

Applying Design Thinking in Food-Waste Mobile Application

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Abstract: Disposal of food that still suitable for consumption or commonly referred to as a surplus, still occurs frequently in Indonesia. Thus, according to The Economics Intelligence, Indonesia become the country with the world's second-largest rate of food waste disposal in 2021. Meanwhile, many people in Indonesia are still hungry and waiting for help from the government to find a solution. However, there needs to be an initiative from the Indonesian people themselves, especially teenagers with higher education they have. Moreover, in the digital era like today, it would be very helpful if food waste in Indonesia could be solved through an application that could be used easily and quickly by the whole community. Implementing the Design Thinking method helps the end-to-end process so that the finished application can later be validated that the application can truly be a solution for the Indonesian people and reduce food surplus in the community.

1 INTRODUCTION

The United Nations Food and Agriculture Organization (FAO) considers food waste to be the discarding of food items that are still suitable for human consumption at any point in the food supply process (FAO, 2011). Recently, food waste has become a significant issue worldwide, with important ramifications for the environment, economy, and society. (Coşkun & Yetkin Özbük, 2020). Every year, a total of 1.3 billion tons of food that is still fit for consumption is discarded worldwide, resulting in an estimated financial loss of \$900 billion. (FAO, 2013)

According to a study, it is estimated that the drinks industry generates around 26% of food waste, with the dairy industry following at 21%. Fruit and vegetable production and processing contribute 14.8%, cereal processing and manufacturing contribute 12.9%, meat processing and preservation contribute 8%, vegetable and animal oil manufacturing and processing contribute 3.9%, fish processing and preservation contribute 0.4%, and all other industries contribute 12.7%. (Nayak & Bhushan, 2019).

Indonesia has the third highest household food waste level in Southeast Asia, with consumption levels reaching 77 kg/capita/year. Brunei Darussalam holds the first rank, Cambodia holds the second, and

Vietnam has the lowest. (UN Environment Program, 2021)

The "Food Loss and Waste in Indonesia" report by the Ministry of National Development Planning in 2021 states that the economic loss from food waste in Indonesia between 2000-2019 was approximately 213-551 trillion rupiah annually, or 4-5% of Indonesia's GDP. Furthermore, the number of people who could have been fed from the loss of nutrition (energy) during the same period is estimated to be 61-125 million, 29-47% of Indonesia's population. (Bappenas, 2021)

Given this situation in Indonesia, we have created a platform to reduce food waste in Indonesia. Users can share information about food waste and food that is still safe to consume. This app is expected to be able to reduce food waste on a small scale. The platform is an Android-based application with research development using a design thinking approach. A digital platform is a systematic foundation for integrating productive, informative, and human resources in a region and industry to offer public services and business ventures. (Zatsarinnyy & Shabanov, 2019). Digital platforms are a prevalent reality that disrupts established companies by altering how digital products and services are consumed and supplied. While conventional firms generate value within the limitations of a corporation or supply chain, digital platforms leverage a network of self-

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governing entities to create value jointly. (Hein et al., 2020). This app is tailored for Android users in Indonesia. The market share of Android users in Indonesia is 89%, followed by iOS with 10%. (Statcounter, 2022).

Design Thinking is used as the basis for innovation in this research. Design Thinking has a market value share of USD 6900.0 million in 2021 and is expected to grow at a CAGR of 7.25% during the forecast period, reaching USD 10500.0 million by 2027. Companies such as IBM, Adobe, and Enigma have made Design Thinking the basis of their innovation. (*Global Design Thinking Industry Research Report, Competitive Landscape, Market Size, Regional Status And Prospect*, 2022)

2 TEORITICAL BACKGROUND

Design thinking, also called designerly thinking, involves a non-linear and repetitive method that aims to comprehend users, question assumptions, re-evaluate issues, and generate new solutions that can be tested and prototyped. (Siang & Interaction Design Foundation, 2018). In more abstract terms, Design thinking can be described as a recursive and cooperative approach to resolving issues creatively. (Pope-Ruark, 2019).

