

1. Application of Linier Regression Method in Analysis of Farm Business Credit on The Welfare of Farmers in Kedung Lengkong Village, Dlangu Sub-District, Mojokerto District
2. Assessment of Motor Vehicle Repair Shop Service Quality Perception Using the SERVPERF Model and Lean Service
3. Product Quality Control Using Six Sigma Methods and Seven Tools in the PDL Shoes Industry
4. Scheduling The Production Process Using Genetic Algorithm Method In Optimization Improvement PT. Kemasan Ciptatama Sempurna
5. Application of the Single Moving Average, Weighted Moving Average and Exponential Smoothing Methods For Forecasting Demand At Boy Delivery
6. Influence of Safety Management Practices on Safety Performance with Safety Knowledge as Intervening Variable in Safety Representative
7. Business Model Design Based on Blue Ocean Strategy Based for Eco-Friendly Sativa Mouthwash
8. Design For Longevity and Design For X: Concepts, Applications, and Perspectives
9. The Usage of Monte Carlo Simulation to Predict The Sales of Sustainable Batik Products in Small Medium Enterprise
10. Analysis of Marketing Strategy in Increasing Sales Volume in the Onion Cracker Industry (Case Study of UMKM XYZ)



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Application of Linier Regression Method in Analysis of Farm Business Credit on The Welfare of Farmers in Kedung Lengkong Village, Dlangu Sub-District, Mojokerto District

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Abstract— The role of the agricultural sector can be optimized if it is supported by an integrated sustainable system and capital support. In this study the problems to be discussed are 1) Capital is a problem faced by farmers, 2) Many farmers can increase crop yields if they have sufficient capital, and 3) Without sufficient capital, farmers will not be able to increase the productivity of their crops. To overcome the problem of lack of capital, farmers borrow money from both formal and informal financial institutions, the purpose of this study is to determine the effect of the efficiency of agricultural credit distribution on the welfare of farmers in the agricultural sector. Agricultural credit plays a very important role in agricultural development: if production increases, farmers' income will also increase. In the research applying quantitative methods where the number of samples is 100 people. With a population of 187 people are farmers in KedungLengkong Village, Dlangu District, Mojokerto Regency. In the research, the analysis applied is simple regression to determine the effect of credit performance on the welfare of farmers. The results of the hypothesis testing that credit has a positive influence on happiness are worth the regression coefficient of 0.291. Farmers are helped by credit to buy fertilizers, seeds, and others according to agribusiness needs to increase profits, as a source of welfare.

Index Terms—About; Farm Business Credit, Income, Welfare

I. INTRODUCTION

Indonesia's economic structure is an agrarian country that always binds the agricultural sector, and national development (Prasetyo et al., 2021). The agricultural sector is essentially a reciprocal relationship. The main

goal of the country's development is for the national ideals to be achieved, namely the creation of a prosperous and just society, starting with improving the quality of life of the community, but most farmers are productive small farmers. They usually do not only have small agricultural land so that their agricultural industry can only support their daily needs. Indonesia is an agrarian country, where industrial and economic development is based on the agricultural sector which is the best choice due to the abundance of human resources as well as natural resources which has a long agricultural tradition, demands the development of infrastructure, technology, and industries that use agriculture, markets, and sustainable products.

Agrarian economics was born in the 1960s to provide social relations characteristic of dynamic production and reproduction. It also proposes changes in historical and contemporary agricultural formation and development.

One of the key elements in the effort to develop the agricultural sector is agricultural financing. On the other hand, banking interest rates in the agricultural sector are still very low (Adams, 2021). Banks are more inclined toward sectors other than agriculture, one of the reasons is because of the high risk in the agricultural sector and low cash flow (Putri, 2019).

Typically, smallholder farmers use agricultural credit to survive and large farmers use this credit to increase their source of income (Van Dam et al., 2018) assert that noodle farmers' income depends not only on agriculture but also on access to agricultural credit sources. Similarly, (Ngeno, 2018) and (Solano & Rooks, 2018) examined credit accessibility and socioeconomic attributes to improve farm household welfare.

