

CHAPTER 2

LITERATURE REVIEW AND THEORETICAL BACKGROUND

2.1. Literature Review

The literature review section will explain the previous research, references used, and current research.

2.1.1. Previous Research

According to Lee & Jirousek (2015), the development and preparation of designed a clothing product can be influenced by many variables. A product design must consider several aspects such as the clothing cut, design characteristics, the ongoing trends, the selling price of products, as well as the composition of the formation of clothing products such as materials, design styles, and some other attributes to obtain a product arrangement that achieves an ideal and attractive product. All the necessary aspects must be obtained to get the centre point of dynamic demands to form a perfect product in the customer's perspective.

According to Savitrie (2008), in designed garment, designers usually use the term "concept" as a synonym for "inspiration" or "idea" as an essential element in a clothing product. This idea or concept is an abstract representation of a designer's final entity of his product. A concept has a vital role in building the vision of the prepared final product (Aspelund, 2010). Designing a clothing product needs seven actions according to Watkins (1988), adapted from Koberg. & Begnall, (1981), they are: accept, analyse, define, ideate, select, implement, and evaluate.

In preparing a clothing product, the attributes that make up the product must be considered optimally. By considering all aspects compiled into a single product, it is necessary to classify what attributes will be the core to achieve the purpose. According to Wianna (2012), seven main attributes to consider in compiling a trend and design-based clothing product are: functional, technical, ergonomic, economical, environmentally friendly, socio-cultural, and visual aesthetics. With the various aspects needed to compile and translate a clothing product, a method that can translate all these aspects into a product composition is needed.

According to Prakosa & Tantowi (2010), there are two common methods to solve a design product problem, there are creative and rational method. Rawlinson (1986), states that the creative method aims to help stimulate creative thought by increasing the production of ideas, mental barriers to creativity, or finding the

solutions. This creative method consists of two parts, namely brainstorming and synectics. Brainstorming aims to stimulate a group of people to generate a large number of ideas quickly. The people involved should be non-homogeneous and familiar with the problem. Meanwhile, Synectics aims to direct the spontaneous thought activities towards explored and transformed design problems. Synectics is a group of activities to build, communicate, and develop ideas to solve design problems creatively. No criticism is allowed in the synectics implementation and a single solution is produced.

The rational method, according to Ginting (2010), emphasizes a systematic approach to design. This method has the same goals as creative methods, such as expanding the search space to obtain potential solutions, seek teamwork and group decision-making. Many designers think that this rational method is an obstacle to creativity. This is a mistaken view of the objective of systematic design, which is intended to improve the quality of the design and the final product. One of the simplest rational methods is the use of a checklist. A checklist can externalize what to do so the designer does not have to keep everything in his head, but the designer is not missed out on any elements either. In the rational method design process, there is a function analysis using a black box and the output is found using the QFD method.

According to Ulrich and Eppinger (2016), in designing a product, generating the customer's requests is needed and it must sound specific to help the company translate the needs easily through the product designed process. There are five steps in identifying the customer needs and they are:

- gathering raw data,
- interpreting the raw data,
- organizing the data into the hierarchy,
- establishing the relative importance of needs,
- reflecting on the results.

In designing a product, identifying customer's needs is crucial to get done because all processes start from the customer's needs as the input.

Nurochim et al. (2016) conducted a study that identified every aspect needed in compiling a product using the Quality Function Deployment method. The questionnaire acts as a medium to collect data used as the primary input in carried out the data processed and analysis process. The purpose of researching the QFD

method is to get the priority number of each prospective customer's request and get specific types of attributes to compose a product. In addition, QFD also matches consumer's demand with the company's ability accordingly.

2.1.2. Current Research

This research is designed to compile t-shirt products with ideal attributes from the wishes and needs of consumers and ongoing trends. The attributes used will refer to the reference of Wianna's work (2012), where there are seven main attributes needed in designing a clothing product. In the product development process, the translation of the attributes will be expanded. Every voice issued by a consumer will be translated using the Quality Function Deployment method. Noruchim et al. (2016) produced waist bag using the Quality Function Deployment method. Later, all the outputs issued in the design process are expected to assist in the preparation of t-shirt products in this study so that an ideal product is formed following the product design objectives, which are trendy and match with customer's needs and wants. With the choice of QFD as a research method, there are several advantages including the new product design that directly satisfies consumers and can give a good product as the output.

However, with the QFD method, problem is solved by foreseeing the context of the problem. In this study, the choice of the QFD method as a problem-solving tool is to get the specific attributes without having a broad alternative through the questionnaire process. From the previous journal reference, the research object from Noruchim has almost similar characteristics and from the same family as the object of this research, namely waist bags and t-shirts, which are classified as fashion products.

2.2. Basic Theory

2.2.1. Fashion

Fashion comes from Latin, which means "to make" or "to do." However, according to Polhemus & Procter (1978), the term fashion is currently being used as a synonym for the terms make-up, style, and clothing.

a. Fashion Business

According to Setiawan & Sesilia (2019), in Indonesia, fashion trends and businesses reflect social and economic status, usually identified as popularity.

