Empathizing Night Market Food Hawkers in Malaysia Using Design Thinking Approach to Improve Food Safety

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Abstract

Food safety is a significant health concern in developing countries like Malaysia, where night markets, also known as "pasar malam", are often linked to food-borne diseases. The practices and environment of these markets are often associated with unhygienic practices by hawkers, contributing to these illnesses. This study aims to identify the experiences, perspectives, and problem statements of six hawkers from two-night market sites in Hulu Langat, Selangor, Malaysia. Using the "Design Thinking" approach covering the initial stages namely "empathy", "define" and "ideation", the study identifies the goals and pains of each hawker, aiming to address holistically to increase their livelihoods and consumer's quality of life. The development of a food warmer was chosen as the best solution, a preliminary outcome of this study, not just it addresses their goals and pains, it also ensures food safety which would reduce enforcement actions, lower the burden of authorities, and indirectly save resources. Consumers also would benefit from increased quality of life and safe, quality products from night markets. To strengthen the study's outcome, more research is needed, considering wider night market sites, increased respondents/subject matters, and a wider variety of dishes. The next chapter of the research would emphasize the final stages incorporating the "prototype" and "testing" stages to develop physically the food warmer, including ensuring its functionality and obtaining feedbacks from the existing users (hawkers) for further commercialization. A "user-centered design" (UCD) approach would be applied in this final stage of the DT process.

Introduction

Food safety has become one of the main topics in health that nowadays has attracted large attention from the authorities and the public. According to the World Health Organization (WHO), an estimated 600 million fall ill after eating contaminated foods and around 420,000 people die each year due to this (WHO, 2023). Furthermore, nearly one in ten individuals become unwell each year as a result of consuming contaminated food, making foodborne infections a serious public health risk (WHO, 2015; Lee & Yoon, 2021). In developing countries such as Malaysia, food-borne diseases usually are caused through institutional settings such as schools, universities, government/private sector premises, and also from catering businesses as indicated through various research from literature (Packierisamy et al., 2018; Rajakrishnan et al., 2022). Nevertheless, sources of food-borne illnesses that originated from night market settings should also not be underestimated, as those that happened between 2011-2014 that lead to deaths due to Salmonella infection (Norrasyidah, 2011; Anonymous, 2011; Che, 2014).

Night markets locally known as *pasar malam* in Malaysia are a normal scene in each neighborhood. It's been around for generations. Apart from obtaining various types of goods including foods, beverages, clothing, and other household products, it's an avenue for small businesses such as micro-small enterprises to begin their entrepreneurship journey, definitely a place for local people, consumers especially in the B40 category (is a representation in Malaysia of lower-class households with incomes under RM 4,850) to obtain their necessary needs for a budget price compared to other outlets, and shops. This type of business model gives a huge impact towards the local economy and indirectly for the whole country. Unfortunately, they also pose some threats towards public health. Studies showed that foodborne diseases could be caused by consuming foods sold at these night markets which in certain cases had led to even death. The usual norm of night market operation hours in Malaysia could last around eight (8 hours), which normally starts around 4 pm and could stretch until mid-night. This long period of time could potentially result in food being kept in the hazardous zone of temperature (40-140°F) for extended periods of time (Sun et al., 2012), thus it would then create a conducive environment for the proliferation of food-borne pathogens, including Salmonella. A typical sight of common night market stalls operated in Malaysia is highlight in Figure 1.

Figure 1: *Typical Sight of Common Night Market Stalls Operated in Malaysia (Source: picture taken during "empathy" stage).*

There is an abundance of research that looks into the knowledge, attitudes, and practices of these night market hawkers but seldomly looks into the heart of their problems that play a significant role in food safety. Therefore, this study would identify the hawker's experiences, perspectives, and problem statements, thus creating possible solutions that contribute to their practices and functions in ensuring food safety through the *Design Thinking* approach.

Basically, this research would be addressed and approached theoretically and practically to ensure that the research meets its purpose to ultimately reduce foodborne diseases from consuming foods from night markets. Through the various stages undertaken within the *Design Thinking* approach, the development of a suitable intervention product as the best possible solution would be addressed accordingly. In order to reduce foodborne diseases incidents, the intended prototype invention could control or reduce the growth of pathogenic microorganisms especially bacteria effectively, thus reducing the chances of consumers getting sick through consumption of such foods from night markets.

Overall, this paper will look into previous studies that are related to the research, methodology used, and the findings that were captured and discussed further to obtain a relevant conclusion for future upgrades and development.

Design Thinking Process

As made popular by IDEO and the Stanford d.school, design thinking (DT) is a transdisciplinary, user-centered approach to innovation (Dunne & Martin, 2006). The most often used methodologies, according to Micheli et al. (2019), are those from IDEO (Inspiration, Ideation, Implementation), Stanford d.school (Empathise, Define, Ideate, Prototype, and Test), and IBM (Understand, Explore, Prototype, Evaluate). Despite having a wide range of applications, the DT technique hasn't been frequently used in the development of new foods (Olsen, 2015). Among examples of those DT approaches utilized in this were the ones done by Markéta and Tereza (2015) and Olsen (2014). Based on Markéta and Tereza (2015), their project aims to explore the use of food as a communication tool to raise public awareness about social issues. They have designed *StreetSauce*, an interactive service with an edible interface, to engage the public in the issue of female homelessness. The research, based on DT principles with regards to the *empathy* stage utilized interviews, participant observation, and online questionnaires, aims to examine the convergence of food and human-computer interaction for social engagement. On the other hand, according to Olsen (2014), to provide innovative food solutions that work, the food sector must comprehend each unique customer, and the environment in which they reside, where to focus on human centered approach and the importance of consumer *empathy* are the basis and foundation of achieving best solutions. Therefore, the objective of their study is to examine and provide examples of how DT may foster innovation within the food sector.

Therefore, in order to popularize the usage of DT, especially in the area of food science/food technology/food safety which is definitely a rare tool in this field, this study will utilize DT based on the Stanford d.school approach which consists of major structured stages which are empathize, define, ideate, prototype, and test stages as indicated in Figure 2.
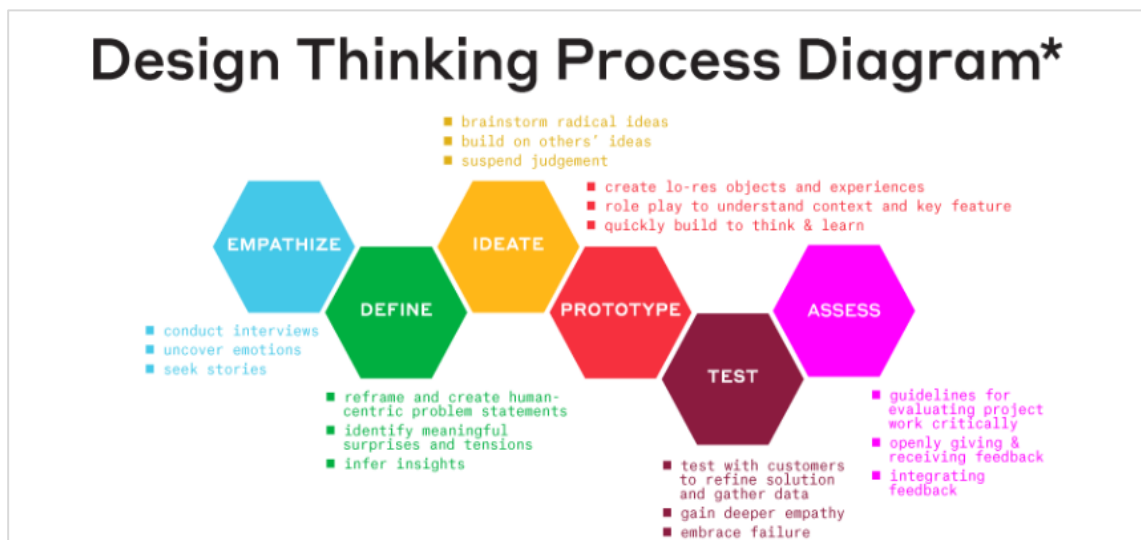

Figure 2: *Design Thinking Process Diagram (Source: Stanford d.school).*

User-centered Design Approach

In 1986, Donald Norman and Stephen Draper coined the phrase *user-centered design* (UCD) in their book User-Centered System Design: New Perspectives on Human-Computer Relations (Norman & Draper, 1986). Based on the Usability Professionals' Association UPA, UCD is *an approach to design that grounds the process in information about the people who will use the product* (UPA, 2008). According to Norman (1988), a design approach that centers on the needs and desires of users is known as user-centered design. It's frequently utilized in software design, graphical design, hospital healthcare items, and the design and construction of the built environment, including place-making, urban development, workplace design, and renovation (Sanders & Stappers, 2008; Sanoff, 2007). Rather of trying to make users alter their behavior to fit the product and services, user-centered design aims to maximize how well products and services fit with how users can, desire, and need to use them.