Limited resources, especially capital, encourage farmers to have a loan (Susanto et al., 2022). Informal sources of finance used by farmers are collectors (Pratiwi et al., 2020). The existence of informal sources of credit is

sufficient to help farmers overcome capital shortages. However, informal lenders, i.e. traders, lend not only to make an economic profit but also indirectly force farmers to sell to them their crops, preventing them from assigning their crops to other traders who can buy at a high price (Keumala and Zainuddin, 2018). From this, it can be shown that the provision of capital from formal and informal organizations is an important factor for agricultural viability.

Some previous research results show that the accessibility to the majority of farmers is still very limited to credit sources (Chandio, 2020). Arguably the importance of the ability to provide credit to farmers is not fully supported by the existence of financial resources, especially formal institutions that are specialized for forest products with annual trees, Damanik (2020) reported that in Indragiri Hilir, Riau Province, coconut farmers have Chinese traders as informal financial access who have bought producers' products in the form of copra. To find out how farmers access available credit sources is to thoroughly investigate the various factors that influence farmers' access. In addition, the provision of additional sources of capital in the form of credit can help farmers so that their business can grow and have an impact so that income increases by increasing production so that it can prosper farmers.

From the description above, it shows that there is an attachment to the capital that is needed by farmers, the fulfillment of this capital can be done by borrowing from formal financial institutions whose criteria and prerequisites must be met by farmers. So the researcher took the research title The Effect of Agricultural Credit on Farmer Welfare in Badung Village, Dlangu District, Mojokerto Regency using linear regression. Linear regression was chosen because this method is very suitable to see the relationship between variables (Ray, 2019). This method has been widely applied in previous studies including predicting sales in a company (Ayuni and Fitriana, 2019) and also analyzing populations in poverty (Suhandi, 2018).

II. METHODOLOGY

This research applies quantitative methods, and the type of research is explanatory. In this study, several samples were drawn. The sample itself is part of the quantity and special characteristics of a population. If the researcher

cannot examine the entire population due to the size of the population or because the researcher has limited time, budget, and human resources, then the researcher can utilize a survival sample of the population (Ramadhan, 2020). All farmers in Kedung Lengkong Village, Dlangu District, Mojokerto Regency with a total of 187 respondents are the population in this study. The linearity test aims to determine the relationship between two variables (Ichsan et al., 2021). The normality test is carried out to check or know whether the distribution of population data is normal or not (Purba and Ruslan, 2020). The heteroscedasticity test is carried out to know the deviation of the classical hypothesis of heteroskedasticity, which means there is a difference in the variance of the residuals on all observations in the regression model (Satria et al., 2022). Hypothesis testing is useful for testing whether the initial research conjecture can be accepted (Canonne et al., 2020). The linear regression method was chosen to see the linear relationship between the independent variable and the dependent variable in a study (Dharma et al., 2020).

Figure 1. below is a flowchart of this research methodology.

