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APPLICATION OF DESIGN THINKING METHOD TO THE INNOVATION BUSINESS DESIGN PROCESS OF AUTOMATIC AQUATIC PET FEEDER WITH IOT

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Abstract: This study aims to apply the design thinking method to the process of designing an innovative Automatic Aquatic Pet Feeder with IoT business. This study focuses on discussing design thinking with four stages, namely empathize, define, ideate, and prototype. At the define stage there is a Business Model Canvas which has nine elements, starting from customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure which aims to provide a simpler business model representation. This study uses a qualitative descriptive research method. Collecting data in this study using questionnaires and interviews with a total of 97 respondents. The results of this study are that fish keepers are very interested in Automatic Aquatic Pet Feeder with IoT products and will facilitate decision-making both in terms of business innovation to the design of the product.

Keywords: Design Thinking, Innovation Business, Prototype

Abstrak: *Penelitian ini bertujuan untuk menerapkan metode design thinking pada proses perancangan bisnis inovasi Automatic Aquatic Pet Feeder with IoT. Penelitian ini fokus membahas design thinking dengan empat tahapan, yaitu empathize, define, ideate, dan prototype. Pada tahapan define terdapat Business Model Canvas yang memiliki sembilan elemen, mulai dari customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnership, dan cost structure yang bertujuan untuk memberikan representasi model bisnis yang lebih sederhana. Penelitian ini menggunakan metode penelitian deskriptif kualitatif. Pengumpulan data pada penelitian ini menggunakan kuesioner dan wawancara dengan jumlah responden 97 orang. Hasil dari penelitian ini adalah pemelihara ikan sangat tertarik dengan produk Automatic Aquatic Pet Feeder with IoT dan akan memudahkan pembuatan keputusan baik dari segi inovasi bisnis sampai ke perancangan desain dari produk tersebut.*

Kata Kunci: *Bisnis Inovasi*, Design Thinking, Prototype

INTRODUCTION

Indonesia is one of the countries that has a very strong culture in the field of fish farming, this is reinforced because Indonesia is a water country (Himawan & Yanu F, 2018). Keeping fish is one of the hobbies that has been in great demand by the community since then and even now. The sense of satisfaction and love of the keepers and the easier way of maintenance and care make most people want to participate in keeping fish (Hayatunnufus & Alita, 2020). However, because of this convenience, many people sometimes forget or ignore giving food on time and according to portions, because they also have other jobs that sometimes like to take up their time.

Pet fish can be kept alive and fish keepers can have peace of mind when they have to leave their fish behind due to busy activities. feel at ease when they have to leave their fish due to busy activities, then an innovative tool to automatically feed fish should be created. The development carried out on fish feeding can be with IoT (Internet of Things). IoT is a communication technology that allows for the existence of an automatic control, communicate, cooperate with various kinds of devices - hardware, communicate data through the internet network (IoT) (Nurmaleni & Yuhandri, 2020). This control capability is what is needed by fish keepers and farmers in caring for fish. In caring for fish, from the above problems, an innovation can be created Automatic Aquatic Pet Feeder with IoT which is expected to be useful for fish keepers.

Automatic Aquatic Pet Feeder with IoT is a product that feeds fish automatically by utilizing IoT as a tool, this product has many uses, starting from helping fish keepers in the aquarium remotely, this product can be used so that keepers can feed and monitor the state of pet fish without having to interact directly with the environment of the aquarium. The innovation in this product is of course its technology. Important features of this product are the ability to feed fish remotely, the ability to allow wireless access, and the product that can provide notifications every time an activity is performed. The problem to be discussed in this research is about the application of the design thinking method to the business design process of the Automatic Aquatic Pet Feeder with IoT innovation which aims to make it easier for fish keepers to reduce their difficulties in keeping fish, especially in feeding fish regularly without having to worry.

Creating an innovation needs to create a Business Model Canvas (BMC) by using the design thinking stages on the Automatic Aquatic Pet Feeder with IoT. BMC was chosen to solve the problem in this study because it provides a simpler representation of the business model, clearly and simply visualizing the nine blocks of business aspects. In addition, BMC shows interconnectedness and is easy to understand the evaluation process and helps to more easily identify Customer Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, and Cost Structure for evaluation steps to improve the business performance of the Automatic Aquatic Pet Feeder with IoT. The design thinking approach is very suitable for the Automatic Aquatic Pet Feeder with IoT Innovation because this approach can see the needs that users want for the innovation product.

Design thinking considers user needs and then combines them with technology that suits the innovation products needed, so that it becomes a good business product because it can

provide a feasibility (Saputra & Kania, 2022). The application of design thinking is of course very useful in defining the problems created with consumers, then being able to create many ideas by brainstorming, and using the prototype method, problems that occur start to become clear problems and even unknown problems will be easily resolved by using design thinking. From this statement, it can be concluded that design thinking can be used as a relevant tool in building a business model innovation. The purpose of this research is to find out the business design of the Automatic Aquatic Pet Feeder with IoT innovation according to the needs of raising aquatic animals and to find out the application of the design thinking method in the process of designing the Automatic Aquatic Pet Feeder with IoT innovation business. Based on the description above, this study will discuss further about design thinking with the title "Application of Design Thinking Methods to the Innovation Business Design Process of Automatic Aquatic Pet Feeder with IoT".