Norman (1988) initially described this strategy as *a philosophy based on the needs and interests of the user, with an emphasis on making products usable and understandable*. User-centeredness can mean either *design for users* or *design by users*, according to Eason (1995). While the second approach more deeply involves the user in the design process, the first asks the designer to collect data on human behavior and create the product and services for users. Therefore, when developing the prototype invention, besides that the product could deliver its function to prevent / reduce microorganism growth especially those pathogenic ones, the needs and wants of the users (in this case the night market hawkers) have to be asked and identified through further observations so that their input could also be gathered, complied and further incorporate towards the development of the related invention. This could enhance the usability chances of it in the night market setting. This is in line with what was highlighted by Giacomin (2014), whereby to increase user pleasure, improve usability, and raise the standard and safety of systems, many have embraced the UCD method.

So far, based on a literature search, UCD is not commonly used in the food industry. This methodology has demonstrated efficacy across various domains, including the medical (Grocott et al., 2007; Privitera et al., 2015), maritime (Österman et al., 2016; de Vries et al., 2017), aviation (König et al., 2012), and industrial sectors (Venturi et al., 2006). Additionally, it has been employed in the development of academic courses (Kahraman, 2010), digital and smart tools (Cha & Ahn, 2019; Demirbas & Timur Ogut, 2020), and interfaces (Wong et al., 2012; Martin et al., 2018). Figure 3 illustrates a UCD phase example, which was adapted from Bevan and Curson (1999), and ISO 9241-210 (2010).
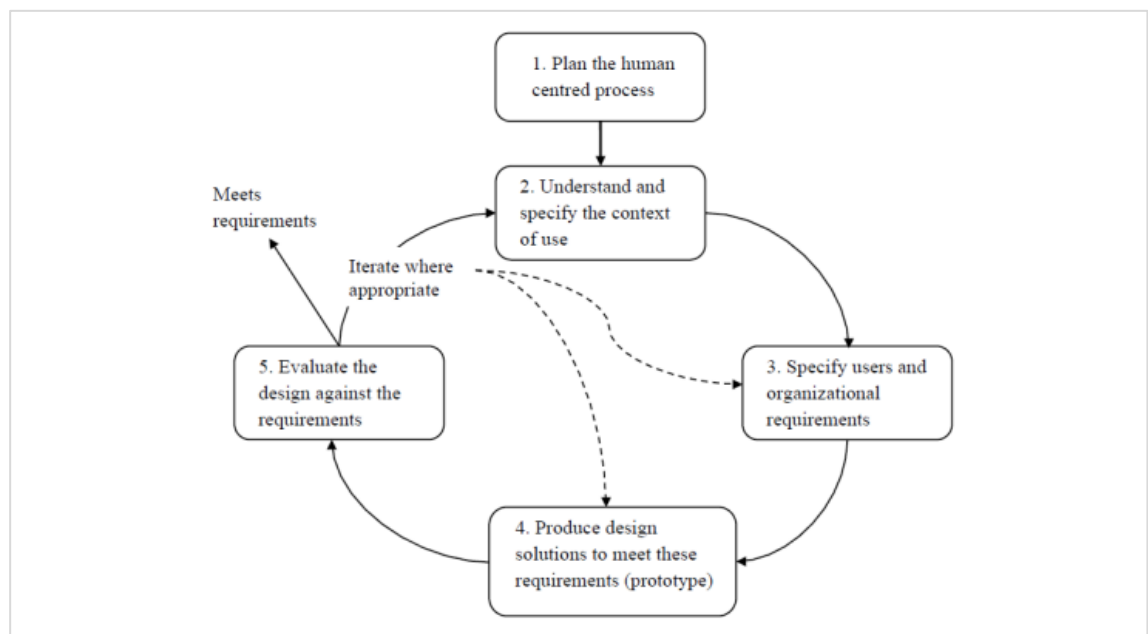

Figure 3: *UCD phase (Source: Bevan & Curson (1999) and ISO 9241-210 (2010)).*

Street Foods (Night Markets)

As reported by Dawson and Canet (1991), in Malaysia, selling street food is a multi-billion-dollar industry that directly employs over 100,000 people and generates gross annual sales of roughly US$2 billion. In 2012, Malaysia had approximately 11,000 street booths and kiosks, with more than 490 million dollars in sales. Between 2008 and 2012, outlets and transactions both expanded at yearly rates of 6.2% and 5.9%, respectively. In Malaysia, street food selling is regarded as one of the primary sources of revenue for those who provide vendors and food handlers with multi-million-dollar annual incomes (Alimi, 2016; Shafiee et al., 2017). Following that, night markets in this country have been practiced for many years. They are well-liked locations for social gatherings. They are one of the popular street foods in Malaysia, usually operates between 4.00 pm / 5.00 pm up to midnight on certain allocated days, however, some operate on a daily basis. Street food and hawking are regarded as significant components of social, cultural, and economic relationships in Southeast Asia (Toh & Birchenough, 2000).

The research listed a number of things that make street food more dangerous for people's health, which could be grouped into three main categories namely microbiological, chemical, and environmental aspects (Abdussalam & Käferstein, 1993). Following this, health, and spoilage/microbiological-related risks were the ones that were most frequently raised as concerns (Umoh & Odoba, 1999; Lues et al., 2006). Although the temperatures used in the cooking and frying processes used to prepare street food are high enough to destroy vegetative cells, resistant spores of microorganisms may survive (Bryan et al., 1988). As reiterated by Umoh and Odoba (1999), before being sold, the majority of items for street vendors are typically cooked in large quantities at various periods. Long holding times of more than six hours, often at room temperature (Muyanja et al., 2011), have been found to be a prevalent cause of food poisoning due to the bacteria' propensity for growth at temperatures between 5°C and 60°C (referred to as the danger zone). In another case, the high load of Bacillus spp. discovered in ready-to-eat street foods, according to Mosupye and von Holy (2000), may be caused by holding circumstances that favored the survival and germination of Bacillus spores.

Microbe contamination of street food is regarded as a global issue that significantly contributes to the spread of food-borne illnesses (Amare et al., 2019). Raw ingredients, food processing surfaces, and food handlers' hands may include pathogenic microbiological contaminants such E. coli, Salmonella, Shigella, Campylobacter, and S. aureus (Tassew et al., 2010). As a result of consuming ready-to-eat street foods, travelers from many countries also report of experiencing extreme diarrhea (Sina et al., 2011). This shows that street foods which are becoming common in our society today could play a bigger part in the development and transmission of food borne diseases especially in developing nations such as Malaysia. Because most Malaysians lack the time to make meals for themselves, there is a greater demand for food from various food service outlets. It is also becoming more common for Malaysians to eat out (Ali & Abdullah, 2012). As tourism is one of Malaysia's sources of income for the economy, this matter should also be addressed. With millions of semi-skilled and unskilled workers employed and millions of meals provided daily, this segment of the food business brings in billions of dollars in revenue. All the same, it poses distinct challenges for food safety, particularly in terms of sanitation and hygiene issues.

On the other hand, food poisoning incidents in Malaysia were 14,433 in 2015, with the highest incidence rate of 47.3 cases per 100,000 people (Department of Statistics Malaysia, 2016). Consequently, it is believed that food establishments are the primary source of foodborne illness outbreaks (Mun, 2020). Worthy to note the cross-sectional research done towards 400 street vendors in India by Sabbithi et al. (2023) that showed only a small percentage of vendors are aware of the value of procedures including separating cooked from uncooked food (22%), thoroughly preparing food (21.7%), and properly storing cooked food (8.5%). Only 4% of vendors really washed their hands with soap, and only around 13.7% of merchants believed it was necessary. Furthermore, Thi et al. (2021) found that the handling techniques of street food vendors were observed to be insufficiently hygienic, and an analysis of the street foods' safety revealed that they did not meet the hygiene requirements for particular meals set by Vietnam.