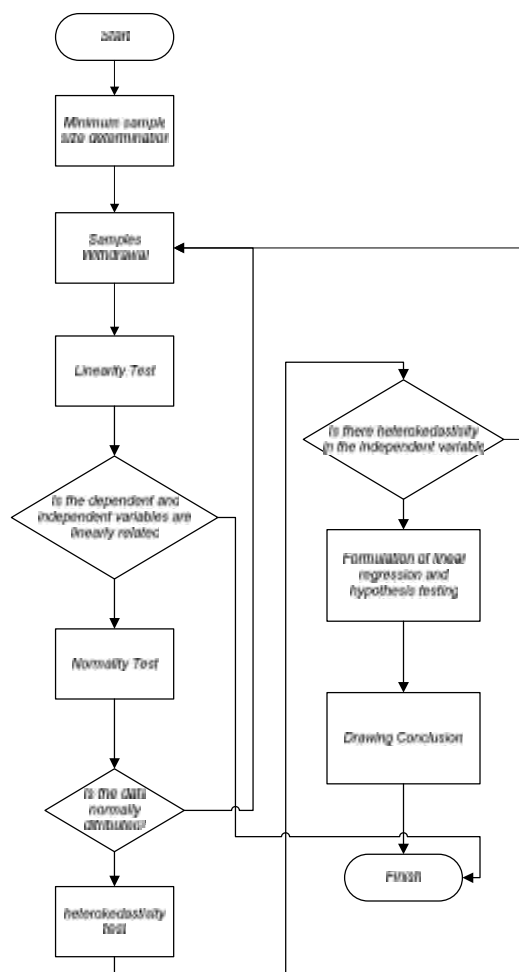


Figure 1. Research Methodology

III. RESULT AND DISCUSSION

The following are the results obtained using a Linear regression method.

A. Minimum sample size determination

$$n = \frac{N}{(1 + (N \cdot e^2))} \quad (1)$$

n= Minimum sample size

N=Population number

e= error

With a 10% error so that:

$$n = 187 / (1 + (187 \times 0,1^2))$$

$$n = 187 / (1 + (187 \times 0,001))$$

$$n = 187 / (1 + 1,87)$$

$$n = 187 / 2,87$$

$$n = 65,15$$

B. Linearity test

Table 1 below is the result of the linearity test.

Table 1
Linearity Test Result

Depend	Equatio	R	Df	F	Sigf	B0	b1
nt	n	Squar					
X	Linear	0,604	53	80,68	0,000	14,0092	2,1329

From the table above, it can be seen that all sig f values are less than 0.05. So the linearity hypothesis can be fulfilled or variable x is linearly related to Y.

C. Normality Test

The guideline for making decisions is through the Kolmogorov-Smirnov test if 0.05 is less than sig. means that the population has a normal distribution and vice versa (Ratnasari and Lestari, 2020).

Table 2
One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
Normal Parameters(a,b)	N	55
	Mean	.0000000
	Std. Deviation	1.1173907
Most Extreme Differences	Absolute	.1171
	Positive	.0741
	Negative	-.1171
Kolmogorov-Smirnov Z		.870
Asymp. Sig. (2-tailed)		.436

The variables have a normal distribution. This can be seen in the significant value which is below 0.05 (0.436).

D. Heterokedastisity test

The heteroskedasticity test result can be seen in Table 3 below.

Table 3
Heterokedastisity Test

Variable	t Value	Sig t	Descript.
Farm bussines credit	0,076	0,583	There is no Heteroskedastisity

In the heteroskedasticity test on the independent variable, the p-value or sig-t result is greater than 0.05. So it can be said that there is no heteroskedasticity.

E. Regression linear formulation and Hypothesis test

Hypothesis calculation using Statistical Product and Service Solution (SPSS) software from calculations with SPSS, simple linear regression data results are presented, the summary of which can be seen in Table 4 below.

Table 4
Hypethesis Test

Variabel	Koef. Regresi (B)	t hitung	Sig. t
Constant	55,017	2,600	0,013
Farm business credit	0,679	2,554	0,014
R Square	0,291		

The linear regression equation of this study is as follows:

$$Y = 55,017 + 0,679X_1$$

From the results using SPSS software, the t-count value is 2.554. For the p-value (sig-t) has a large 0.04, then the p-value (sig-t) is less than 5% (0.04 < 0.05). This means that farm business credit has a significant effect on farmer welfare.

From these results, it is shown that the higher the farm credit, the better the welfare of farmers. The opposite also applies

The coefficient of determination R² has a large 0.291, which means that there is a 29.1% variation in the dependent variable Welfare that can be explained by variations in the independent variable Farm Credit factor. Variables that are not explained in the model affect the remaining 70.9%. So that the research hypothesis that explains "Farm Credit has an influence on improving Farmer Welfare" is accepted.