LITERATURE REVIEW

Design Thinking

Design thinking is an indispensable concept in the present or future because design thinking is essential with humans as the center of the innovation process that emphasizes observation, collaboration, fast learning, visualization of ideas, rapid concept prototyping, and business analysis, which has a major influence on innovation and strategy in a business (Aman et al., 2021).

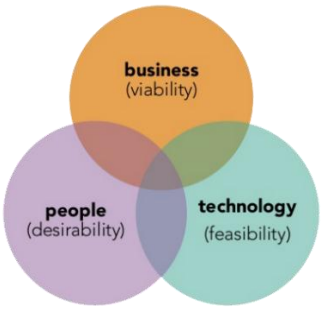

Figure 1. Elements of Design Thinking

Figure 1. shows that design thinking has three elements that are important for consideration in creating an idea that is needed. Consideration in design thinking is to consider the desirability of people, namely the needs required by users (users) then combined with the appropriate technological capabilities (feasibility of technology), in order to become a product that is in accordance with what is needed or expected (viability of business) and of course provides feasibility and effective solutions in a problem (Madanih et al., 2019) in (Kelley & Brown, 2018).

Design thinking can be defined as a human-centered approach to innovation taken from a design tool to integrate the needs of many people, technology, and various requirements for the success of a business (Kelley & Brown, 2018). Design thinking has 5 (five) stages, namely Empathize, Define, Ideate, Prototype, and Test. In this study only uses 4 (four) stages, where the Test stage is not carried out because the Automatic Aquatic Pet Feeder with IoT product is still in prototype form.

Figure 2. The Stages of Design Thinking

1. Empathize

   This stage is useful for knowing how the target persona is by paying attention to various aspects, such as aspects of the needs, problems, emotions, and situations that the target persona is feeling. Empathize in theory is to put yourself as the target of the persona in order to feel or empathize to get deeper into the problems that are happening. at this stage you can use the empathy map.
2. Define

   This stage means collecting the needs that are being needed or wanted by the target persona by describing the concept or using the view from the persona's side in answering and overcoming the problems experienced by the persona. In this process, the classification of problems, needs and desires is carried out after the empathize stage is carried out.
3. Ideate

   Ideate is the process of describing big ideas that are carried out by expanding the problem space in order to produce an alternative solution with reference to various aspects of the problems that occur and are associated with the needs and desires of the target persona. In general, this stage also determines the creative way to get new ideas that can later be developed.
4. Prototype

   In this process, a flow and a design of a general product description is made which will be used to test ideas for the best solution. Prototype in Indonesian can be interpreted as a prototype, which is an initial form or standard size of a model. This process or step is carried out to provide an overview for the persona about the ideas that have been generated.
5. Test

   This process is useful for collecting various user feedback from the design that has been done in the previous stage.

Business Model Canvas

Alexander Osterwalder and Yven Pignuer invented the Business Model Canvas for the first time. The definition of Business Model Canvas is a business model that provides a comprehensive picture of an organization in creating, capturing, and delivering value (Osterwalder & Pigneur, 2010). The Business Model Canvas has 9 building blocks.

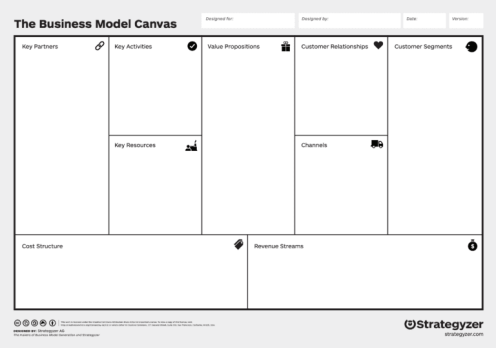

Figure 3. The Nine Elements of Business Model Canvas

The following is an explanation of the 9 elements (Building Blocks) of the Business Model Canvas:

1. Customer Segments, is an activity in determining consumers who are the target market of the business being developed. Consumers are grouped by the characteristics possessed by these customers.
2. Value Proposition, is identifying the value that is able to meet customer needs. This value must have advantages and even have distinctive characteristics in order to differentiate it from the value that competitors offer.
3. Channels, a way to distribute value to customers, about how the value offered can be received and can be felt well by customers.
4. Customer Relationship, is an emotional bond that has been planned by the company in attracting customer segments to buy the company's products, by providing assistance or being able to utilize a community so that the product can be felt by customers.
5. Cost Structure, is the cycle of costs incurred during the operation of the activity.
6. Revenue Streams, is the way the company/pathway in obtaining funds/money from each Customer Segment (Herlina, 2022).
7. Key Activities, are the main activities that can be value-added and profitable.
8. Key Partnership, an operational way or process to reduce company risk and typically builds buyer and supplier relationships or describes a network of suppliers and partners.
9. Key Resources, the resources needed are in order to provide added value to customers, also consider them as company assets to support the business. what resources need to be determined as the business model should be. Key resources are a description of the most important determining assets for a company to successfully operate a business model (Yuliani et al., 2022).