Pathogens can be transferred from food workers to consumers less frequently with effective food handling procedures and good personal cleanliness (Evans et al., 1998).

Regarding research done by Sandrasaigaran et al. (2023), the findings showed that 5.1% and 1.6%, respectively, of battered items purchased from night markets, street stalls, and food trucks were contaminated with S. enteritidis and Typhimurium. On top of that, research by Latchumaya et al. (2021) found that cooked RTE meatballs and sausages collected from street stalls and night markets in Malaysia were heavily contaminated by E. coli and aerobic bacteria, suggesting that they were unfit for human consumption. Similar results were also shown where of the 63 food items examined, 57.1% had contamination levels that were higher than those permitted by law and were therefore deemed unsafe for human consumption (Ferrari et al., 2021). Through these studies, temperature abuse during the serving period for street foods (within the danger zone of between 5°C-60°C) for more than four hours surely will increase the proliferations of these pathogenic microorganisms, thus increasing the chances of getting foodborne diseases among the consumers.

Apart from sources such as street foods, night markets, and through institutional settings, food that is catered in large amounts for mass gathering events such as during weddings, gatherings, festive celebrations, etc. also poses a high possibility of foodborne disease risk if the foods not handled appropriately. For instance, in a study performed by Rajakrishnan et al. (2022) towards a large-scale event in Petaling District, Selangor, Malaysia, on October 6, 2019, which was attended by around 20,000 people and resulted in a food poisoning incident, it was concluded that there was a substantial correlation observed between consuming "nasi lemak" during the mass gathering and being sick. Further investigation found that Bacillus cereus, Staphylococcus aureus, or coliforms were found in positive samples from suspected food, food handlers, and the environment. In a common mass gathering event in Malaysia, usually, foods will be on display from morning to late afternoon, and if the temperature of these foods is not properly controlled, indeed it will perpetuate the growth of microorganisms to the extent of developing foodborne disease outbreaks. This scenario would be further worsened if the event is done in the open environment (inside tents in a common household setting) whereby the surrounding temperature is hot (more than 30°C) coupled with high humidity levels could further elevate the risk posed. As highlighted by Hennekinne (2018) food poisoning was caused by germs multiplying more rapidly throughout the holding period, which exceeded four hours.

Methodology

As highlighted, this study applied the *Design Thinking* approach using the model established and popularized by IDEO and the Stanford d.school which consists of structured *empathize*, *define*, *ideate*, *prototype* and *testing* stages. However, for this study, only stages of *empathize*, *define* and *ideate* will be done to explore deeper the heart and soul of the hawkers in order to identify their goals and pains, thus effectively a best solution could be addressed further.

Empathy Stage

In this stage, interviews were conducted with the selected hawkers from the identified night market sites. On top of that, information was also gathered from selected *person in charge* (PICs) from various stakeholders/authorities that also oversee the food safety aspect of the foods sold at these night markets either directly or indirectly. Furthermore, information on the actual practices of hawkers was also gathered through observation done on-site during night market operations by taking pictures and videos. Subsequently, secondary information pertaining to the overall safety of foods sold in Malaysia generally was also obtained through annual reports from relevant authorities involved.

Two-night markets in the area of the Hulu Langat district in Selangor were selected for this research. Based on initial surveys and shortlisting of overall night market establishment information provided by the relevant local authority (in this study, the Kajang Municipal Council), the selected night markets for this project were at Section 7, Bandar Baru Bangi, which operated every Thursday and at Reko Sentral

(Uptown), Kajang, which operated every day except Mondays. Both of these night markets were managed by the community association and the hawker's association respectively.

The focus will be dwelt on what type of foods are sold at each night market, identification of RTE foods that are normally served hot, and concentration on high-risk foods especially hawkers that sell rice with various dishes (mixed rice or locally known as *nasi campur*) and pasta products, which are then displayed on a stainless-steel tray, which is a common practice adopted by the majority of the hawkers. A total of six interview sessions in this empathy stage were undertaken consisting of three hawkers for each night market locations. Interview questions would be in the form of open-ended design and format.

Based on initial interviews and observations towards the two selected night markets that were involved in this project, the specific six hawkers (three from each night market) identified for the empathy stage are listed in Table 1.

Table 1: *Six Night Market Hawkers Involved in This Study*

Location Night Market	No.	Hawker	Type of Foods
Section 7, Bandar Baru Bangi	1	Mr. A	Tomato Rice / Chicken Rice
	2	Ms. B	Chicken *Penyet* Rice / Tomato Rice
	3	Mr. C	Western Food (Spaghetti, Meatballs etc.)
Reko Sentral (Uptown), Kajang	4	Ms. D	Ambeng Rice
	5	Ms. E	Tomato Rice / Fried Chicken (Spices) Rice
	6	Mr. F	*Kerabu* Rice

Among the types of food selected includes Ambeng Rice, Tomato Rice, Chicken Rice, Chicken Rice Penyet, Kerabu Rice, and Western foods (e.g. meatball, spaghetti, etc). A set of interview questions was prepared which consists of 54 questions covering various topics including hawker's background, raw material used, food/dish preparation, method of displaying of food at the night market, actions taken for left overs of food, and additional questions pertaining their food safety knowledge and practices.

Each of the contact numbers of the hawkers was obtained with assistance from MPKj through the chairman of the resident association of Section 7 Bandar Baru Bangi and from PIC of the management company that handled the operation of Night Bazaar Reko Sentral (Uptown). Following this, appointments for interviews were arranged within the span of 1-2 weeks until completed. Interviews were done physically according to the hawker's preferability, timing, and comfort. Most are done at eating places (restaurants), one was done at the hawker's day job office and the rest were conducted at the market itself. Concurrently, observations at the night market were done hand in hand with the interviews with the respective hawkers.

Define Stage

From all the information obtained and gathered through various methods such as interviews, observations, and secondary data, they are further analyzed and transformed into *empathy map* canvases. From there, individual Personas were developed which led towards their own POVs.

Ideate Stage

In this stage, through the goals and pains obtained from the Personas and POVs, prioritization of the main problems faced by the hawkers were obtained through their votes to be focused as not all problems could be addressed at one time. From this list of priorities, possible solutions were figured out through brainstorming and further screened to come up to the best solution that is related to food safety improvement. Finally, the proposed best solution would be presented in a *pitching session* which would be attended by the related supervisors and industry advisors pertaining to this study together with identified lecturers and postgraduate students from the Azman Hashim International Business School (AHIBS) and Faculty of Chemical and Energy Engineering (FCEE) of University Technology Malaysia (UTM).