Based on the data from CNBC Indonesia (2019), the development of fashion industry was able to contribute around 18.01% or IDR. 116 trillion. Recently, fashion is not only a primary need that protects the body but has become an artistic need to encourage rapid industrial growth due to many enthusiasts in the fashion field.

According to Andriani, (2021), the relatively fast and dynamic change in trends has shifted people's priorities in buying fashion products and has led business actors to adjust business strategies to answer and provide products as the needs of current ongoing fashion trends. Adi Rahardja (2020), the director of Shopee Indonesia's Business Growth, stated that orders for the fashion category have increased by 2.5 times during the pandemic through Shopee's e-commerce. According to (Lidwina, 2020), the data of the most purchased through online shop media in 2020 shows that 81% of the total transactions made are fashion products. The data in Figure 2.1 informs the percentage of purchases according to categories at online shops through the Indonesia Online Shopping Day event in 2020.

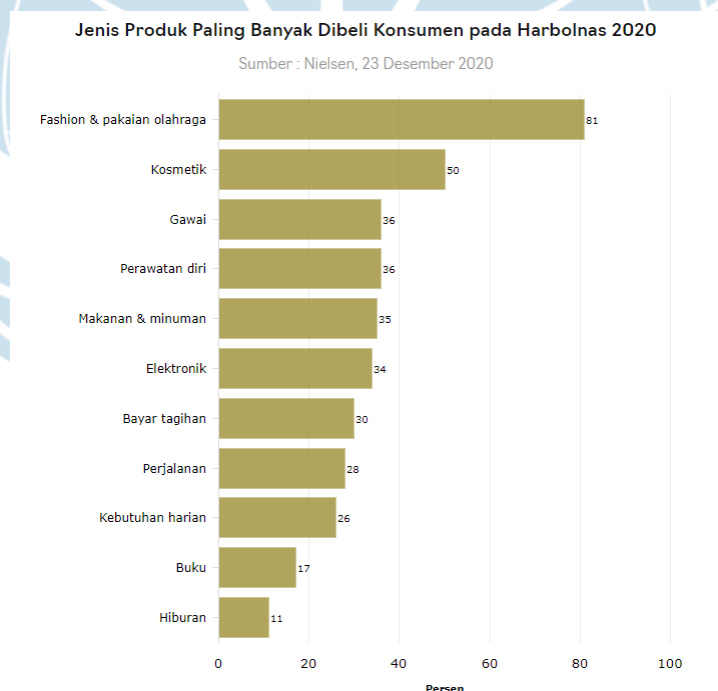


Figure 2. 1. Product Type Purchased Ranking in 2020

Nowadays, the dissemination of information can be received very quickly, so that there are no geographical boundaries to know, see, or receive information from any part of the world, so that changes in trends and turnover of goods in all sectors

will be straightforward to occur, where the influence of trends does not only come from the surrounded environment but from all over the world.

b. Fashion Trend and Lifestyle

According to Saravanan & Nithyaprakash (2015), fashion trends will continue to evolve in a specific cycle, where the success lies in the way people interpret and accept these trends. Today's teenagers have high enthusiasm for fashion developments accompanied by a high tendency to shop, try new things, and experiment. Fashion in Indonesia tends to imitate western styles both in materials and design. Teenagers in Indonesia are generally more comfortable with simple and casual clothes, especially for daily activities such as going to campus or simply hanging out with friends.

According to Hedariningrum & Susilo (2008), lifestyle helps define one's attitudes, values, and social position in modern society. This term connotes individualism, self-expression, and awareness to be stylish in contemporary society. One determined factor in realizing this is how to dress up and wear clothes. According to Ibrahim (2004), it can be explained that consumer society in Indonesia grows together with the history of economic globalization and the transformation of consumer capitalism shown in the risen number of shopping centres such as malls, fashion or fashion industries, and beauty industries. They are accompanied by technological developments such as smartphones that spread advertisements and information about fashion topics and lifestyle every time through social media. The intake of fashion contents that these young people consume every day, wrapped under the guise of "trend," creates an urge to participate since the adolescent tends to be anxious in searching for self-identity and self-image. On the other hand, there are situations where dressing up can fulfil the consumer's desires to express themselves non-verbally, by looking rich and luxurious, elegant, neat, or maybe the opposites from what they wear.

The trend of dressing that changes from time to time will never fade. There will always be fans who want to be creative with how to dress. However, the style and direction of the clothing silhouette rotate. Fashion goes through a cycle from when many people wear it until it becomes outdated. Usually, fast trends like this also comes from an influencer or an idol, that has fans following their styles, and that later interest many other people.

On present days in Indonesia, enthusiasm for dressing up is high. This enthusiasm is due to many influencers scattered on social media sharing their dressing styles and ways of life, thus formed a new trend called “Outfit of the Day,” or commonly shortened to OOTD. This trend can be carried out anywhere if followers can participate by showing off the clothes they wear and the creativity that hangs on their bodies through social media or direct contact in everyday life. In this ongoing trend, people compete to share their “creativity” in dressing up, matching up some pieces of clothing on their bodies to form a character, identity, and recognition for themselves. With this trend, people are challenged to stay updated in wearing trendy clothes that are in demand by the majority. In this case, the spread of a new trend is swift and comprehensive, where the silhouettes of the clothes worn will be similar. This incident creates a rapid and broad trend rotation in a short time so that with this great demand, local MSMEs are expected to be able to meet the demands of consumers interested in participating in the ongoing trends.