RESEARCH METHODOLOGY

Types of Research

This research uses descriptive qualitative research methods to provide an overview of business model innovation in research subjects (design thinking). Qualitative research has a descriptive nature and tends to use analysis. In this research, the process and meaning are more emphasized by utilizing the theoretical basis as a guide so that the research focus is in accordance with the facts in the field (Ramdhan, 2021).

Data Collection Methods

The data collection method in this study was carried out by distributing questionnaires online with the help of google form in order to obtain primary data. The population in this study are people who keep fish. The technique used in this study is to use the Cochran formula sample. Calculation of sample size can be determined using the Cochran formula because the population is unknown. According to (Sugiyono, 2019) the calculation of the sample size with the Cochran formula for unknown populations is as follows:

$$n = \frac{z^2\, pq}{e^2}$$

$$n = \frac{(1{,}96)^2(0{,}5)(0{,}5)}{0{,}1^2}$$

$$n = \frac{(3{,}8416)(0{,}25)}{0{,}01}$$

$$n = \frac{(0{,}9604)}{0{,}01}$$

$$n = 96{,}04$$

Description:
n = Number of samples required
z = Price in the normal curve for a 5% deviation, with a value of 1.96
p = 50% chance of being correct = 0.5
q = 50% chance of being wrong = 0.5
e = 10% margin of error

Based on the calculation results using the Cochran formula above, the sample size in this study obtained 96.04 samples which will be rounded up to 97 samples to serve as respondents in this study. This questionnaire utilizes the features found in the google application, namely google form. The list of questions asked relates to the interest of fish keepers with Automatic Aquatic Pet Feeder with IoT products. The respondents in this study are considered appropriate because the population of this questionnaire is respondents who keep fish so that respondents know more about what they complain about, need, and are interested in keeping fish. The results given from the questions that have been set will be the basis for conducting the next stage of research, namely on the Empathy Map and Define. The following is a list of questions and objectives.

Table 1. Questionnaire Questions and Objectives

No.	Questionnaire Questions	Purpose of the Questionnaire
1.	Do you love fish, especially ornamental fish?	To determine the level of respondents' preference for ornamental fish
2.	How long have you been keeping fish?	To find out the comparison of how long respondents keep fish
3.	Do you ever forget to feed your pet fish because you're busy?	To find out if respondents often forget to feed pet fish
4.	Do you know about automatic fish feeding products?	To find out the respondents' knowledge about automatic fish feeding

5.	Can the design of Automatic Aquatic Pet Feeder with IoT help you leave your pet at home?	To find out if the automatic fish feeder can help respondents when they have to leave their pet fish.
6.	Can this Automatic Aquatic Pet Feeder with IoT reduce the burden on your mind regarding the maintenance of fish animals?	To find out if this product can reduce the burden on the mind of fish rearing
7.	Will you be using this Automatic Aquatic Pet Feeder with IoT in activities that keep you busy watching your fish?	To find out whether this product will be used by respondents
8.	What is your price expectation for this Automatic Aquatic Pet Feeder with IoT?	To find out the expected price of respondents for Automatic Aquatic Pet Feeder products
9.	Are you interested in the Automatic Aquatic Pet Feeder with IoT?	To find out respondents' interest in products

The next data collection technique is to use the interview method to confirm the suitability of respondents' answers with facts in the field. The method used was to ask several questions directly to the source regarding their activities. The source in question is an aquarium fish keeper who likes fish and wants this product.

RESULT AND DISCUSSION

The research results are organized based on only 4 stages in the design thinking method, which are as follows:

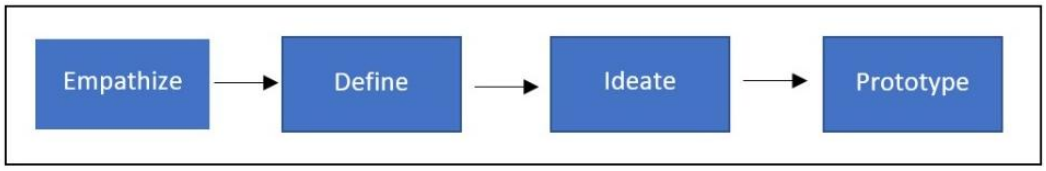

Figure 4. The Stages of Design Thinking

Empathize

Target Markets

In the innovation business design process, the determination of the target market is carried out at an early stage in order to become a reference in validating the Automatic Aquatic Pet Feeder with IoT business idea. The main target or main target market that will use our product is ornamental fish keepers from various layers, from the middle to the upper class. By using this product, the maintenance burden of feeding their aquatic pets will be eliminated and overcome.