Methodological Gap and Summary

The current research framework only selected two-night market venues, but more sites and locations from other districts or neighboring states could enhance the project's outcome. The number of hawkers was limited to six, with focuses only on RTE foods. This selection is considered a purposive (judgmental) sampling as the hawkers were predetermined in terms of their type of foods and the way they displayed their foods, hence the number of hawkers selected were deemed sufficient. However, a greater variety and number of hawkers would provide a more realistic approach to obtain a better and overall outcome. The overall research framework is illustrated in Figure 4.
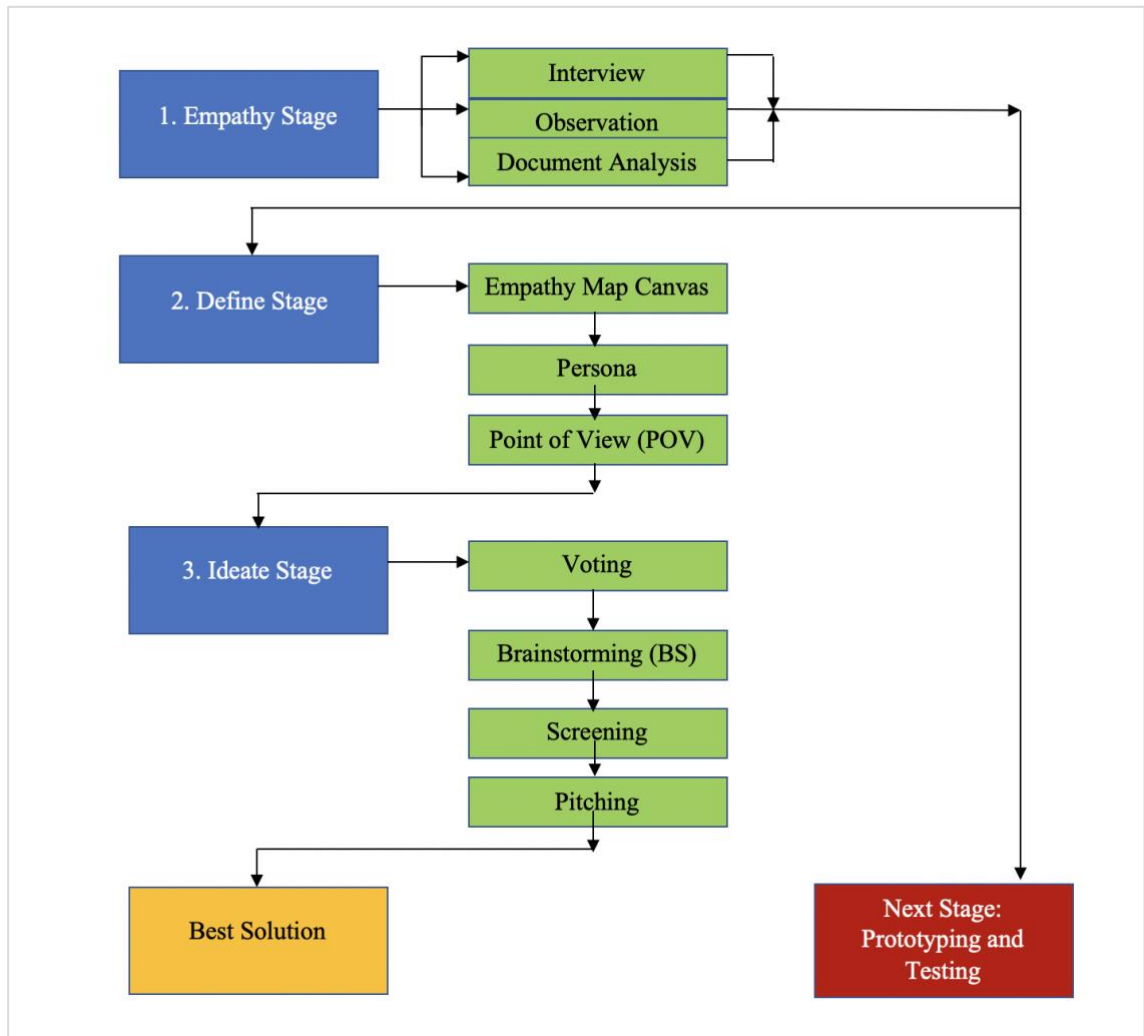
Figure 4: *Research Framework of the "Design Thinking" Approach Used in this Study.*

Result

Empathy Stage

The research revealed several key findings, including workers not attending mandatory food handler's courses, forgetting or not knowing the seven steps of hand washing technique, cooking raw materials early, selling foods within a high relative humidity environment, especially during the late afternoons/evenings, selling back left-over foods, and hawkers not wearing clean and appropriate attires as required by the authorities. The study also found an increase in food samples not complying with the Food Act 1983 and its regulations between 2015 and 2019.

Overall, the study suggests challenges within night market activities and will be explained through an *empathy map* canvas in the *Define* stage. Figure 5 shows one of the interviews and observations done during this stage.

Figure 5: *Interview and Observation Done During Empathy Stage.*

Define Stage

Six empathy map canvases were developed, based on the type of food/dish prepared. Three hawkers from *Tomato Rice* were chosen for combination into a single canvas, as they share similar food handling practices. Unique and high-risk attributes were combined within the canvas. These empathy map canvases that were developed are shown in Figure 6.

Empathy Map Canvas — Designed for: Mr. C — Designed by: MIA — Date: 20/11/23 — Version: 2

- 31 years old, single
- Western food (meatball/spaghetti etc)
- 2 workers/lot
- Seksyen 7 BBB
- Worked as Food Panda rider before
- GOAL
- More income and Profit
- Safe, healthy & delicious food
- Provide affordable foods to customer
- SPM holder, from Sg Buloh
- Since 2022 (after MCO), 6 lots
- Never eaten western food before this
- Frozen foods bought straight away sent to freezer. If late, product would defrost and produce unpleasant smell and have effect on its quality
- Early days, complaint food spoiled/became sour. Possible reason due to water vapour of hot foods covered early
- Water vapour from hot food is source of spoilage
- Foods bought during 7-8pm should be fine, but customers tend to store it and consume late around 4-10pm onwards. High chance to taste sour/spoiled
- Left food for too long to cool down not good due to the long distance of market that could reduce its shelf life
- Workers not properly attired (not wearing head gear and apron)
- Good food safety behaviour
- 7 PAINS — What do they THINK and FEEL?
- Left over of foods during rainy days
- Foods sold out every night
- Food could stand for longer times
- No customer complaints
- Stall clean, neat and organized
- No food warmer used
- Use generator for electricity
- What do they HEAR?
- Complaints from customer that foods spoiled/become sour
- Food easily become sour/spoiled
- Customer complaints
- More customer come during rainy days
- Workers from family
- Most raw materials are imported. Chicken from Thailand
- Attended food handler's course in 2022
- Not aware central kitchen require FSAP (MeSTI, GMP, HACCP) and must be registered under MOH
- Buy main ingredients from frozen supplier within Sg Buloh
- TY2 vaccine
- Rainy days, left overs a lot. Give discounts or discard (high moisture easily spoiled)
- Raw materials frozen inside box
- Price of warmer depend on quality. RM200 still affordable
- To prevent drying of foods, warmer opened from time to time
- Foods must be in warm conditions
- Support usage of food warmer to increase shelf life of foods
- Cook spaghetti at 11am. Cook chicken chop at 12.00-1.00pm depending on distance of market. 3pm everything finished
- Foods cooked at shop (central kitchen)
- Have 2 chiller and freezer each
- What do they DO?
- Buy raw materials once in 2-3 days. Previously done once a week, but limited to freezer capacity
- 4.30 pm start selling foods. Usually, 8-8.30pm sold out
- Put hot food into tray to cool until no water vapour (but still warm) and wrapped by plastic cover
- Start barbequing chicken 12/1pm
- Freezer cleaned every week
- Freezer between chicken and fish is separated
- Raw materials taken out from box and arranged in freezer accordingly
- Raw material transported using van (Hi-Ace)
- Foods stored in stainless steel tray wrapped with plastic
- Use plastic chopping board. For fruits and vegetables only. Chicken not required cutting
- Thawing starts 6/7am. Submerged in basin with water. Not using flowing water
- Raw mat cleaned including chicken and meatballs
- Raw materials taken out from box and arranged in freezer accordingly
- © 2017 Dave Gray, xplane.com

Empathy Map Canvas — Designed for: Ms. D — Designed by: MIA — Date: 20/11/23 — Version: 2

