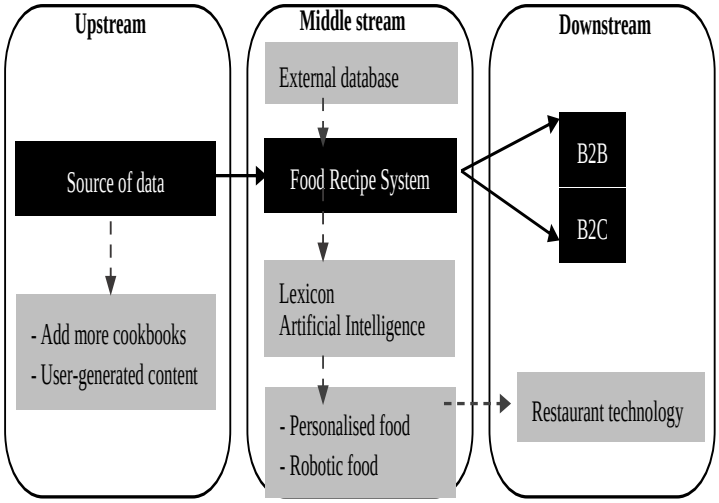

FIGURE 5
TECHNOLOGY VALUE CHAIN ANALYSIS

The opportunity for a value-adding chain in Figure 5 exhibits that more data sources can be added to the upstream from the cookbooks. Furthermore, a food recipe system can also be developed with user-generated content to expand the database by creating community cooperation. It can be linked with an external database such as nutrition or herbs in the middle stream. Moreover, the bag of words in the food recipe system database can be developed into the lexicon for use in the text mining of Thai food. Whereas the lexicon can be improved with artificial intelligence to develop personalised food, robotic food, or a recommendation system. Finally, in the downstream, value creation can involve restaurant technology to support urbanisation.

Business Model Canvas, the application of a BMC can help clarify the value proposition of the SFRS in providing Thai culinary data to customers by targeting restaurants, food businesses, industry, culinary schools, and cookery lovers. The potential revenue generated by the SFRS will come from membership subscriptions, payable either quarterly or annually.

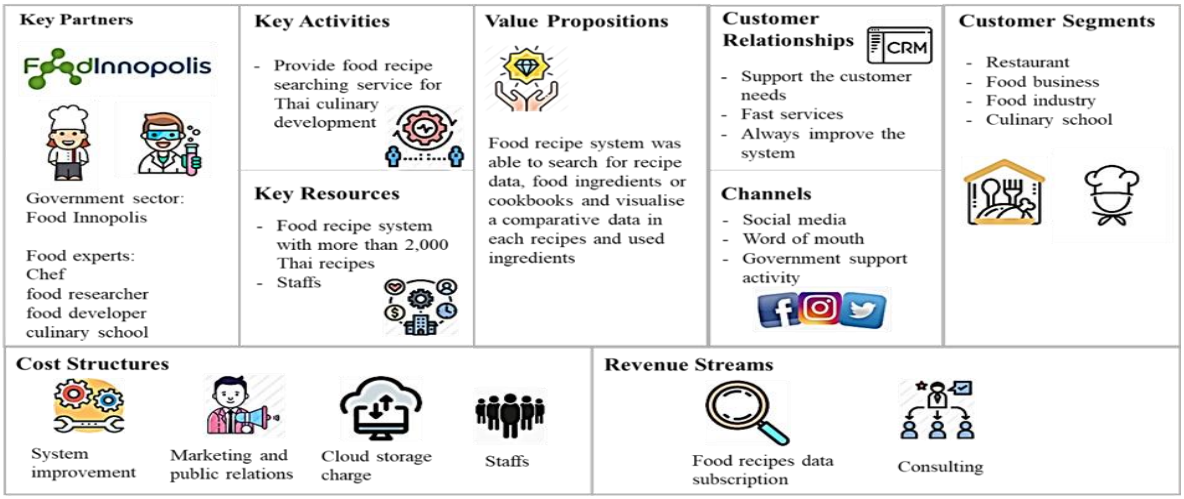

FIGURE 6
BUSINESS MODEL CANVAS (BMC) OF THE SFRS

The cost structure revolves around the development and improvement of the food recipe system, marketing and advertising, clouding storage fees, and employment expenses. A summary of the BMC is provided in Figure 6 to illustrate the essential functions of the food recipe system business and help technopreneurs to focus and organise the entire idea and its value proposition. The BMC is categorised into critical partners, key activities, essential resources, value proposition, customer relationships, customer segments, channels, cost structure, and revenue stream.