According to Saravanan and Nithyaprakash (2015), in society, personal appearance is a ticket to convey nonverbal messages or communication media that explain social status, values, and lifestyle. The success of a clothing trend lies in the social response to the style or activity, which means the number of followers and participants in the trend can be a parameter of the trend's success. A clothing product that is sold in the market is also eyeing this trending phenomenon to compete and participate in providing updated products accepted by the public with a high number of enthusiasts. Therefore, preparing a product that is in line with the ongoing trend will be an auspicious choice.

Setiawan and Sesilia (2019) stated that the type of fashion that has the fastest development is t-shirts because t-shirts change models faster and are purchased the most by public compared to other clothing products.

c. Fashion Customers

The need for a clothing product is based on the needs and desires of the consumers themselves. To understand the level of a person's needs, according to Savitrie (2008), it is more accurate if the method is used to classify the type of consumer. In this process, consumers are separated from clothing products into several classes according to the hierarchy of needs method created by Abraham Maslow, namely:

- i. Physiology : the need to survive
- ii. Safety : the need to fulfil a sense of security
- iii. Belongingness: the need and drive to be considered socially
- iv. Esteem : the need to be free to pursue ego and desires
- v. Self-actualism : the need to prove and show oneself

According to Solomon et al. (2006), in Maslow's pyramid, clothing is categorized as belongingness or social needs. Meanwhile, designer clothing is included in the esteem section. The level of belongingness in Figure 2.2 signifies the human need for clothing as a need to be accepted by others on a certain basis (such as friendship, love or social). From this pyramid, clothing products are more developed into symbols of the wearer to be more accepted. In addition, the third class or belongingness is the need related to feelings of belonging or social needs. Humans need to feel needed to be considered citizens of their social community. These needs can include the desire to be friends, to have a partner and children, to be close to one's family, and the willingness to give and receive love. Clothing products are included in this category because at this time, clothing is an identification of class for someone, especially young people, where there is a sense to follow and participate in ongoing trends to be accepted by certain targeted groups.

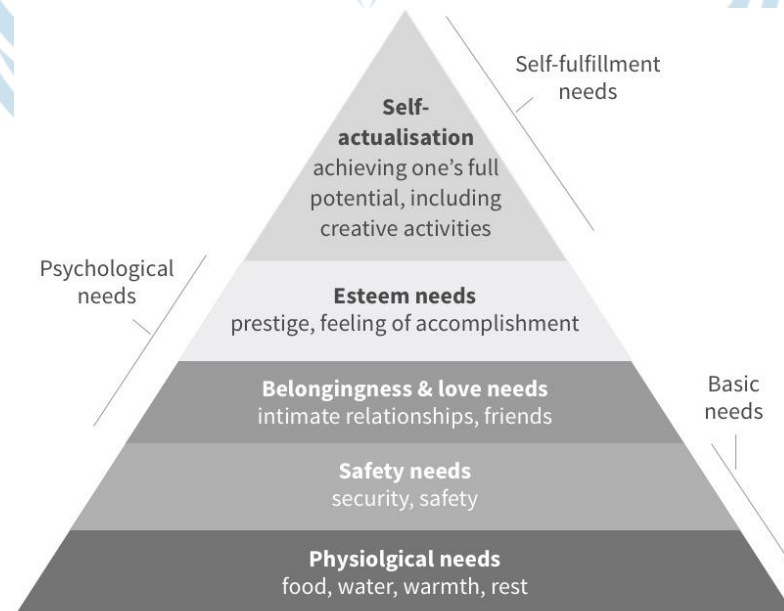


Figure 2. 2. Maslow hierarchy of Needs

The Hierarchy of Needs method has limitations in its application in certain cultures. This hierarchy can be applied to the marketing concept and the application of marketing targets and consumer determination, which is the centre of marketing practice that belongs to Maslow. When one of the needs in this hierarchy is met, the marketed strategy's psychological effectiveness immediately increases with the purchase, but in some cases, it would be different because some consumers have different priority of needs in different consumption situations.

2.2.2. Consumer Behaviour

Clothing product is one of human's three primary needs. According to Kotler (1997), consumer behaviour is a study of how individuals, groups, and organization choose, buy, or use a product or service with the purpose to achieve their wants and needs. According to Engel, Blackwell, & Miniard (1994), consumer behaviour is a direct action in obtaining or consuming a product or service. Consumer behaviour according to Mowen & Minor (2002), is a study of units and decision-making processes involved in reviewing, using, and determining goods or services.

According to Kotler (1997), there are several main factors that influence consumer behaviour, such as cultural factors, social factors, personal factors, and psychological factors. Cultural factors are influenced by culture, sub culture, and social class. Social class is a division in society that consists of individuals who share the same values, interests, and behaviours. Social factors have several points that influence buying decisions, such as reference groups, family, social roles and status. A reference group is a group that has a direct or indirect influence on the attitude or behaviour of the person. The third factor is personal factor, including age, life style, profession, and income. Personal factor gives a big role in consumer's taste in choosing goods or services. Profession and income will lead to the needs and desires of a person in consuming the desired goods or services.