Data Source

In this process, an information data collection is carried out, the source of information used is primary data. The use of primary data, namely the results of an online questionnaire by utilizing the google form feature shared through social media and direct interviews with aquarium fish keepers. The purpose of doing this is to find out the interests, needs and desires

of potential users. The questions given are questions that lead to the behavior of potential users of the automatic fish feeder innovation product. The following are the results of the questions that have been filled in by 97 respondents.

Question 1:

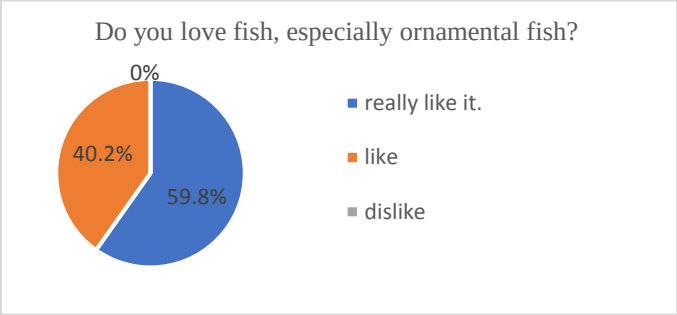

Figure 5. Respondent Results Question 1

The results obtained in Figure 5 above are that out of 97 respondents who filled in as many as 59.8% or 58 respondents liked fish, especially ornamental fish and as many as 40.2% of respondents or around 39 respondents answered that they liked fish, especially ornamental fish, no respondents answered that they did not like it. Thus, it can be interpreted that most people like to keep fish.

Question 2:

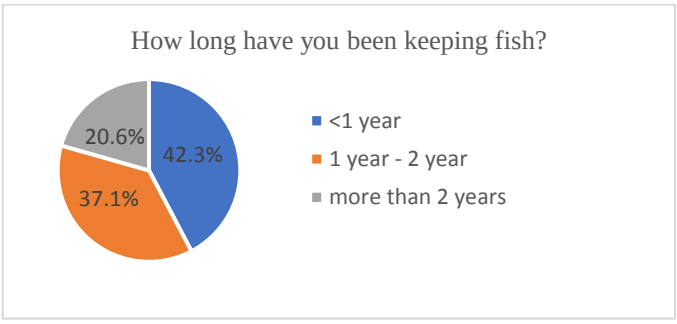

Figure 6. Respondent Results Question 2

The results of this question are very diverse, namely, 42.3% or 41 respondents keep fish for less than 1 year, 37.1% or 36 respondents keep fish for 1 to 2 years, then the remaining 20.6% or 20 respondents have kept fish for more than 2 years. This means that most fish keepers have been keeping fish for a long period of time or above 1 year.

Question 3:

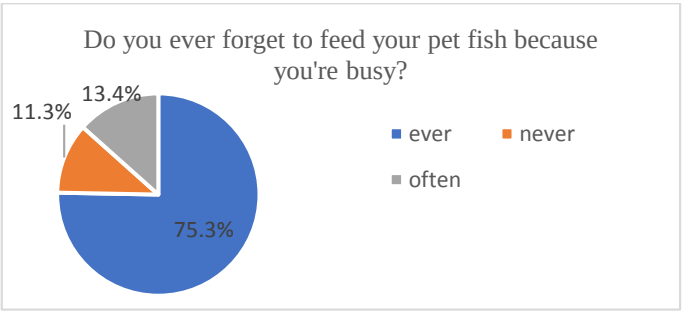

Figure 7. Respondent Results Question 3

The results of this questionnaire question were dominated by 75.3% or 73 out of 97 respondents who had forgotten to feed pet fish due to the respondents' busy schedules. 13.4% or 13 respondents answered that they often forgot and the remaining 11.3% or 11 respondents

never forgot to feed pet fish. This means that only a few respondents never forget to feed the fish and the rest have forgotten.

Question 4:

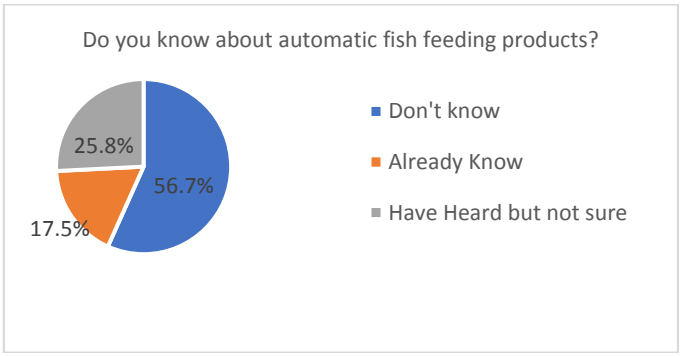

Figure 8. Respondent Results Question 4

The results of the questions in the next questionnaire were that 56.7% or 55 people did not know about the automatic fish feeder product, 25.8% or 25 respondents had heard of the product but were still not sure, and the remaining 17.5% or 17 respondents already knew about the automatic fish feeder product. This means that most respondents do not know about the Automatic Aquatic Pet Feeder with IoT product.