The Farm Credit Variable (X) has a positive effect on improving the welfare of farmers, which has a regression coefficient of 0.679. From this it is obtained that if the Farm Credit Variable increases by 1 percent, the Farmer's Welfare will increase by 0.679 percent, assuming that the other independent variables are constant. Sig. t or significance value has a large 0.014 which is lower when compared to 0.05. then the influence of the Farm Credit variable on Farmer Welfare is significant.

The constant value is 55017 which means that student learning motivation is 55017 if the learning variable is zero. This can be explained by the fact that farmers' welfare will not be achieved without agricultural credit. The agricultural credit variable (X) has a positive effect on increasing the welfare of farmers, with the regression coefficient having a magnitude of 0.679 this means that if the agricultural credit variable has increased by 1% then the welfare of farmers has also increased by a magnitude of 0.679% assuming the agricultural credit variable increases by 1% Let the other independent variables remain unchanged. The significance value (Sig.T) is 0.014, which is lower than 0.05, so the credit variable has an effect.

IV. CONCLUSION

The conclusion that can be drawn from the research results is that the coefficient of determination R² is 0.291, which means that 29.1% of changes in the dependent variable Welfare can be explained by variations in the independent variable agribusiness credit. Meanwhile, variables that are not explained in the model explain the remaining 70.9%. Therefore, this study's hypothesis that "agricultural credit affects improving farmers' welfare" is accepted.

This study used simple regression analysis with the intention that the impact of credit availability on farmers' welfare can be understood. The results of the hypothesis testing show that credit has a positive influence on happiness, with a regression coefficient of 0.291. Credit has an important role in increasing capital to meet the cost of production inputs so that production from producers can be increased, thus capital is very influential on optimal results, so with additional credit, input use can be increased.

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Assessment of Motor Vehicle Repair Shop Service Quality Perception Using the SERVPERF Model and Lean Service

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Abstract— The benchmark for the success of a business or product is to measure the satisfaction of customers who have used or felt the goods or services. The customer's expectations of the function and emotional happiness factors that arise from the use of goods or services are entirely the responsibility of the producer. So that manufacturers need to focus on what attributes must be presented in a product or service to increase customer satisfaction. The decrease in customer interest in providing vehicle service at an automotive company in Sidoarjo is the problem studied in this study, to analyze the level of customer satisfaction and attributes that are priority improvements as recommendations for the company.

Data generated from customers is processed and analyzed using the Service Performance (SERVPERF) and Lean Service methods. Based on the results of data processing, it can be concluded that the level of customer satisfaction with service quality is 82.3%, and three service attributes are classified as a top priority and two types of critical waste.

Keywords: Customer Satisfaction; Service Performance (SERVPERF); Lean Service Method.

I. INTRODUCTION

Since the onset of the COVID-19 virus pandemic in Indonesia, there have been many businesses that require employees to prioritize company performance. How not, even though it had fallen, various business fields in Indonesia have now bounced back with various kinds of innovations and technological advances to improve company performance (Roh et al., 2022). One of the performance-value factors that can increase the company's profit is the customer satisfaction factor. Company performance and

customer satisfaction are closely related (Suryadi et al., 2021). Customers are the reason why a business continues (Bandi et al., 2022). Customers are individuals or businesses that buy goods or services from other companies (Prohl-Schwenke & Kleinaltenkamp, 2021). Without customers, we will not know where the product or service will be sold. Service is an inseparable bridge between companies and customers and plays an important role in meeting customer ratings (Ruan & Mezei, 2022). The customer has a very important position in the business. Therefore, every business must try to meet customer satisfaction (Woo et al., 2021). This is to the quality of service, if the quality of service is poor, it will automatically reduce the level of customer satisfaction (Salamah et al., 2022). So the quality of service needs to be included in the company's priorities in increasing company profits (Özden & Celik, 2021). Especially in automotive companies.