According to Sumamora (2001), economic conditions of the targeted consumers greatly affect the way they choose the product. Psychological factors are divided into several parts, such as motivation, perception, learning, beliefs and convictions. Consumer motivation is a condition in a person's personality that encourages an individual's desire to carry out activities in order to achieve a goal.

2.2.3. Target Market

In a determined the target market, it is necessary to consider several factors that influent consumer behaviour, including psychological, social, cultural, personal, and economic factors. From these five factors, the age range is considered to create the highest consumptive nature of consumers. According to Anggraini & Santhoso (2017), in the age range of 12-24 years (teenagers), the lifestyle is to adapt to the environment and conditions that they find interesting, both in the real world and on social media. It will create a sense of not wanting to lose, which causes high hedonism and leads to a consumptive attitude. Teenage is when individuals will experience physical, attitude, emotional and behavioural changes, one of them is the drive to be consumptive (Sukari, et al., 2013).

2.2.4. Research Data

Mulyadi (2011) states that based on its nature, research data is divided into two parts, namely:

a. Quantitative Data

Quantitative data is presented in numbers or numeric and mathematical operations to process. In quantitative data, there are two sub-datas, namely discrete and continuous. Discrete data is the data obtained from calculation and enumeration results, while continuous data is obtained from measurement results.

b. Qualitative Data

Qualitative data is data in the form of sentences, words, and pictures. Data cannot be retrieved through mathematical operations. Qualitative data can only describe the characteristics or properties of an object of research.

2.2.5. Data Collecting Technique

According to Ulrich and Eppinger (2016), collecting data in the product development process is an effort to obtain information that will later be used as an input for the analysis and design process of the product. In the data collection process, several methods can be used, such as:

a. Interview

The interview is one of data collection techniques carried out face-to-face using questions and answers between the researcher and the resource person.

b. Focus Groups

FGD is a discussion process carried out in a systematic and focused way about a particular issue or problem that is very specific through group discussions.

c. Observation

Observation is a method of collecting data by observing or reviewing carefully and directly at the research location.

d. Questionnaire

The questionnaire is a method of collecting data by giving questions to respondents to answer.

According to the explanation of data collection methods above, the most suitable method to use in this research is the questionnaire distribution method. Questionnaires is a method that is easily distributed through digital media, and questionnaires can also be carried out simultaneously, which will save costs and energy during the data collection process. Kasnodiharjo (1993) stated that questionnaire collects data to obtain an overview and information about a situation. According to Doman et al. (2002), in designing a questionnaire, three elements determine the success of the questionnaire including the length of the questions and questionnaires designed should be ideal, the questions clear and unambiguous, and the questions do not lead to a particular outcome. There are several principles in preparing the questionnaire, including clear, helping the respondent's memory, making respondents willing to answer, avoiding bias, making it easier for respondents to express their opinions, and can filter respondents.

In preparing the questionnaire, Kasnodidarjo (1993) also stated that it is necessary to think about designing and selecting the types of questions to be used. The steps are done to simplify the process of filling out the questionnaire. The types of questions that can be used are free response, direct response, multiple-choice, checklist, ranking question, dichotomous question or yes-or-no question, and the last one is an open-end question.

According to Ulrich and Eppinger (2016), there are five steps that must be taken in the data collection process to be able to identify customer's needs and desires related to the product to be designed and developed, namely: collecting abstract raw data from consumers, analysing and interpreting raw data, compiling a hierarchy of each aspect obtained to get the specifications for each attribute,

determining the relative importance of each attribute, and then reflecting on the results and process.

2.2.6. Sampling Method

According to Taherdoost (2016), there are two general sampling methods. The first is probability sampling, where each item in the population has an equal chance and opportunity to participate as a sample. Several types of fractional methods can be used in the sampling probability method, including simple random sampling, systematic sampling, stratified random sampling, cluster sampling, and multi-stage sampling. The second is non-probability sampling, where this method is generally applied to case study research designs and qualitative research. Data collection using this method focuses on a small group of samples that represents a phenomenon that correlates with the research being carried out. Several types of non-probability sampling method fractions are quota sampling, snowball sampling, convenience sampling, and side judgment.

2.2.7. Likert Scale

Likert scale is a psychometric response scale which is mainly used in questionnaires to obtain respondents' preferences for a statement or series of reports. The technique of determining the scale is one of the crucial steps taken by researchers to measure attitudes to provide value to the choice of questions posed by researchers to respondents. The scale that Rensis Likert discovered in 1930 is used to measure the attitude or choice of the respondent towards a statement. The Likert scale can be used to ask the respondent's assessment of the state of the object of research. The Likert scale defines the respondent's attitude in the form of a statement and has a number in each statement to provide a more precise quantification.