Question 5:

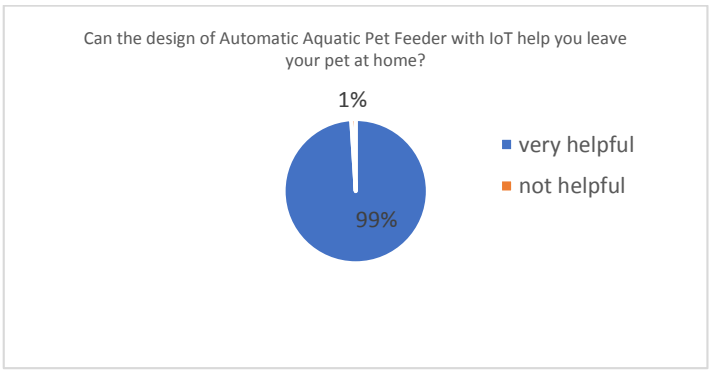

Figure 9. Respondent Results Question 5

The results of the answers were dominated by 99% or 96 respondents who felt that the design of the Automatic Aquatic Pet Feeder with IoT could help respondents when required to leave pets at home.

Question 6:

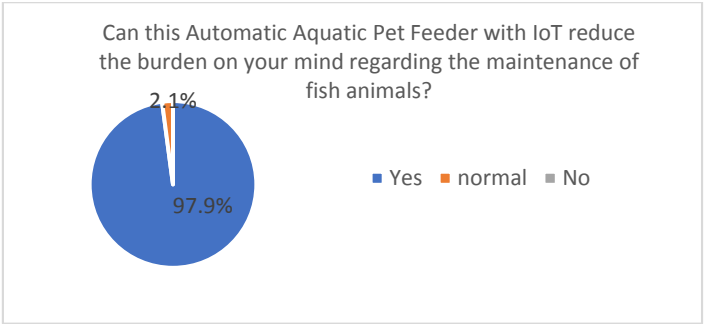

Figure 10. Respondent Results Question 6

The results of the questionnaire on question 6 were dominated by 97.9% or 95 respondents who felt that the Automatic Aquatic Pet Feeder with IoT could reduce the burden on respondents' minds regarding the maintenance of fish animals.

Question 7:

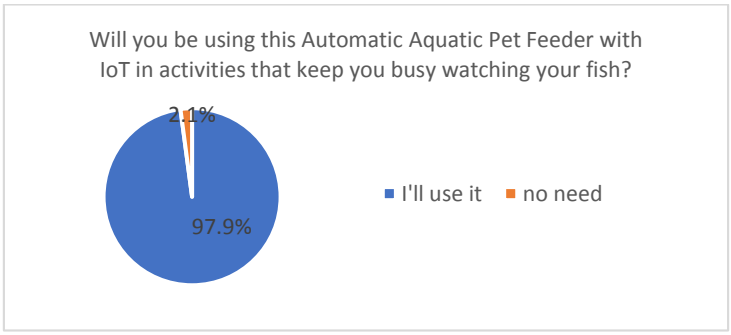

Figure 11. Respondent Results Question 7

The results of the questionnaire on question 7 are dominated by 97.9% or 95 respondents will use the Automatic Aquatic Pet Feeder with IoT product in activities that keep respondents busy to pay attention to pet fish. Thus it can be interpreted that respondents need an Automatic Aquatic Pet Feeder with IoT to feed fish when they are not at home (busy working).

Question 8:

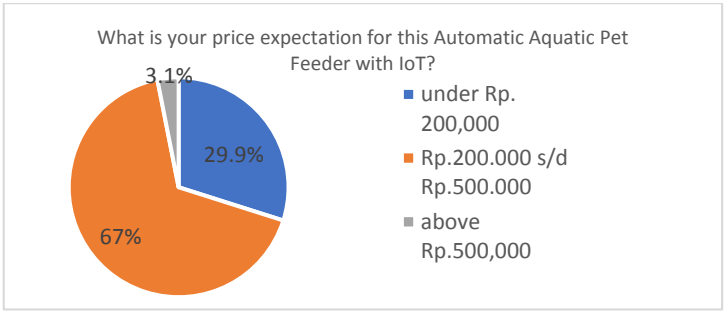

Figure 12. Respondent Results Question 8

Respondents in this question predominantly gave price expectations of Rp. 200,000 to Rp. 500,000, and the rest expected prices below Rp. 200,000.