- Nasi Ambeng, 8 years, from Kelantan
- 46 years old; family with kids
- Degree holder, have a day job
- Reko Sentral (Uptown)
- GOAL
- Extra income and Profit
- Safe, healthy & delicious food
- Provide affordable foods to customer
- Indicator on when to clean freezer is where there is ice accumulation
- Stall is in good, organized and clean state
- Using stainless steel trays reduced water vapour development and cools faster compared to plastic trays
- Hot dishes must be cool down, reduce water vapour, and wrapped with plastic. This extend shelf life of food (not go bad quickly)
- 7 What do they THINK and FEEL?
- Sharing plastic chopping board
- Manage time doing 2 jobs
- Foods sold out every night
- No food warmer used
- Good food safety behaviour
- Electricity provided by management
- Employ workers
- 6 What do they HEAR?
- Rainy days
- Left overs of food
- Freezer temp not measured
- No action by MOH/MPKj
- Attended food handler's course
- Freezer usually not fully loaded except catering jobs
- Nothing wrong of thawing technique as no complaints of food poisoning from customers
- More customer comes during rainy nights
- Freezer usually will be cleaned from time to time
- Distance market to house around 10-15 min
- TY2 vaccine
- Thawing by covering raw materials in a basin is good enough to ensure its safety
- Wearing appropriate attire
- Make foods more attractive (e.g. warm foods)
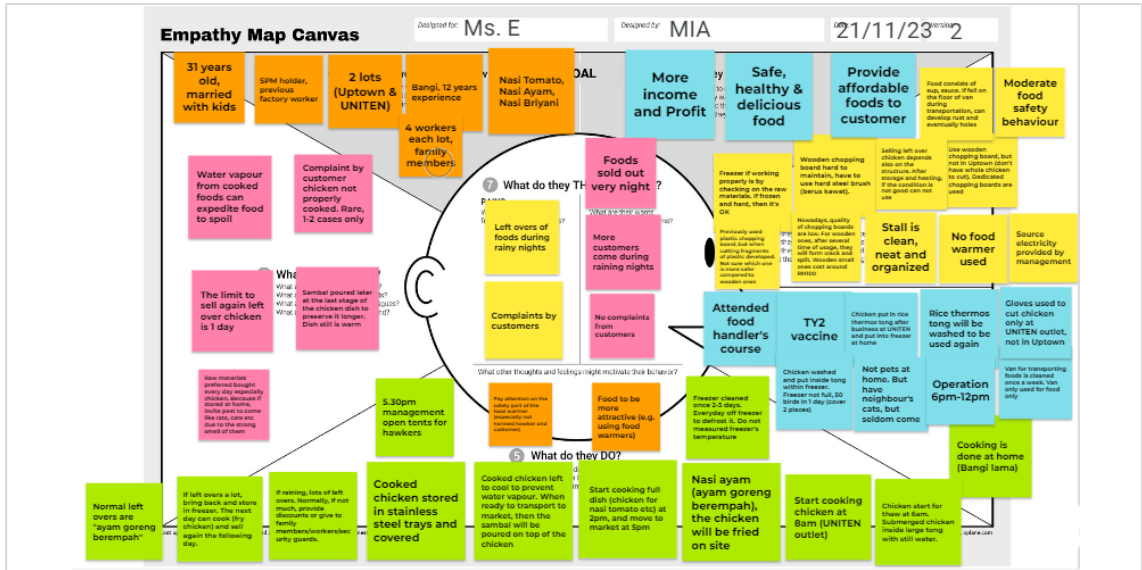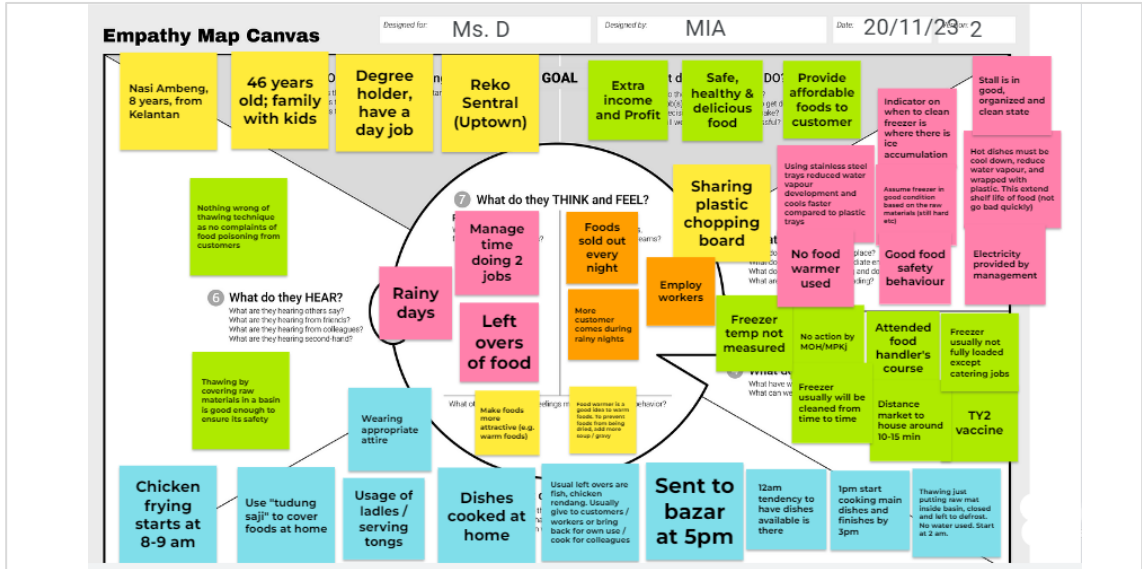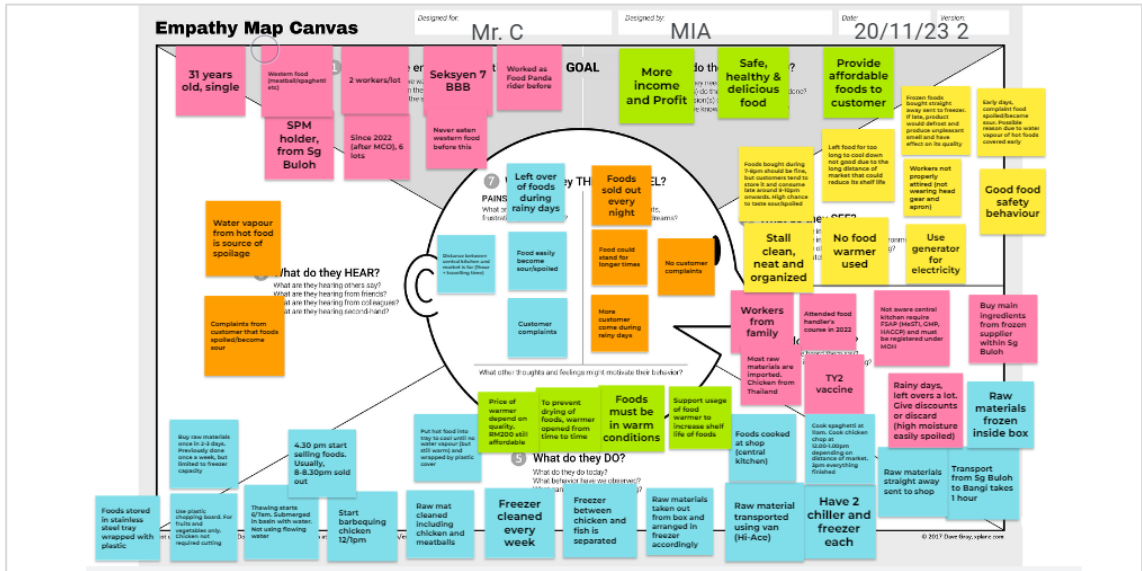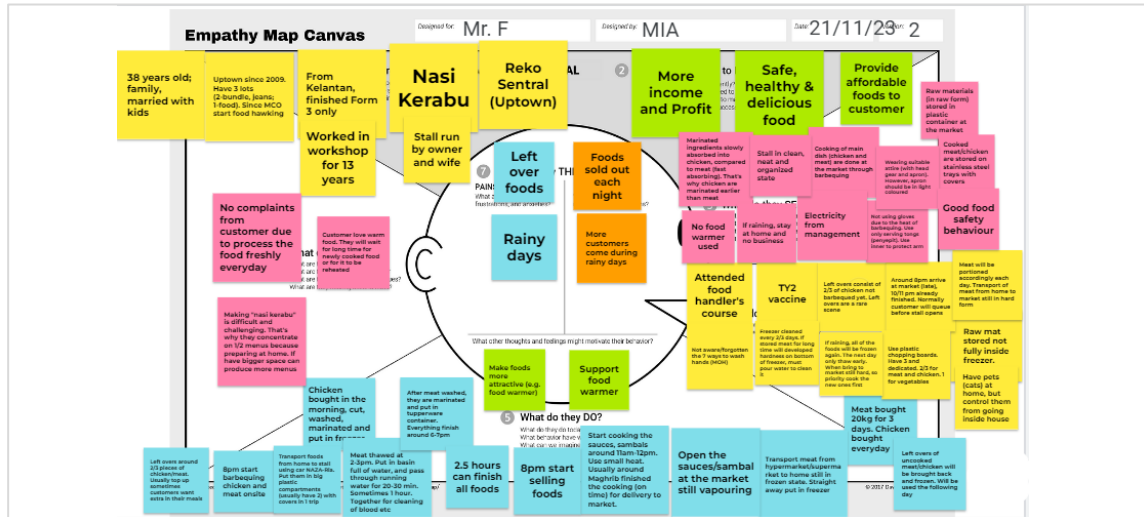- Food warmer is a good idea to warm foods. To prevent foods from being dried, add more soup / gravy
- What do they DO?
- Chicken frying starts at 8-9 am
- Use "tudung saji" to cover foods at home
- Usage of ladles / serving tongs
- Dishes cooked at home
- Usual left overs are fish, chicken rendang. Usually give to customers / workers or bring back for own use / cook for colleagues
- Sent to bazar at 5pm
- 12am tendency to have dishes available is there
- 1pm start cooking main dishes and finishes by 3pm
- Thawing just putting raw mat inside basin, closed and left to defrost. No water used. Start at 2 am.