2.2.8. Product Design and Development

According to Rachman & Santoso (2015), design can be defined as the generation of ideas, product development, testing, and manufacturing implementation on a physical object, product, or service. Product design is the key to the success of a product being able to penetrate the market as an essential bargaining marketing, where designing a product means reading market conditions, the market will, and market capabilities. The ability of a product to survive in a market cycle is

determined by how a design can adapt to changes in any form that occurs in the market so that this ability can be a success value for the product itself in the future.

The design of a product has a significant influence on purchasing decisions. In a broad sense, design is an applied art or engineering that integrates with technology. Design is imposed on the form of a plan. In this case, it can be in the form of proposals, drawings, models, or descriptions. So, for the sake of forming the best design of a product from the translation of interests, needs, data from desires, requests, problems to be solved, research, brainstorming, or other methods, design is considered comprehensive as means of interpreting the results of research activities and development before the actual design can be produced and sold.

According to Ulrich & Eppinger (2016), from the point of view of a company, the development of a product can be said to be successful if the resulting product can be sold and make a profit. Five dimensions are specifically used to measure product performance in product development efforts. The first is product quality. The parameter used in measuring product quality is to ensure that the product can meet customer's needs and desires and the product is reliable according to the function and purpose of the product. The second is product cost, where one of the parameters is because the product cost will affect the company's profits. The third is development time, which is how fast the company can complete product development. The time that the company takes, reflects its responsiveness to the existing competition. Fourth is the development cost, which is how much the company spends in developing the product; it is considered because development costs are usually a significant part of the investment needed to achieve profits. The last is development capability, which is an asset that the company can use to develop products more effectively and economically in the future.

Ulrich & Eppinger (2016) stated that there are four types of product development projects. The first is the new product platform. This type of project involves a significant development effort. The new product platform project is a product development process based on a new common platform. The second is derivatives of existing product platforms, which are projects that aim to expand current products to be better known, or in other words, the addition of new features with the same type and product model. The third is incremental improvements of existing products, namely product development efforts that add some existing

product features to keep product lines up-to-date and competitive. The last one is a fundamentally new product which in this project, the efforts made are to build an entirely new product.

According to the statement above about the four types of product development projects, such as new product platforms, derivatives of existing product platforms, incremental improvements to existing products, and fundamentally new products, this research focuses more on the incremental improvements to projects existing products type. The project type is chosen because the third type of project has the most apparent correlation with the research objective: to replace the old product attributes in BENK companies with new attributes and specifications.

2.2.9. Product

a. T-Shirt

A T-shirt is an item of clothing that can be found anywhere. T-shirt itself can be divided into two parts, a functional or aesthetic fashion item, or it may have both aspects at once. According to Putri and Ratih (2020), the Covid-19 pandemic since 2019 has changed everyone's daily habits to stay at home. With this change, the clothes worn also adjust to these circumstances. From this incident, through the survey on changes in dressing habits conducted by Visi Thoroughly in July-August 2020 involving 1,128 respondents, as many as 640 (56.7%) respondents stated that they experienced changes in the way they dress. As many as 466 (72.8%) respondents experienced a change from formal dress to casual and casual clothes. One item of relaxed clothing but can still give a fashionable impression is the t-shirt, where its easy use can be worn and paired with any item, making t-shirts the first choice to still look fashionable. The fashionable element in clothing, especially t-shirts, can be enhanced by the presence of attractive graphic designs, types of cuts, and the selection of colours on the t-shirts. According to Ari and Setiawan (2019), T-shirts are one of the fashion items that are in demand by all circles of economic status. With the rapid flow of developments in the fashion world that makes t-shirts their main item, products are required to have attractiveness as a differentiation from other products, such as unique concepts ranging from design, shape, packaging to features.

b. Product Attribute

Wibowo (1999) stated that "Design is usually related to the ability to produce technological copyrighted works that can truly describe the market demand or, even, affect the market itself."

Wianna (2012) refers to a t-shirt product that the public will consume at large with various dimensions must go through a planning and design process that considers several aspects or attributes, namely:

i. Functional

Functional attributes include problem-solving from the previous product so that the designed product can become feasible and optimally useful.

ii. Technical

The technical attribute is the calculation of every planning activity towards consideration of durability, precision, use of appropriate technology, the material selection including quality, and technical specifications.

iii. Ergonomic

Ergonomic attribute discusses adjustments to anthropometric standards, safety, security, comfort, and aspects related to human physiology, such as applying appropriate sizes, using appropriate textile elements, and applying models that support the activities and needs of the user.

iv. Economic

Economic attributes are planning towards efficiency, effectiveness, and other economic principles so that the product will be ideal under the current situation and conditions.

v. Environment

The environment attribute considers every element that influences the responsible use of resources and the impact of the designed product on the environment.

vi. Social-Culture

Socio-cultural attributes are considerations regarding product design that are suitable for the existing social and cultural conditions and can adapt to the dynamics of environmental life.

vii. Visual Aesthetic

Aesthetic and visual attributes are parts that relate to the visual quality of a product based on its use, function, and purpose in form.

Each aspect that has been described above is an essential constituent element of the product. In this case, the compiled product is a clothing product in the form of

a t-shirt, where every aspect that has been mentioned above is redefined according to the wishes of consumers and the classification of the researcher.