This process of Design Thinking is consists of five phases: Empathize, Define, Ideate, Prototype and Test (Doorley et al., 2018). During the Empathy phase, designers investigate the needs and objectives of the target users for a product. In the Empathy phase, designers research the needs and goals of a product's target users. This phase is a valuable opportunity to uncover crucial user traits, address gaps in understanding users, and question pre-existing assumptions. In the Definition phase, designers synthesize core user characteristics and establish the design requirements, which are the must-haves for the product.

The ideation phase is a crucial step in the design thinking process, where designers generate ideas that can be materialized. These ideas can pertain to various aspects of the product, such as navigation menus, content style, visual presentation, etc. Ideation enables designers to think innovatively and often collaboratively. This phase is characterized by generating many ideas, some of which may be unrealistic or unfeasible, but the designers need to consider all options.

The prototype phase follows the ideation phase in the design thinking process. In this phase, designers create one or more product mockups and visual representations of the ideas generated during the ideation phase. These prototypes provide designers

with a tangible expression of the product and can be used to test its functionality, usability, and user engagement. This allows designers to obtain valuable feedback on the product's design. It's worth noting that prototypes are not the final products and may be altered based on feedback and testing. (Doorley et al., 2018).

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The design thinking methodology is not a linear progression but rather a cyclical and iterative process. Designers frequently revisit the Empathize stage to conduct further user research as they engage in the ideation phase. Additionally, testing is not undertaken exclusively after the process, but rather, it is incorporated throughout various stages of iterative prototyping on both a large and small scale (Siang & Interaction Design Foundation, 2018).

3 METHODOLOGY

In this research, the methodology employed is the design thinking method, which entails the following stages: Empathize, Define, Solution, Prototype, and Testing. The sample population consisted of 30 individuals of diverse backgrounds, all of whom are members of the target customer segment for this platform.

3.1 Empathize

During the Empathize stage, the focus is on gaining a deeper understanding of the user regarding their thoughts and feelings. This enables the identification of pain points, which serve as a foundation for the development of features that address the user's problems. (Liu & Cai, 2022). The output generated is in the form of an Empathy Map. (Bittner & Shoury, 2019).

An Empathy Map is created to enable researchers to gain a deeper understanding of the user through interviews. (Bittner & Shoury, 2019). The Empathy Map comprises four groups that are differentiated based on the results of the interviews. The first group contains information about what the user Says, the

second group includes information on what the user thinks about their experiences, the third group contains information about what the user Feels or their emotions, and the fourth group contains information about what the user Does. (Siricharoen, 2021).

3.2 Define

The collected interview results provide insights through a user journey and pain points, summarized on an insight board. Once collected, these insights are categorized based on the grouping of insights obtained from the interviews, the definition of problems derived from understanding the wisdom and planning for solutions that can be used to resolve the issues and the journey undertaken by the respondents from start to finish.(Parizi et al., 2020)

3.3 Ideate

The next step is determining which features are suitable solutions to the problems identified. After identifying the elements to be implemented, the next step is to filter these features to prioritize which ones will be designed first in the MVP stage using an Action Priority Matrix. (Panyukov et al., 2022).

3.4 Prototype

The researcher first creates a sketch to focus primarily on the translation of features. After making the sketch, the next step is to convert the digital drawing into a digital form and create a clickable application structure (prototype) so that users can directly experience the solution offered.(Vogel et al., 2021)

3.5 Testing

To test the application, the System Usability Scale (SUS) method is used to determine the usability of the system that has been created (Hyzy et al., 2022). The first step taken is to document all of the answers that users have submitted through the form after requesting feedback from users regarding the application under development. The criteria for participants recruited for testing align with the User Persona created previously..

4 IMPLEMENTATION - HERE

After conducting interviews with users in the initial phase, an empathy map is produced as follows. The empathy map provides an initial overview of the

user's perspective on the problems encountered. The researcher has concluded the results of the interviews with users and generated 4 groups within the empathy map. Where in the "Does" and "Feels" group, the most conclusion points were obtained, 8 points as we show in figure 1.