Empathy Map Canvas — Designed for: Ms. E — Designed by: MIA — Date: 21/11/23 — Version: 2

- 31 years old, married with kids
- SPM holder, previous factory worker
- 2 lots (Uptown & UNITEN)
- Bangi, 12 years experience
- Nasi Tomato, Nasi Ayam, Nasi Briyani
- GOAL
- More income and Profit
- Safe, healthy & delicious food
- Provide affordable foods to customer
- Food consist of nasi, sauce. If fell on the floor of van during transportation, can develop rust and eventually holes
- Moderate food safety behaviour
- 4 workers each lot, family members
- Water vapour from cooked foods can expedite food to spoil
- Complaint by customer chicken not properly cooked. Rare, 1-2 cases only
- Freezer if working properly is by checking on the raw materials. If frozen and hard, then it's OK
- Wooden chopping board hard to maintain, have to use hard steel brush (berus kawat)
- Selling left over chicken depends size on the structure. After storage and heating, if the condition is not good can not use
- Use wooden chopping board, but not in Uptown (don't have whole chicken to cut). Dedicated chopping boards are used
- 7 What do they THINK and FEEL?
- Foods sold out every night
- Left overs of foods during rainy nights
- More customers come during raining nights
- Complaints by customers
- No complaints from customers
- Previously used plastic chopping board, but when cutting fragments of plastic developed. Not sure which one is more safer compared to wooden ones
- Nowadays, quality of chopping boards are low. For wooden ones, after several time of usage, they will form crack and split. Wooden small ones cost around RM500
- Stall is clean, neat and organized
- No food warmer used
- Source electricity provided by management
- The limit to sell again left over chicken is 1 day
- Sambal poured later at the last stage of the chicken dish to preserve it longer. Dish still is warm
- Attended food handler's course
- TY2 vaccine
- Chicken put in rice thermos tong after business at UNITEN and put into freezer at home
- Rice thermos tong will be washed to be used again
- Gloves used to cut chicken only at UNITEN outlet, not in Uptown
- Raw materials preferred bought every day especially chicken. Because if stored at home, invite pest to come like rats, cats etc due to the strong smell of them
- Chicken washed and put inside tong within freezer. Freezer not full, 50 birds in 1 day (cover 2 pieces)
- Not pots at home. But have neighbour's cats, but seldom come
- Operation 6pm-12pm
- Van for transporting foods is cleaned once a week. Van only used for food only
- 5.30pm management open tents for hawkers
- Pay attention on the safety part of the food warmer (especially not formed hawker and customer)
- Food to be more attractive (e.g. using food warmers)
- Freezer cleaned once 2-3 days. Everyday off freezer to defrost it. Do not measured freezer's temperature
- Cooking is done at home (Bangi lama)
- 5 What do they DO?
- Normal left overs are "ayam goreng berempah"
- If left overs a lot, bring back and store in freezer. The next day can cook (fry chicken) and sell again the following day.
- If raining, lots of left overs. Normally, if not much, provide discounts or give to family members/workers/security guards.
- Cooked chicken stored in stainless steel trays and covered
- Cooked chicken left to cool to prevent water vapour. When ready to transport to market, then the sambal will be poured on top of the chicken
- Start cooking full dish (chicken for nasi tomato etc) at 2pm, and move to market at 5pm
- Nasi ayam (ayam goreng berempah), the chicken will be fried on site
- Start cooking chicken at 8am (UNITEN outlet)
- Chicken start for thaw at 8am. Submerged chicken inside large tong with still water.

Figure 6: *Empathy Map Canvases Developed in the Define Stage*

Following this, the user Persona has been designed for all the hawkers based on the empathy map canvas developed earlier. As mentioned earlier, only four Personas were developed, taking into account the combination of the three hawkers who sold similar foods (Tomato Rice) into one consolidated persona. Names of all the personas were changed accordingly as fictional characters. All of the Personas developed is shown in Figure 7.
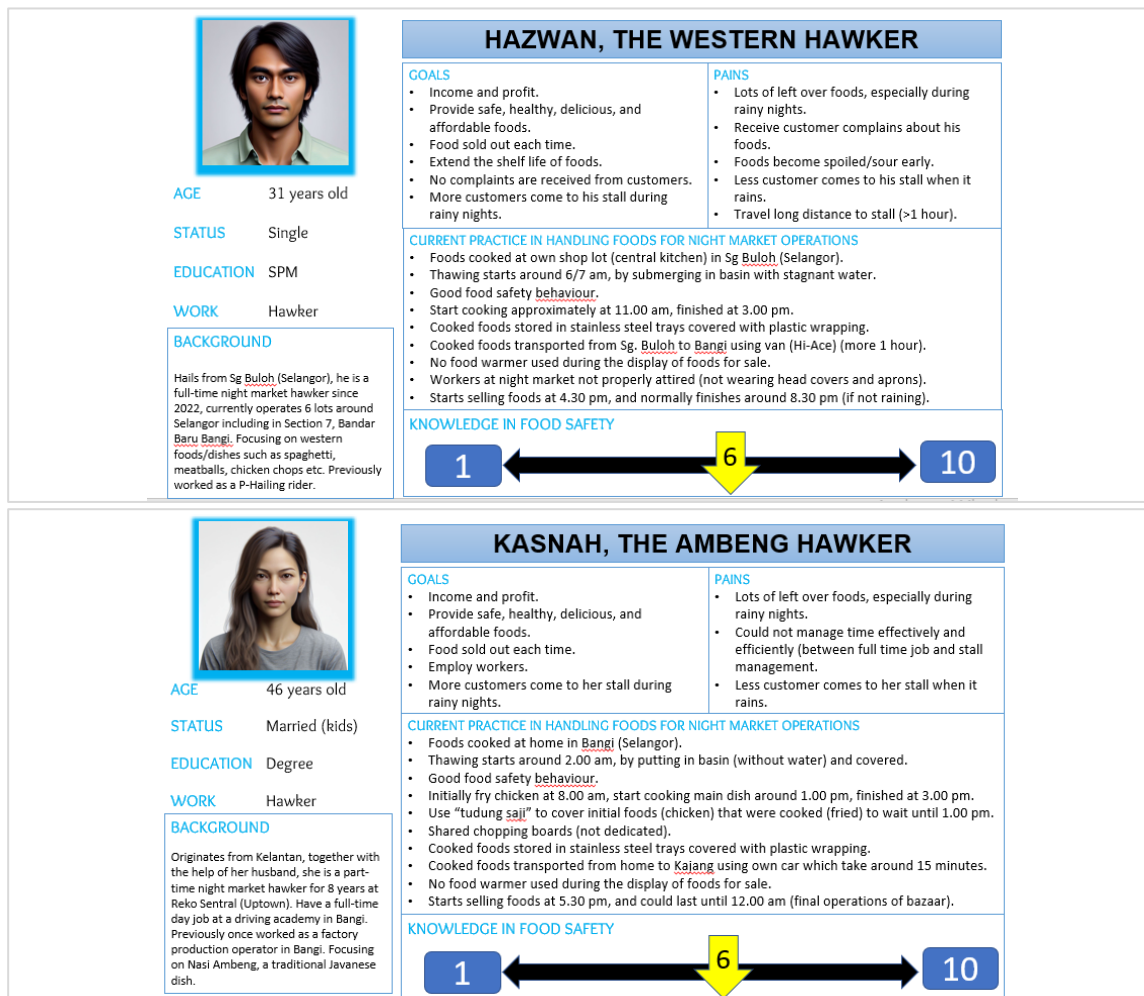

HAZWAN, THE WESTERN HAWKER

GOALS
- Income and profit.
- Provide safe, healthy, delicious, and affordable foods.
- Food sold out each time.
- Extend the shelf life of foods.
- No complaints are received from customers.
- More customers come to his stall during rainy nights.