Vehicles are included in the group of crucial needs for humans (Sun et al., 2021). Whatever the work or activities carried out by humans, vehicles are considered useful support to facilitate their daily activities (Pudāne et al., 2019). Increasing technology makes the emergence of vehicles with various interesting feature innovations higher. This makes the maintenance needed for vehicles a routine that owners should not abandon (Novák et al., 2020). Various kinds of maintenance are provided according to the type and type of vehicle. However, regardless of the type and type of treatment or service offered, the quality of service is an absolute price that must be obtained by customers beyond the high or low price of the selected vehicle service (Belwal & Amireh, 2018).

One of the service providers in Sidoarjo experienced a decreasing trend of customer interest in servicing vehicles. After initial identification, the cause of the declining trend of customer interest is due to errors in inventory

factors and repair mechanisms, loss of timing in performing services, waiting times that are too long, repeated processes that cause unnecessary movements, and poor communication. These mistakes become fatal if they result in a decrease in the level of customer interest. This can cause the image or branding built by the company (Sürücü et al., 2019) to become one of the trusted choices in performing vehicle service, to be tarnished resulting in customers fleeing to other competitors because there is no longer a sense of loyalty due to the image that has been formed (Steinhoff & Zondag, 2021).

This problem is the background for the company to analyze this research, to analyze the company's service performance to customers and the level of customer satisfaction, and what attributes are priorities in making improvements as recommendations for companies based on research data that has been generated. The research method used in this study is the Service Performance (SERVPERF) and Lean service methods. The combination of the two methods is the right step that can be taken because it does not only look at the level of performance or satisfaction from customers but also produces what attributes are the guidelines for making improvements to the workshop work system itself. So that both the Service Performance (SERVPERF) method and the Lean service method will be beneficial in conducting research related to service quality and improvements that can be made by the management. The SERVPERF model is commonly used in measuring customer satisfaction which consists of 5 dimensions, namely Tangibles, Reliability, Responsiveness, Assurance, and Empathy (Johnson & Scott, 2022). Most lean methodologies refer to the manufacturing industry, where there is a real product in it. The main purpose of this method is to achieve a model for Lean Services and ensure its applicability to service activities (Rajab et al., 2022).

II. RESEARCH METHODS

This research was conducted at a vehicle service provider company located in the city of Sidoarjo. Research data were collected by conducting observations, interviews, and distributing questionnaires. The data that has been collected is then tested for validity (validity) and quality (reliability) using the

SPSS program. After obtaining valid and reliable results, data processing will be continued using the Service Performance (SERVPERF) method. The results of the questionnaire that have been valid and reliable are then continued by calculating the average level of importance and performance. The calculation results are entered into the Impotence Performance Analysis (IPA) and Customer Satisfaction Index (CSI) matrices (Aghajanzadeh et al., 2022).

In the lean service method, the first step is to make Big Picture Mapping and Process Activity Mapping to get information about waiting times and processing times for each activity accompanied by the location changes experienced by users and grouping activities for each work process (Steckowych & Smith, 2019). The results of the processing activity mapping show that there are non-value-added activities which are further identified into 7 types of waste which are referred to as 7 wastes and consist of Waiting, Duplication, Unnecessary Movement, Unclear Communication, Error, Incorrect Inventory, Lost Opportunity (Klein et al., 2021). Measurement of 7 waste is done by distributing questionnaires where the questionnaire questions relate to the 7 dimensions of waste that have been determined. After obtaining the questionnaire data regarding the 7 wastes, then the weighting is carried out to produce critical waste where the waste is the waste that has the highest weight and the cause of the waste is searched using root cause analysis to trace the causes and impacts of a problem that occurs (Ito et al., 2022). Root Cause Analysis is carried out to find out the causes of the waste that occurs by using 5 whys.

III. RESULT AND DISCUSSION

The data collection stage was carried out by distributing questionnaires based on service quality factors in five dimensions consisting of Tangibles, Reliability, Responsiveness, Assurance, and Empathy (Tadesse & Bakala, 2021). Tangibles (the physical environment embodied by objects and subjects). Reliability (the service provider's capability to offer precise and trustworthy services). Responsiveness (a firm's readiness to help its customers by a willingness to offer each customer individual service).