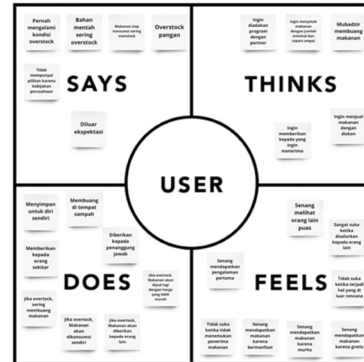


Figure 1: Result of Empathy Map.

Based on the results of the empathy map, the researcher has drawn the conclusion that the problem encountered requires the define phase to be carried out. In the define phase, the researcher creates a list of pain points. The results obtained are as follows :

- The excessive amount of food being discarded
- The excess food available cannot be reused
- Difficulty in finding individuals willing to accept surplus food
- Unforeseen issues that cannot be resolved independently
- Food is often thrown away due to lack of alternative options
- Strict company policies resulting in wasting food that is still edible
- Food vendors are difficult to contact
- Raw materials cannot be sold if they have poor form
- Difficulty in finding individuals willing to share their food for free
- Prepared food does not have a long shelf life
- Many foods are not accessible due to their high cost
- There is a minimum amount required for stock ordering

In this phase, the creation of user personas and user journeys is also conducted to observe the daily patterns of the user and identify the target audience of this application

The next step is Ideate. In this stage, solutions are generated for the problems mentioned in the previous stage. As the goals of this research are to produce an

MVP, the actions to be taken must be low effort with maximum impact. Thus, the solutions to be developed will be organized using an Action Priority Matrix in figure 2 below.

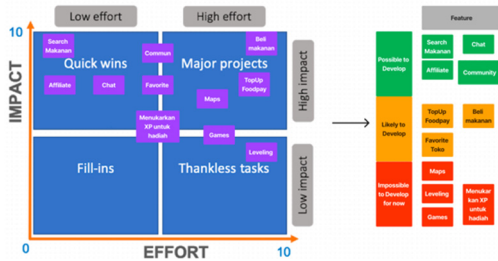


Figure 2: Action Priority Matrix Result.

The Action Priority Matrix will result in features with low effort but high impact, where the features are **Food Search, Chat, Affiliate, and Community**.

The features that have been compiled will be implemented in sketches in low-fidelity design up to high-fidelity design. The prototype produced is as in figure 3 below.



Figure 3: High Fidelity Design.

Next, it will be developed into a high-fidelity design to view at the surface level. The high-fidelity design is created to approximate the original product like in figure 4.

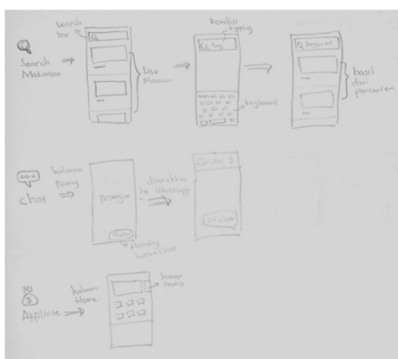


Figure 4: Low Fidelity Design.

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In testing stage, the System Usability Scale (SUS) is used with the final value obtained being 81,375 and is classified as **Excellent** quality. (Wahyuni (Universitas Sultan Ageng Tirtayasa) et al., 2021).

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{1672,5}{20}$$

$$\bar{x} = 81,375$$

Note :
 \bar{x} = average score
 $\sum x$ = total SUS score
 N = number of participant

5 CONCLUSION

Design Thinking provides a concrete and structured method for transforming abstract ideas into actionable plans. When applied to app development ideas, this approach is quite effective. Initially, ideas that are only pieces of solutions will become more concrete and focused solutions. Design thinking greatly helps the product development process to be faster. The current participants are fond of the concept of sharing food waste based on this Android application. Currently, we are reaching out to other platforms (iOS, PWA) to expand the market.

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