PAINS
- Lots of left over foods, especially during rainy nights.
- Receive customer complains about his foods.
- Foods become spoiled/sour early.
- Less customer comes to his stall when it rains.
- Travel long distance to stall (>1 hour).

CURRENT PRACTICE IN HANDLING FOODS FOR NIGHT MARKET OPERATIONS
- Foods cooked at own shop lot (central kitchen) in Sg Buloh (Selangor).
- Thawing starts around 6/7 am, by submerging in basin with stagnant water.
- Good food safety behaviour.
- Start cooking approximately at 11.00 am, finished at 3.00 pm.
- Cooked foods stored in stainless steel trays covered with plastic wrapping.
- Cooked foods transported from Sg. Buloh to Bangi using van (Hi-Ace) (more 1 hour).
- No food warmer used during the display of foods for sale.
- Workers at night market not properly attired (not wearing head covers and aprons).
- Starts selling foods at 4.30 pm, and normally finishes around 8.30 pm (if not raining).

KNOWLEDGE IN FOOD SAFETY

| 1 | ← 6 → | 10 |

AGE 31 years old

STATUS Single

EDUCATION SPM

WORK Hawker

BACKGROUND

Hails from Sg Buloh (Selangor), he is a full-time night market hawker since 2022, currently operates 6 lots around Selangor including in Section 7, Bandar Baru Bangi. Focusing on western foods/dishes such as spaghetti, meatballs, chicken chops etc. Previously worked as a P-Hailing rider.

KASNAH, THE AMBENG HAWKER

GOALS
- Income and profit.
- Provide safe, healthy, delicious, and affordable foods.
- Food sold out each time.
- Employ workers.
- More customers come to her stall during rainy nights.

PAINS
- Lots of left over foods, especially during rainy nights.
- Could not manage time effectively and efficiently (between full time job and stall management).
- Less customer comes to her stall when it rains.

CURRENT PRACTICE IN HANDLING FOODS FOR NIGHT MARKET OPERATIONS
- Foods cooked at home in Bangi (Selangor).
- Thawing starts around 2.00 am, by putting in basin (without water) and covered.
- Good food safety behaviour.
- Initially fry chicken at 8.00 am, start cooking main dish around 1.00 pm, finished at 3.00 pm.
- Use "tudung saji" to cover initial foods (chicken) that were cooked (fried) to wait until 1.00 pm.
- Shared chopping boards (not dedicated).
- Cooked foods stored in stainless steel trays covered with plastic wrapping.
- Cooked foods transported from home to Kajang using own car which take around 15 minutes.
- No food warmer used during the display of foods for sale.
- Starts selling foods at 5.30 pm, and could last until 12.00 am (final operations of bazaar).

KNOWLEDGE IN FOOD SAFETY

| 1 | ← 6 → | 10 |

AGE 46 years old

STATUS Married (kids)

EDUCATION Degree

WORK Hawker

BACKGROUND

Originates from Kelantan, together with the help of her husband, she is a part-time night market hawker for 8 years at Reko Sentral (Uptown). Have a full-time day job at a driving academy in Bangi. Previously once worked as a factory production operator in Bangi. Focusing on Nasi Ambeng, a traditional Javanese dish.

Figure 7: *Personas Developed Through the Define Stage.*

Based on the four Personas developed earlier, their respective POVs were developed as indicated in Figure 8.

POINT OF VIEW (POV) STATEMENT KASNAH, THE AMBENG HAWKER

USER

NEEDS

INSIGHTS

Kasnah, is a night market hawker, 46 years old, has a day job, married with kids and involves selling *Ambeng* Rice, a popular Javanese dish.

She needs to sell all of her foods each night, to receive income and profit, thus to sustain her livelihood.

In order to achieve this, she has to make her foods more attractive, employing more workers to run her stall and increase its efficiency, and also ensure more customers come to her stall, especially during rainy nights.

POINT OF VIEW (POV) STATEMENT HAZIZI, THE KERABU HAWKER

USER

NEEDS

INSIGHTS

Hazizi, is a night market hawker, 38 years old, married with kids and involves selling *Kerabu* Rice, a popular Kelantanese dish.

He needs to sell all of his foods each night, to receive income and profit, thus to sustain his livelihood.

In order to achieve this, he has to make his foods more attractive and ensure more customers come to his stall, especially during rainy nights.

POINT OF VIEW (POV) STATEMENT AMINAH, THE TOMATO HAWKER

USER

NEEDS

INSIGHTS

Aminah, is a night market hawker, 46 years old, married with kids and involves selling Tomato Rice, a popular Malaysian dish.

She needs to sell all of her foods each night, to receive income and profit, thus to sustain her livelihood.

In order to achieve this, she has to make her foods more attractive, ensuring no customer complaints and more customers come to her stall, especially during rainy nights.

Figure 8: *POVs Developed Through the Define Stage.*

Ideate Stage

Six *How Might We* (HMW) questions were gathered from the goals and pains of all Persona and their POVs, including ensuring food sales, eliminating customer complaints, increasing customers during rainy days, increasing food shelf life, shortening the distance between the central kitchen and night market stall, and improving time management between day and night market operations. Hawkers were contacted to vote on their priorities and prioritized issues.

Only five HMW questions were considered, with the distance between the central kitchen and night market site considered less priority. All questions were treated individually, except for questions related to customer complaints and food shelf life, which were grouped together due to their close relationship.

Based on the five *How Might We* questions; they were grouped into four possible solutions which consist of a total of 25 solutions.

Screening

Overall, there were seven possible solutions extracted and touched all the five prioritized HMW questions that are related to controls of a microbiological load of the food which eventually led to the development of a *food warmer* whilst still addressed their goals and pains as the conclusion of the best solutions in line with the study's objectives; as illustrated in Figure 9.
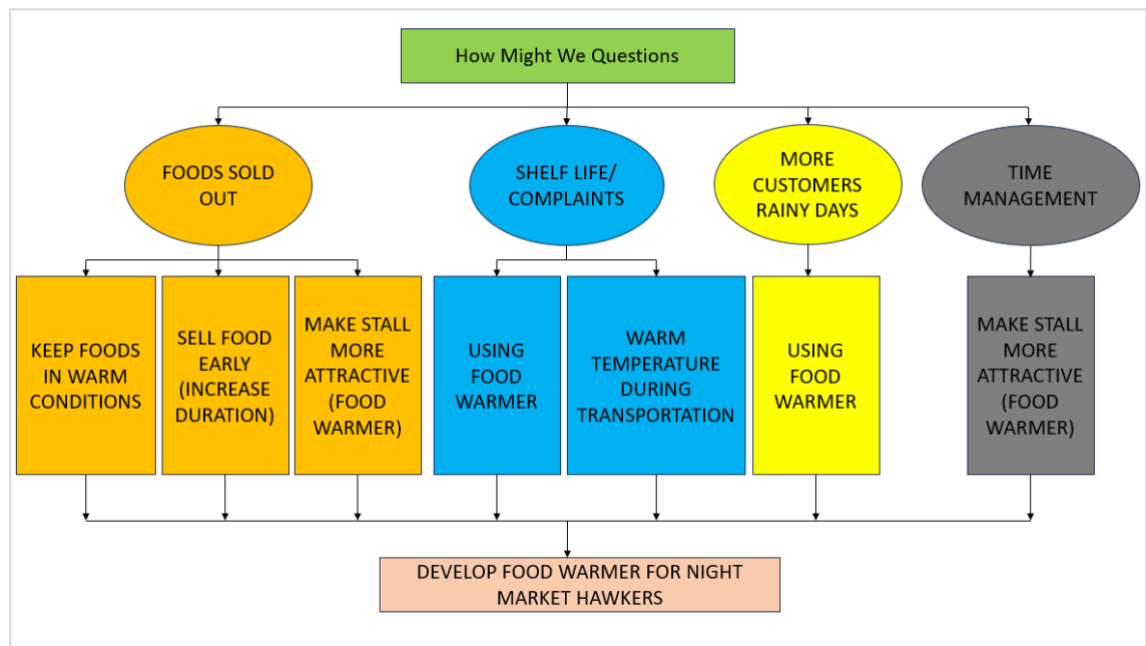
Figure 9: *Best Solutions Towards Idea of "Food Warmer" Development.*

Idea Selection (Pitching)

Idea selection was conducted through a *pitching day* function attended by postgraduate students, academic supervisors, and industry advisors. The idea was based on the priorities of hawkers and was considered the best solution. The panel agreed that the food warmer was the best overall solution to improve food safety, particularly in terms of microbiological safety, and addressed the hawker's other goals and pains.