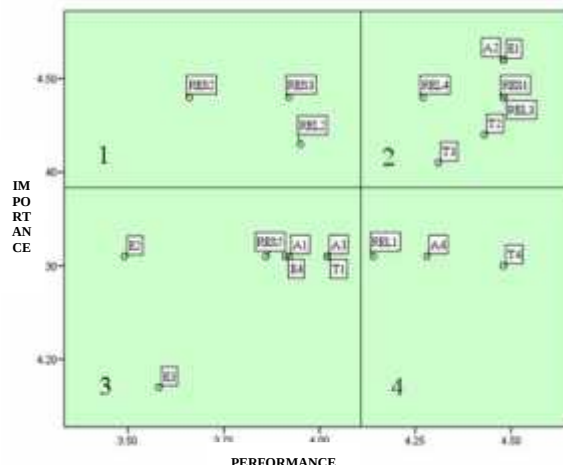


Figure 1. Importance Performance Analysis Based on Mapping SERVPERF processing results



Figure 2. Types of Services and Percentage of Classification

Based on the results of processing the questionnaire data using the Service Performance method, namely data on the level of performance and the level of importance, a calculation is carried out to produce the mean value of the level of performance and level of importance. The next step is to map these values into the interest and performance quadrants, which can be seen in the following figure 1. Based on the quadrant in figure 1, it implies quadrant I (High Interest-High Performance), Quadrant II (High Interest-High Performance), Quadrant III (Low Interest-High Performance), and Quadrant IV (Low Interest-Low Performance). Those belonging to quadrant 1 are the attributes of the employee's ability to explain the damage or problems encountered in the vehicle service repair. The next step is to perform calculations and analyses using the Lean service method related to the 7 wastes. In the Lean Service method in Process Activity Mapping, the activities selected for

analysis are Tune-up and Oil Change services. The results of the analysis obtained are the total time required for the Tune-Up service is 93.8 minutes, while the Oil Change is 18.93 minutes. To get the critical waste that has the most influence on the activity under study, it is done by obtaining information through interviews with the workshop experts, then weighting the waste.

Based on the picture, it can be seen that the waste with the largest percentage is Incorrect Inventory, followed by Lost Opportunity. Furthermore, from the 2 critical wastes, the cause is sought by Root Cause Analysis (RCA). Based on the analysis results with the SERVPERF, several recommendations can be given which are divided into 5 areas of activity. The first field of activity is improvement in the field of HR development. Providing certified training in the form of workshops or in-house training for mechanics. The second area is HR Recruitment. The recommendation is to

tighten the selection process accompanied by a certificate of expertise. The third field of activity is the inventory sector. The recommendation is to check the spare part stock regularly & updating the supply data regularly. The last field of activity is the field of storage, and the recommendation is to provide insight to employees about the grouping of components according to type. Recommendations for improvement in the lean service process are adjusted to the critical waste with the highest value, namely the waste with the highest value, namely the

incorrect inventory waste of 20% with the type of waste consisting of stock checking errors, difficulty in finding spare parts in the storage section, and the unavailability of the type of spare part requested by the company. Then the recommendations for improvement that can be done are the storage arrangement according to the type of spare parts, making code stickers on the storage rack which also contain information about the spare parts, making and updating stock list cards, and making plans for controlling stocks of spare parts.

IV. CONCLUSION

Based on the results, it can be concluded that the percentage level of customer satisfaction with the level of service quality is 82.3% which means that customers are still in the category of

satisfied with the services provided by the company but there is critical waste consisting of Incorrect Inventory of 20% and Lost Opportunity by 19% which requires repairs from the company.