Question 9:

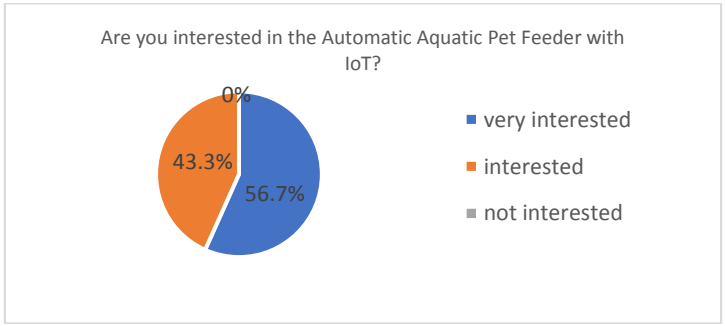

Figure 13. Respondent Results Question 9

A total of 56.6% or 55 respondents were very interested in the Automatic Aquatic Pet Feeder with IoT product. Then, 43.3% or 42 respondents were interested in the product. This means that all respondents are interested in the Automatic Aquatic Pet Feeder with IoT product. Based on the results of interviews conducted with fish keepers, it is known that fish keepers have several obstacles in feeding fish, including when the keeper is required to leave the house

because of work that cannot be left behind and does not have time to feed the fish in a timely manner. This causes fish keepers to worry more often. Fish keepers are very interested and hope that the existence of an innovative product for automatic fish feeders or Automatic Aquatic Pet Feeder with IoT can reduce worries when the keeper has to be away from his pet fish.

Empathy Map

In the design thinking method, the next step at the Empathize stage is to create an Empathy Map. Empathy map has six components such as says, does, thinks, feels, pain, and gain. In addition, empathy maps can be used as a tool in the interview process and present a picture of consumer behavior and characteristics in developing business models (Cairns et al., 2021). The following is a form of empathy map from the Automatic Aquatic Pet Feeder with IoT innovation business.

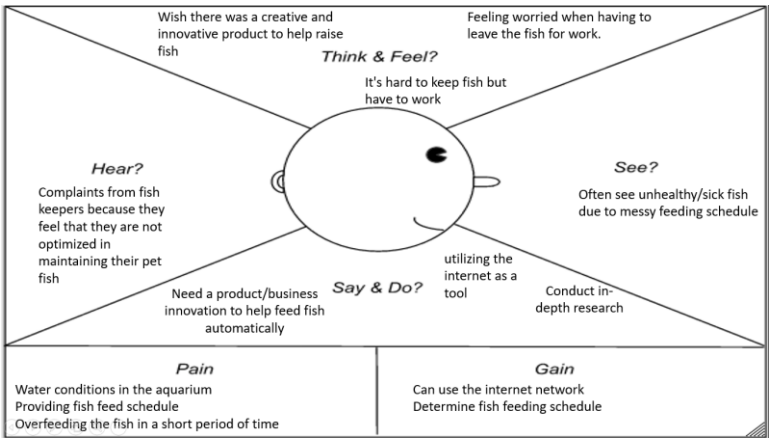

Figure 14. Empathy Map Automatic Aquatic Pet Feeder with IoT

1) Think & Feel

   In this component contains what the user thinks and about what the user feels when the fishkeeping activity takes place or when starting to raise fish, based on the results of the questionnaires and interviews that have been conducted, the results obtained are the difficulties of fish keepers when they are busy working and their need for innovative products that can help to maintain fish and fish keepers feel worried when they have to leave pet fish because of important business or because of work.

2) See

   This component contains what the user sees. Based on the results of questionnaires and interviews, users often see unhealthy / sick fish due to messy feeding schedules.

3) Say & Do

   This component contains what the user says and will do. Based on the results of questionnaires and interviews, fish keepers or prospective users need an innovative product/business to help feed fish automatically and prospective users or fish keepers do in-depth research on an innovative product and utilize the internet as a tool.

4) Hear

This component contains what is heard by the user. Based on the results of questionnaires and interviews are complaints from fish keepers because they feel that they are not optimal in maintaining pet fish.

5) Pain

This component contains the discomfort that is being felt by the user. Based on the results of questionnaires and interviews, worry about the condition of the water in the aquarium, giving fish feed schedules, feeding fish excessively in a short period of time.

6) Gain

This component contains what benefits the user gets. Based on the results of questionnaires and interviews, fish keepers and prospective users can use the internet network and can set or determine fish feeding schedules.

Define

After the Empathize stage is complete, the next step is to collect the information that will be needed and then analyze the information that has been obtained. This define stage is the stage to analyze and identify the data that has been obtained at the empathy stage. The process of collecting information at the empathize stage is carried out by distributing questionnaires online using the google form feature.

The questionnaire results that potential users as the target market of the Automatic Aquatic Pet Feeder wit IoT business are very interested in the product. Respondents find it difficult to feed fish because they are busy and often forget to feed their pet fish. Another problem found is that many respondents are not aware of the latest technology related to automatic fish feeding, and respondents' concerns with the time they have with the schedule of feeding fish that they have to do regularly. Respondents really hope that the Automatic Aquatic Pet Feeder with IoT business innovation can help them continue their favorite activity, namely keeping fish without having to worry or interfere with their daily activities.

The next step after analysis is to identify the initial problem in the process of designing an innovation business for Automatic Aquatic Pet Feeder with IoT. The following is a statement of the problems that have been found:

1. Initial concept of the automatic fish feeder product
2. Ensure the database can store data, such as the feeding schedule of pet fish.
3. Ensuring the hardware of the product works properly according to the input entered by the user.
4. Availability of internet access so that users can monitor pets remotely.