2.2.10. Population and Sample

a. Population

According to Amirullah (2015), the population is the actual data that is the centre of attention within a predetermined scope and time. The population is related to information. If a human provides data, the size or number of the people were the same as the number of humans. The population can also be defined as a collection of groups of people, events, or goods used as objects by researchers to be studied.

b. Sample

A sample is a subgroup of the population where the sample is used from several populations that are used as research targets. The sample is selected in the hope of representing the voice of the entire population. The use of samples aims to shorten research time, save costs, and save energy.

The number of samples can be determined by several formulas, one of which is the Slovin formula. The Slovin formula is a formula to calculate the minimum number of samples if the behaviour of a population is not known with certainty. Slovin first introduced this formula in 1960. Slovin's formula is as follows:

$$n = \frac{N}{1 + N x a^2} \quad (2.1)$$

2.2.11. Validity and Reliability

Hadi (2001) states that validity and reliability test are essential in the data collection process. The purpose of the test is to ensure the validity and reliability of the instrument used as a data collection medium. So with that, the data obtained can be recognized for its credibility.

a. Validity Test

Hadi (2001) states that a validity test is an assessment standard that ensures the level of ability of an instrument to reveal something that is the object of measurement is carried out. An instrument can be declared as valid if it can measure what it wants to measure, expresses what it wants to express, and accurately guess the predicted target. The formula for the validity test follows these steps:

- i. Calculating the factor score derived from the number of item scores

- ii. Calculating the torque correlation using the formula as shown in the formula 2.1.

$$r_{xy} = \frac{N\sum xy - (\sum x) - (\sum y)}{\sqrt{[N\sum X^2]\{N\sum Y^2 - (\sum Y^2)\}}} \quad (2.2)$$

Descriptions:

- r_{xy} : tangent moment correlation
 N : number of respondents
 $\sum X$: total x item score
 $\sum X^2$: sum of squared item scores
 $\sum Y$: sum of y score factor
 $\sum Y^2$: sum of squared factor scores
 $\sum x y$: number of multiplication items and factors

- iii. Calculating the correlation of the total part to the correlation coefficient of the total part with the formula 2.2.

$$r_{pq} = \frac{(SB_y) - (SB_x)}{\sqrt{(SB_x^2) + (SB_y^2) - 2(rs_y)((SB_x)(SB_y))}} \quad (2.3)$$

Descriptions:

- r_{pq} : coefficient of correlation of the total part
 r_{xy} : torque correlation coefficient
 SB_x : standard deviation of item scores
 SB_y : factor score standard deviation

- iv. Test the significance level of the correlation of the whole part or r_{pq} . It is tested with degrees of freedom (db) in $N-2$. The item in the question can be declared as valid if the result of the calculated r_{pq} value is greater than the r_{pq} value obtained from the r test table.
- v. Aborting invalid items, namely items that do not meet the total part correlation test value. The correlation must be positive and have an error probability p with a maximum of 5% correlation.

After completing all these processes, a statement of the validity of each question item will be obtained through the questionnaire.

b. Reliability Test

Hadi (2001) states that the reliability test is a standard for evaluating an instrument according to the stability of the results of observations with the instrument. With the reliability test, the research data results can be tested for reliability and can be used to the next stage if it meets the requirements for data accuracy, data consistency, and stability of the value of the measurement scale results. Reliability test can be measured using the following formula:

$$r_{pq} = \left[\frac{b}{b-1} \right] \times \left[\frac{DB^2 - \sum DBi^2}{DBi} \right] \quad (2.4)$$

Descriptions:

- r_{pq} : reliability coefficient
- b : number of questions
- DB^2 : variance of scores of all questions according to respondents
- DBi : variance of scores for certain questions (question no- i)

The best reliability coefficient is reaching a value of 1.

2.2.12. Descriptive Statistic Analysis

According to Dianna (2020), descriptive statistics is a statistical analysis method that is useful for describing and explaining the general characteristics of the entire sample. This method works by summarizing the results of research data that will be presented in an informative and easy-to-understand form.

According to Ashari & Harum (2017), descriptive statistics describe the data collected from the answers obtained from respondents based on the questions asked. Therefore, from the data collected, conclusions can be drawn that apply to the public.

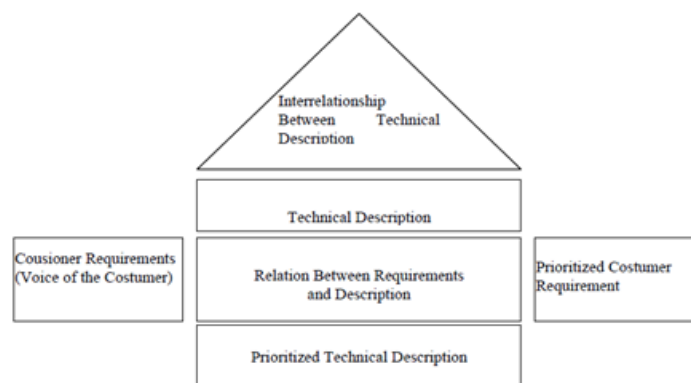
2.2.13. Quality Function Deployment

a. Quality Function Deployment Definition

Cohen (1995) states that Quality Function Deployment (QFD) is a structured method used in the product planning and development process to determine the specifications of customer's needs and wants and evaluate whether a product meets these needs and desires. QFD is a helpful methodology for designing a product or service as it integrates customer requirements with product or service specifications from the company.