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Product Quality Control Using Six Sigma Methods and Seven Tools in the PDL Shoes Industry

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Abstract— CV Yunanda is one of the companies whose manufacturing process is in the form of shoes and sandals, CV Yunanda has one of PDL's main products in the field of leather footwear. The problem with this company is a production defect. Based on these problems, the purpose of this study is to determine the extent of the defects, determine the underlying causes of defective products, and make recommendations for improvement to reduce the number of defective products. This study uses *seven tools* and *six sigma methods* to identify the key factors that cause defective products and identify corrective actions to be taken based on the underlying factors. The results showed that there were 4 types of product defects, namely 13% *overlapping skin defects* and 11% *flexed skin*, 10% *wrinkled skin*, and 7% *scratched skin*. The proposed solution is to control, inspect and perform maintenance on machines or equipment used in the production process, establish SOPs for each machining area, and improve human resources through training and improvement of the work environment.

Keywords: Defect; Quality; Six Sigma; Seven Tools; Shoes.

I. INTRODUCTION

The competition that occurs brings every actor industry to increase the value the quality of the product produced In addition companies must make products that match consumer desires so which can increase competition between industries manufacturing other. Age is getting progressing and continues to grow every year as well as a company must be able to grow and can face tough competition. Every company must be able to highlight the quality

of products and can compete with the competition which tight [1]. Consumers always hope for a product that received a quality that corresponds with what want and expected. A competition that is strictly this which later will differentiate products from one another, is seen from the aspect of the quality product itself [2] . The number of products equals the variance in price and packaging product that attracts the consumer. Therefore

company must anticipate the competitive market by favoring quality product that is guaranteed and according to the expectations of consumers. Because quality is a key company in getting the trust of consumers [3] .

CV.Yunanda is a company that is engaged in industrial manufacturing and produces leather shoes and sandals which is located CV. Yunanda implementation of production uses system *make to order* with activities produce as many goods as 2000-8000 pairs of shoes every month to achieve a target of the company, the most important part of CV. Yunanda is the Production department Department of production is a part which charge of the managing process production. A quality product contained in CV. Yunanda it is known that there is a variety type defect that less good that affects the quality of the company target company *defect* produced by production includes among others, item damage to product shoe leather such as product scratches, *overlap*, *product bent*, and shoe product wrinkled [4] Product *defects* contained in the production department required efforts to improve product quality to meet product quality in the hands of consumers to consumer satisfaction and in order to fulfill existing production targets [5] .

In activity production required the determination of a strategy to reduce the level of defects product produced [6] there are several that cause *defects* from kinds of as

employees who lack skills and experience [7]. To the of product defects it is necessary to have an analysis regarding deviation that occurs in-process production and search for the cause defect product that [8] . In addition to that is also needed strategy improvement as efforts to minimize defective products so that defective products do not repeat be well received by consumers[9]To improve quality control product which is currently running research conducted by using method *Six sigma Seven tools* [10] The reason election method is as improvement which measures quality performance with having continuous improvement which can reduce pass *defect* on product and able to improve quality of production [11] Method implementation *Six sigma* in the identification step to the formulation of the problem i and solving existing problems i using the "DMAIC" approach (*Define , measure , analyze, Improve , Control*) [12,13]

The use of the *seven. method tools* function as *statistical process control* that has the advantage of being able to know the analysis of deviations that occur during production activities and can analyze the level of quality of products that have been completed and are ready to be marketed into the hands of consumers or product *finish good* [14] . Product quality measurement using *Seven tools* and *Six sigma methods* is expected that results that can become means

improvement quality and able to reduce product defects, especially in-process production. Because process production which pays attention to quality will yield a product that is free from damage [15]. The result of repair has various forms such as the reduced occurrence of defective products before will be processed so can sort material that is *good quality* and does not have abnormal , so that the firm can provide quality that conforms to standards and has an advantage for compete, has a *value* which more than manufacturer other shoes and has confidence is more than customers and able to avoid from wasting so that costs production unit affords pressed and price product can become competitive.

II. METHOD

Output results production total whole product PDL shoes on CV Yunanda from September 2021 to December 2021 with a maximum standard of *defect* on CV Yunanda of 3% so that you can see the *defect status* of the product that is lacking or inappropriate for the quality that has been standardized according to company regulations. Therefore, it is necessary to increase the optimization of the results of the work carried out to minimize the *defect value* of DPL's shoe products. This research uses the six sigma method followed by seven tools. Data collection was carried out in the period September-December 2021.