Business Model Canvas (BMC)

After determining the problem statement at the define stage, the next step is to prepare the Business Model Canvas to focus on aspects that are easy to understand for development and validation reference.

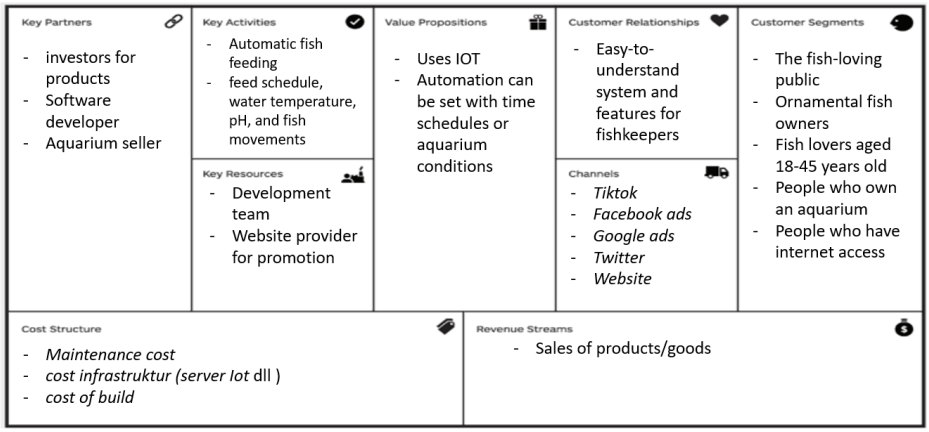

Figure 15. Business Model Canvas Automatic Aquatic Pet Feeder with IoT

1. Customer Segments, in the Automatic Aquatic Pet Feeder with IoT innovation business are fish lovers, ornamental fish owners, fish lovers aged 18-45 years, people who have aquariums, people who have internet access.
2. Value Proposition, in the Automatic Aquatic Pet Feeder with IoT innovation business is using IOT, automation can be set with a time schedule or aquarium conditions.
3. Channels, in this innovation business is to utilize the TikTok application, Facebook ads, Google ads, Twitter, and the website as a place to distribute innovation business products.
4. Customer Relationship, the Automatic Aquatic Pet Feeder with IoT innovation business uses systems and features that are easily understood by potential users or fish keepers.
5. Cost Structure, the costs required in this innovation business are maintenance costs, infrastructure costs (IoT servers etc.), and cost of build.
6. Revenue Streams, in this business is the result of sales of products/goods.
7. Key Activities, activities carried out are feeding the fish automatically, providing a meal schedule, temperature, water pH, and fish movements.
8. Key Partnership, this innovation business cooperates with investors for products, software developers, aquarium sellers.
9. Key Resources, the main resources in this innovation business are the development team and website providers for promotion.

Ideate

After doing the next stage of define is exploring ideas based on the stages that have been done before. Ideate in design thinking is a stage in developing ideas. In this process, brainstorming is very important to do, because it can bring up many creative and innovative ideas that are possible to become solutions to the problems raised. All ideas found have a very important and useful value.

After brainstorming, the initial concept of an automatic fish feeder product is an object in which there is a fish feed storage area, then the fish feed will be given to the fish according to the schedule and commands given by the user or fish keeper, via remote access or by using the internet (Internet of Things). The idea that has been obtained is to create a system that involves two parties, namely the user (user) and the product. The user will do the setup and settings, and receive reports. On the other hand, the product will feed and calculate the time according to the settings given and provide a report after feeding. The next problem is to ensure that the

hardware of the product works properly according to the input entered by the user, the idea is to create an activity diagram that aims to describe the workflow based on the roles owned by the system.

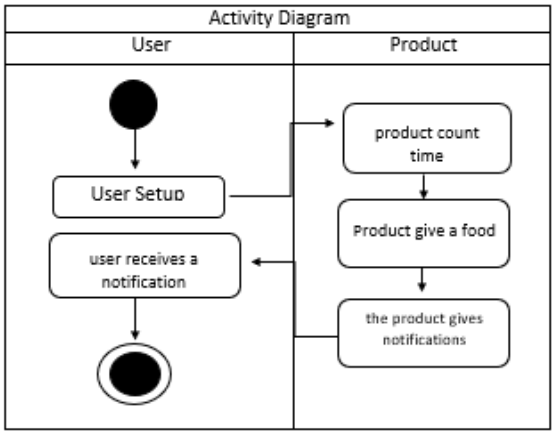

Figure 16. Activity Diagram Automatic Aquatic Pet Feeder with IoT

Prototype

At this stage, the prototype of the Automatic Aquatic Pet Feeder with IoT innovation business is made as a picture or visualization of the results of ideas and concepts that have been designed. This stage also aims to see the needs of potential users or fish keepers and implement these needs into the desired innovation business product. This stage includes how the system design of the automatic fish feeder. The system used in this product is the communication between the user and the product. The stages used in this product will be made in various forms of diagrams.