b. Designing House of Quality

House of Quality (HOQ) is a method that supports the product identification process into a design specification. The HOQ concept is based on a quality table that shows the structure in designing and forming a cycle in a house-shaped table. The primary input from the preparation of the HOQ is the matrix of consumer needs and wants, or the so-called Voice of Customer. The information on the HOQ is a target value that consists of several parts such as voice of customer, planning matrix, technical requirements, target and limits, correlation matrix, and interrelationship matrix. Each part must be adjusted to function optimally. The HOQ matrix can be seen in Figure 2.3.



Picture Source: Kompasiana.com / Mertikatiga Halibi

Figure 2. 3. House of Quality Matrix Layout

c. Voice of Customer (Customer Preferences)

Cohen (1995) states that Voice of Customer (VoC) is points related to product or service attributes that inform the needs and desires of customers. VOC is a part of market research technique. VoC can be identified by finding the attributes that will be the primary basis for customers' needs and wants for the product or service. According to the customer's point of view, customers will choose the attributes that represent their needs (What) and the attributes that are considered essential and needed in the product.

d. Planning Matrix

Cohen (1995) states that the planning Matrix is part of the preparation of the House of Quality. The Planning Matrix focuses on the elements in the Voice of Customer, which function is to convert the Voice of Customer attributes into a numerical or quantitative form so that it can be an indicator to determine the priority value of these attributes in realizing consumer's wants and needs. The Planning Matrix consists of the VOC importance score, level of customer satisfaction, targets,

improvement ratios, point of sale, raw weights, and normalized raw weights. Some of these elements will later become input for calculating strategic priorities or making decisions in the preparation of the House of Quality matrix.

i. Importance to Customer (Priority)

Importance to Customer is a quantitative assessment used to express how important the Voice of Customer attribute is. The level of importance is obtained from a formal questionnaire filled out by potential customers directly. Then the results of the data obtained will be processed through the HOQ matrix table. The level of importance is expressed on a Likert scale with a range of values from 1 to 5, from very important to very unimportant. The calculation of the level of importance is expressed in the formula 2.4.

$$ITCi = \frac{\sum i (\text{total number of customer important value no} - i)}{(\text{total number of response})} \quad (2.5)$$

ii. Satisfaction Performance (Product Score)

Customer Satisfaction Performance is a quantitative assessment used to express the score of each attribute on the product for each VOC point. The satisfaction rate should be obtained by obtaining direct assessment data from respondents who fill out the questionnaire. However, in this study, the score in this study is obtained from the development team's assessment of each VOC point compared to the product owned. This is done on the grounds that the team do not have access to previous consumers who have already used the product they want to develop. So to save time and costs, the evaluation product score will be assessed by BENK's team.

iii. Target Value

The target value is an indicator used to determine the final target that states the successful fulfilment of Voice of Customer. The development team determines the target value by considering how much the company is performing in meeting the needs and desires of consumers.

iv. Improvement Ratio

Improvement Ratio is a quantitative assessment measure to determine the amount of improvement and development efforts carried out at each VOC point. An increase in Ratio is calculated by comparing the predetermined Target Value with the product score value. The function of the Improvement Ratio is to help the

company to know the value of the amount of effort that must be made in achieving the goal, meaning that the greater the improvement ratio value obtained, the greater the improvement efforts that need to be made. Improvement ratio can be measured using the following formula:

$$IR_i = \frac{(Target\ value\ i)}{(Customer\ Satisfaction\ Performance\ i)} \quad (2.6)$$

v. Sales Point

Determination of sales points aims to assess which attributes need corrective action to increase the competitive ability of the product. Sales points are given to attributes that have high product selling power. The value of the sales point is divided into three weighting criterias according to the ability or selling power, namely:

- No selling power : 1
- Medium selling power : 1, 2
- High selling power : 1, 5

vi. Row Weight

The standard row weight value is determined by the consumer interest level, improvement ratio, and sales points values. Raw weight serves to determine the priority value of each VoC attribute to be improved and developed to meet consumers' needs and desires. The formula that can calculate row weight value is demonstrated in formula 2.7:

$$RW_i = (ITC_i \times IR_i \times SP_i) \quad (2.7)$$

vii. Normalized Raw Weight

Normalized Row Weight is obtained by dividing the Row Weight value of the *i*-th attribute with the total value of the row weight attribute of the voice of customer. Normalized row weight is determined to reduce the number and simplify the calculation of attribute weights in the relationship matrix between the voice of customer attributes and the company's technical needs. The normalized row weight value can be calculated using the following formula:

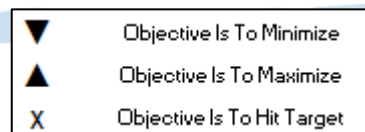
$$NRW_i = \left(\frac{RW_i}{\sum Raw\ Weight} \right) \quad (2.8)$$

e. Voice of Engineer (Technical Requirements)

Cohen (1995) states that the voice of engineer is a set of technical requirements developed to meet consumer's demands from the VoC department. Technical requirements contain a list of technical plans and designs derived from customer requirements relating to what the company must achieve to meet the needs and desires of consumers. The development of technical requirements is expected to make strategic proposals, improvements, and developments from the needs and desires of consumers. This section focuses on how to improve and develop each VoC attribute. The Technical Requirements also contain elements that can be converted into a systematic and quantitative design consisting of Direction of Improvement, Interrelationship Matrix, Difficulty Level, Absolute Importance, and Relative Importance.

i. Direction of Improvement

The direction of Improvement is a technical response that is carried out to adjust the wishes of consumers. The direction of Improvement is stated with a symbol, as shown in Figure 2.4.