Discussion and Conclusion

Consequently, from this *Design Thinking Approach* study, we have come across that the *food warmer* was seen as a best solution, taking into account the current scenario and objectives of the study, could help in solving the problems faced by the hawkers overall. Nevertheless, this food warmer usage could be expanded to other food-based businesses such as the catering industry, institutional premises e.g. schools, government/private premises, etc.

Usage of a food warmer especially in the food catering industry does give benefit towards the safety and quality of the food being sold. With regards to Regulation 36(1)(m) of the Food Hygiene Regulations 2009, it is mandatory to *ensure that a food warmer maintains a temperature of food above 60°C, where the food is to be served hot*.

Failure to execute this condition, the night market hawker (in this study) commits an offence under Regulation 36(4) of the said regulations, whereby he/she is liable to a fine not exceeding RM 10,000 or to an imprisonment for a term not exceeding two years if found guilty. Thus, using a food warmer in the operations of selling RTE foods at night market definitely can deter the tendency to be taken enforcement actions from the authorities either from the Food Safety and Quality Program (FSQP), Ministry of Health (MOH) or the MPKj.

As highlighted before through literatures, by preventing foods especially RTE ones from being displayed for sell or stored within the *danger zone* temperatures of 5°C - 60°C for more than four hours surely will help inhibit the growth of microorganisms, especially the ones related to pathogens and spoilage bacteria. Through these studies also within the literature, with temperature abuse during the serving period for street foods (within the danger zone of between 5°C-60°C) for more than four hours definitely will increase the proliferations of these pathogenic microorganisms, thus increasing the chances of getting foodborne diseases among the consumers. Therefore, using food warmers in this case would definitely reduce the chances of getting foodborne diseases among consumers and also would assist in prolonging the shelf life of the food itself.

Unfortunately, besides giving great benefits either to the *pasar malam* hawkers or the local consumers, as highlighted earlier, these night markets also pose some threats towards public health. Studies showed that foodborne diseases could be caused by consuming foods sold at these night markets which in certain cases had led to even death. There are various factors that could lead to this among others such as pertaining to the quality of the raw materials used, the cooking process, the night market (food handlers) knowledge and practices towards handling foods, the environment of the night market, storage of foods, its transportation, and distribution, etc. Nonetheless, the usage of food warmers would reduce the tendency of foodborne diseases coming from the consumption of the end product.

As highlighted before, the usage of food warmers especially in the night market/street food scene do give benefits in terms of the safety of the food sold, especially pertaining to its microbiological quality. Currently, as requirements to warm RTE foods above 60°C is a mandatory requirement legally required by existing regulation and is important in reducing the risk of foodborne diseases caused by pathogens, more focus on the empathy part of this area will be delved further. Notwithstanding this, other potential causes will be also looked into accordingly and holistically through the empathy phase. Based on an extensive search of the literature, there was no such development of a mobile food warmer to be used by street food operators especially pertaining to night market hawkers. The common way to reheat these foods was through normal reheating or recooking back the foods that are still available. Therefore, with the aid of a mobile food warmer would indirectly maintain the hawker's economic sustainability and further contribute to the growth of the country holistically.

As we selected that food warmers are the best solution for the hawkers, the way forward is to addressed issues that might hinder the usage of it in their everyday night market operations. There are various factors that possibly could make night market hawkers reluctant to use a food warmer. First of all is the mobility issue. As normally hawkers move from one-night market location within an area to the next, using a bulky food warmer would be difficult. One could associate a food warmer with the ones used in a common restaurant setting such as the Bain Marie. Additionally, an added power source would be required to operate the food warmer, hence limiting its mobility function. Thus, a lightweight, mobile, and a portable power source could be the ideal solution to attract hawkers to use such food warmers. Secondly, the high price to own a food warmer together with its operating costs is also a hindrance factor of using one. Thus, developing a food warmer which is cheap is an ideal push factor to use them. Thirdly, a food warmer may not suit to all types of foods sold, bringing the problem of multiple types of food warmers needed if various foods are sold at one stall. Therefore, for this research purpose, a specific focus would be highlighted on certain types of food initially that are high risk and prone to be sold more than four hours to limit the scope. Nevertheless, this research could be expanded further later to accommodate other types of foods.

With regards to the selling period, possibly certain hawkers would argue that their foods would be sold prior to the four-hour window period. This could be debatable as proper monitoring of the serving time might be done by the hawkers. However, as an assurance for such conditions, having a food warmer is better to ensure food safety. Subsequently, usage of a food warmer continuously might make the overall food conditions to be dry and reduce its quality appearance similar to those impacted by using a common Bain Marie. In this case, attention to detail on the temperature provided by the food warmer should be highlighted so that the minimum temperature of 60°C is achieved without going too overboard and produce dry foods. Finally, no / lack of enforcement by relevant authorities such as from the FSQP, MOH would deter the hawkers from owning a food warmer as no actions were taken to those selling foods intended to be served hot for more than four hours at *danger zone* temperatures (5°C - 60°C). Therefore, the authorities should begin enforcing this requirement as stipulated in the Malaysian Food Hygiene Regulations 2009 as a push factor for hawkers to start using food warmers in their business. As a conclusion, when all of these factors are addressed accordingly, night market / *pasar malam* hawkers would willingly start and use food warmers.

Overall, through the usage and application of the food warmer, besides of reducing enforcement actions towards hawkers, this would directly contribute in lowering the burden of the authorities, thus indirectly saving resources of the government not limited to just monetary, and human resources but other aspects as well. Lastly, consumers will get the ultimate benefit of this through increased quality of life (not sickened by foodborne diseases) and obtaining a safe and quality product from food establishments such as night markets.

Based on the current research framework, the total night market venues selected were only two sites. Alternatively, due to current constraints, selecting more night market sites would be better in getting the overall picture of the night market scene. Furthermore, as the current research involved night market sites within the same district, selecting sites from other districts or to the extent of other neighboring states would further enhance the outcome of the project.

Related to this, the number of hawkers selected was also limited to only six. Selection of them was done using a pre-determined factor, whereby only hawkers that sell RTE foods were identified and chosen for this research. For this reason, if a greater variety and number of hawkers were selected would give a more realistic and practical approach towards a universal usage of food warmers that are compatible to more than one types of serving conditions.

Furthermore, in this study, a great effort was taken to ensure that the type of dishes sold by the hawkers are different from each other. However, dealing with human subjects does give its unique challenges. Many of them were reluctant to be selected and interviewed as most of them were busy, not interested, and even possibly scared that they could be scammed and other reasons. Eventually, three of the hawkers sold similar dishes but when interviewed, their approaches and practices towards food preparation does show some uniqueness and distinctness. Therefore, by selecting a more variety of dishes does influences in terms of the overall design and mechanism of operation of the proposed food warmer.

As highlighted earlier, this paper only addresses the outcome of the *design thinking* approach which takes into consideration the initial three phases, namely the *empathy, design, and ideation* stages which lead to the development of the food warmer as the best solution. Therefore, the *prototype* and *testing* stages of the food warmer including obtaining feedback from the users (identified hawkers in this study) for further improvement will be covered in this next chapter of the research. This would include assuring that the food warmer functions accordingly to ensure food safety (improve food's microbiological quality) and also addresses the other goals and pains suffered by the hawkers related to ensuring foods sold out each night (increase sales and profit), increase customers to their stall, reduction of complaints, ensuring shelf life of food and also improving time management. Furthermore, the last phases of the DT process would involve the use of a *user-centered design* (UCD) approach in order to get the food warmer fully accepted by users, not just of its usability but also in terms of its ergonomics, economic viability, attractiveness, etc.

Acknowledgements

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