1. User

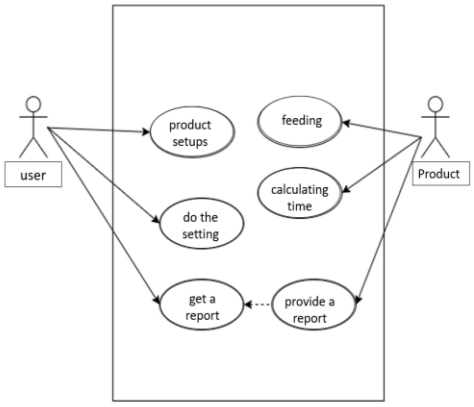

Figure 17. Diagram of User Communication with Product

The system created in this Automatic Aquatic Pet Feeder with IoT product involves two parties, the first party is the user and the second party is the product itself. Figure 17 shows that user setup products and settings and receive or get reports. On the other hand the product will feed, calculate the time according to the settings made by the user then the product will provide a report after the feeding activity is carried out.

2. State

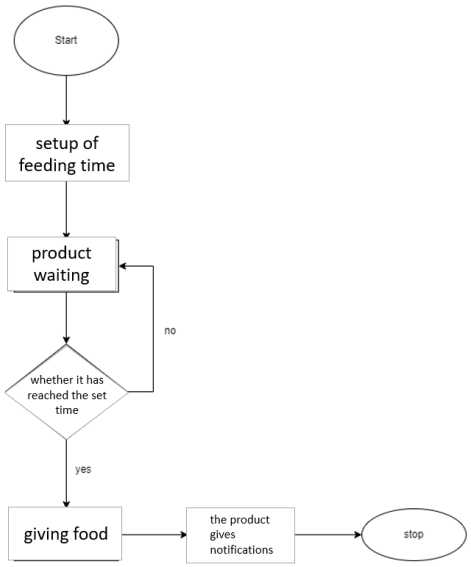

Figure 18. Diagram State

This diagram explains the path or workings and the state of each stage in the automatic fish feeder product. The first state is when the user turns on the product, then the user sets up the product. When the time has reached the specified time, the product will feed and also notify the user, after which the product will stop operating and will start its performance when the product is turned on again by the user.

3. Product Design

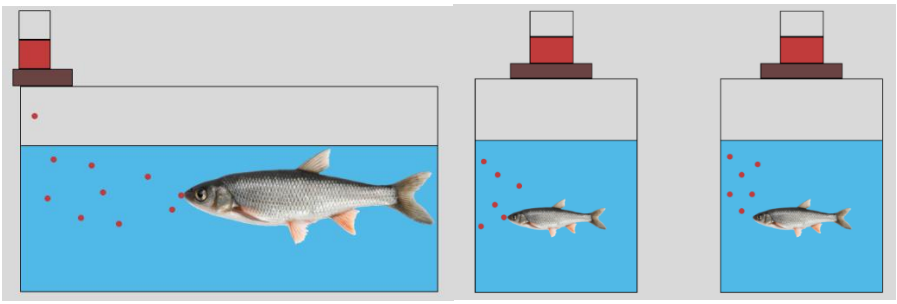

Figure 19. Product Side View and Product Front View

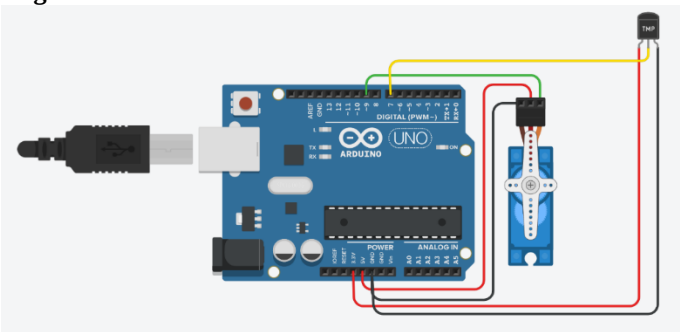

Figure 20. Series of Systems

In Figure 20. is a series of systems that are connected components that cannot stand alone in one scope that can connect and interact with each other so that the purpose of building the product can be achieved.

CONCLUSION

The conclusion obtained is from the application of the design thinking method in the business design process of the Automatic Aquatic Pet Feeder with IoT innovation is that by applying the design thinking method the benefits obtained are to facilitate decision making both in terms of business innovation and even to the design of the product. The design thinking method can also produce solutions to problems that exist in society and can help and reduce the worries of fish keepers who like or hobby of keeping fish but they have difficulty in the feeding schedule because they are not always near the aquarium where their pet fish live. Then, the use of Business Model Canvas also makes it very easy for users to provide a simpler business model representation and focus on aspects that are easy to understand for design reference and validation and can produce a solution to existing problems.

In designing this innovation business, it is far from perfect. Therefore, suggestions for further research are expected to include the last stage of design thinking, namely the test stage of the business model built, expanding the scope of problems and solutions when designing these business innovations.

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