The commercialisation success of innovation is dependent on how users accept the value of innovation (Chuawatcharin & Gerdsri, 2019; Pora, Gerdsri, Thawesaengskulthai & Triukose 2020; Slater & Mohr, 2006). To ensure acceptance of the SFRS, the user feedback was obtained through the focus group interview using the TAM questionnaire with the 5-Likert scale. The utility, feasibility, and usability of the system were investigated to determine customer perceptions and their intention to use the SFRS。

In terms of feasibility, the responses from the target customers resulted in an average score of 4.36 (SD 0.19), demonstrating that users were delighted with the food recipe system. Users also expressed the positive view that food recipes in each cookbook can be compared to reveal the ingredients used and evaluated the data to revisit traditional recipes for further Thai food development. Next, usability received an average score of 4.19 (SD 0.15), revealing that users were very satisfied and perceived the system to be easy to use. The overall mean for customer satisfaction was at a high level. On the other hand, the utility score was 4.60 (SD 0.16), illustrating high satisfaction towards the SFRS, with users expressing that the system could monitor eating behavior trends and collect recipe data and was easily visualised in just one click. Finally, all the users accepted the technology and expressed the intention to use the SFRS.

In addition, participants in the focus group mentioned the benefits of a food recipe system from each angle according to their expertise. For example, they stated that it could be used as the basis of conceptual flavour development or linked with an external database for research and development in the food industry. In the second round, following the technology value chain analysis, which identified the channels for maximising the technology value for future development and minimising the risk from infringement of the existing patents in the market. The focus group raised another theme: the intention to participate in business collaboration or joint ventures. Participants frequently mentioned the opportunity and barriers to investment. The most positive feedback was received in relation to joint ventures and the readiness of the food recipe system. The following responses were received from members of the focus group:

"Do you need a business partner? I would like to invest in this project. I also think that there is a lot to do before starting the business."

"This system can be used for many applications. I want to develop it into an online library for culinary lovers … if the source of funds is a problem, let's work together and make it happen."

"I would like to understand the current status of the project. Do you have any more business milestones? … I think it would be easy to seek a business partner to provide financial support."

DISCUSSION AND CONCLUSION

The aim of this study was to explore the innovation development process of the SFRS to support food innovation communities in creating novel food to align with consumer eating behavior.

The SFRS was developed according to the customer requirements obtained from the field survey at the beginning of this study. The system was designed with the key features of search, compare, analyse, and visualise. The visualisation dashboard was also designed as an interactive user interface to illustrate information on consumer eating behavior trends, including flavour preferences for different types of food. It also reflects the changes in consumer eating behavior. This information is beneficial for food developers and innovators because it gives them the opportunity to design new food recipes or innovative food products based on consumer preferences. Such evolutionary data can be used to predict future changes in consumer behavior. Therefore, this SFRS can benefit food innovation communities and guide the direction of food design and development according to consumer satisfaction.

Moreover, the feature comparison facility also shows how different food ingredients are used in each recipe and the distinction between traditional and current cook/฿books. Since the data has been gathered over a hundred years, some of the 2,500 recipes are similar. Hence, the amount of data is indicative of the evolution of that recipe. For example, in an announcement by the CNN on the world's 50 best foods in 2021, Massaman curry from Thailand was revealed as the world's most delicious—the king of all foods (CNN, 2021). When searching for Massaman curry recipes in the SFRS, nine different types of Massaman curry can be found, with the recipes evolving since the first period (1782) and becoming increasingly popular with consumers to the present day. The SFRS compares the different ingredients for making Massaman curry in each cookbook; for example, some recipes add a bay leaf, while others include cardamom or coriander seeds. Therefore, the SFRS is extremely valuable for those interested in legacy recipes.

However, the effectiveness of the SFRS system has been verified by the various food experts monitoring how well the data reflects consumer eating behavior. With this approach, food innovators can effectively observe and design novel food based on the evidence provided by the SFRS rather than using conventional methods alone.

Moreover, the technology value chain analysis revealed room for future development, illustrating the value created by technology in the vertical integration stream and the channel's ability to achieve better coordination. The SFRS has the capability to retrieve information from other nutritional or healthy food databases, including unstructured data such as that on social media. After the participants in the focus group were presented with the relevant data on technology feasibility, the feedback not only contained a high level of satisfaction but some participants also expressed interest in the prospect of a joint venture. Although this group was not representative of all target customers, the opinions obtained provide evidence of the system's initial success in enhancing investment awareness.

The aim of the SFRS is to enhance the proficiency of food research and development through an understanding of consumer psychographics, and the evolution of consumer eating behavior through the food preference trends in food flavourings, ingredients, recipes, etc. In addition, the SFRS dashboard enables the visualisation of comparable recipe data from traditional and current cookbooks. Therefore, the SFRS is expected to provide insights and clues to inspire food innovators to better

understand consumer eating behavior, leading to the design of novel food to align with consumer preferences.

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