▼	Objective Is To Minimize
▲	Objective Is To Maximize
X	Objective Is To Hit Target

Figure 2. 4. Direction of Improvement Symbol

ii. Technical Correlation Matrix

The Technical Correlation Matrix identifies the relationship and interrelationships between the technical requirements (How) that have been designed. Positive and negative values can characterize the relationship between technical requirements. A positive value means that the relationship between technical requirements is interrelated, while a negative value means that the required technical relationship is not interconnected. The company's goal to improve will be better if the link between the technical requirements is more vital or positive. The Technical Correlation Matrix can be represented by the symbols shown in Figure 2.5.

++	Strong Positive Correlation
+	Positive Correlation
-	Negative Correlation
▼	Strong Negative Correlation

Figure 2. 5. Correlation Matrix Symbol

iii. Difficulty Level

The scoring of the difficulty level is a method used to determine how much effort is required and the company's ability to achieve its technical needs. The score on the Difficulty Level refers to the ITC, CSP, and Target Value scales. The difficulty level affects the direction of improvement because the level of difficulty will affect the target time in achieving technical needs. The level of difficulty is given based on the criteria for weighing the difficulty of achieving technical needs with a scale; 0 = very easy, up to 10 = very difficult.

iv. Absolute Importance and Relative Importance

AI & RI is a calculation method to determine priorities for each technical need to be developed. The calculation of Absolute Importance is obtained by multiplying the Importance value and the relationship between each Voice of Customer attribute and Technical Requirement in the Relationship Matrix. At the same time, the value of Relative Interest is obtained from the division between the value of the i-th Absolute Interest and the cumulative total for all values of Absolute Interest. By determining the value of Ai and RI, the company will know which Technical Requirements priority will be developed first. The AI and RI formulas are shown in the following formula:

$$AI_i = ITC_i \times Relation\ Value_i \quad (2.9)$$

$$RI_i = \frac{Absolute\ Importance_i}{\sum Absolute\ Importance} \quad (2.10)$$

f. Interrelationship Matrix

Cohen (1995) states that the interrelationship matrix describes the relationship between customer's needs and wants and the company's technical needs. Interrelationship Matrix elements consist of Voice of Customer (What) and technical needs (How). Numeric values and symbols indicate the use of the Interrelationship Matrix. Determining the relationship between (What) and (How) in

the Interrelationship Matrix serves to calculate quantitative values that are useful as a reference for calculating target priorities to determine the attributes of customer needs and desires that need to be developed. Interrelationship matrix scores can be represented by symbols, as shown in figure 2.6.

⊕	Strong Relationship	9
○	Moderate Relationship	3
▲	Weak Relationship	1

Figure 2. 6. Interrelationship Matrix Symbol

g. Benchmarking (Competitive Assessment)

Benchmarking or competitor comparison is the part that defines the relationship between Voice of Customer and competitors in the market so that the performance of each competitor can be analysed through the graph shown. This process is carried out by giving a score on a scale of 1-5 on each VOC point for each of the selected competitors.

2.2.14. Economic Analysis

According to Nugroho et al. (2018), economic analysis is the last stage in product development before execution. It is necessary to carry out an economic analysis that aims to determine the cost of goods to be developed. Economic analysis is carried out to precisely identify the benefits obtained from a t-shirt product designed to be compared with previous clothing products. Cost of goods sold is the cost that arises from goods produced and sold in business activities. Economic analysis is carried out to get the ideal capital or selling price figure. Economic analysis calculations can be done with the following calculations.

$$\text{Selling Price} = \text{Cost} + \text{Tax} + \text{Profit} \quad (2.12)$$

Descriptions:

- Selling Price : The amount of money that consumers need to get the product
- Cost : The amount of money that the company needs to produce
- Tax : The amount of money that the company spends excluding production costs
- Profit : The amount of profit earned after the product is sold

2.2.15. T-Shirt Prototype Design

According to Setiawan (2021), prototyping is a method in product development by making designs, samples, or models to test the concept or work process of the product. The prototype itself is not, necessarily, the final product that will be circulated later. The primary purpose of prototyping is to develop a model or product design of a final product that can meet user's demands. In the product development process, users can evaluate and provide necessary feedback.

According to Fitinline (2019), there are several stages in designing a T-shirt prototype: pattern sketching, 2D design, mock-up design, material execution, screen printing execution, sewing, inspection, and completion of supporting attributes (packaging, bonuses, etc.).