Table 1.
Monthly Outcome Product Achievement

No	Month	Target Global	results /day	Note.
1	September	5000	192	Not Achieved
2	October	7000	196	Not Achieved
3	November	4000	201	Not achieved
4	December	5000	226	Not achieved

Significantly the assessment of the achievement indicators of shoe products described in table 2. is as follows:

Table 2.
Description of Shoe Performance Indicator

Month	Order	Week	Reject
September	5000 Install	1	39 install
		2	55 install
		3	47 install
		4	51 install
October	7000 Install	1	49 install
		2	44 install
		3	59 install
		4	44 install
November	4000 Install	1	43 install
		2	39 install
		3	61 install
		4	58 install
December	5000 Install	1	41 install
		2	64 install
		3	59 install
		4	62 install

III. RESULTS

Six Sigma Method

A. Define stage

In analyzing the *six sigma method*, an initial stage is needed to define the value of *product defects*,

so the first step is to collect analytical data related to *the percentage of defects product* as in the table. 3 as follows:

Table 3.
Percentage of PDL Shoe Defects for September – December 2021

Period d e / Sunday	Amount Product	Amount Product Disabled				Total Disabled	Percentage
		Skin	Skin	Skin	Skin		
		Overlap	flexed	Wrinkled	Scratched		
September							
I	1450	10	9	12	8	39	2.69%
II	1285	11	18	22	4	55	4.28%
III	1380	18	7	13	9	47	3.40 %
IV	885	13	17	15	6	51	5.76%
TOTAL	5000	52	51	62	27	192	3.84%
October							
I	1830	13	14	10	12	49	2.68%
II	1745	16	15	8	5	44	2.52%
III	1695	28	13	11	7	59	3.48%
IV	1730	15	12	9	8	44	2.54%
TOTAL	7000	72	54	38	32	196	2.80%
November							
I	1254	18	14	17	12	61	4.86%
II	484	5	15	8	5	33	6.81%
III	9 01	28	13	11	7	59	6.54%
IV	1361	15	12	13	8	48	3.52%
TOTAL	4000	66	54	49	32	201	5.03%
December							
I	1 349	16	14	16	12	58	4.30%
II	677	16	18	13	15	2	9.15 %
III	1 558	16	13	11	7	47	3.01%
IV	14 16	21	12	15	11	59	4.16%
TOTAL	5000	69	57	55	45	226	4.52%

In Table.3 the most dangerous level of defects occurs in November as big at 5.03%, as well as the level of product, lowest occurred in month October at 2.80%. height product of 5.03% should be overcome and minimized, as evidenced by the level of product disabled. Lowest as big as 2.80% with this thing a company in implementation should be capable carry out the process production with a defect level of 2.80%.

During production activities, CV Greece implements the minimum level of existing defects with a set policy limit maximum standard damage amount of 3%.

The results of the analysis are related to the table.3 regarding the reason the product is disabled among others :

- The Material in a *warehouse* is not arranged neatly.
- No existing process Inspection on pile

material which was not enough noticed before production activities as well as the *handling process* on sewing machines that are lacking thorough.

- Determination of measurement activities that are not adapted to the pattern of process *cutting* often occurs as a mismatch with measurement caused by shoe pattern.
- Error installation on accessories on shoe type in division *Assembling*.
- In the sewing process, it occurs in the *upper part* (finished goods) because of an error that occurs in the process of webbing and inner.
- Strouble* machines are often constrained causing problems when merging *upper* activities and *inner*.

Inspection on the level of product quality is carried out by classifying *defective products*

and OK products, so it is hoped that *product* defects can reach consumers. Examiner product goods and disabled conducted with the number of samples, as well as the placement of the actual limit of each product in the quality assessment.

B. Stage Measure

Activity This *measure* is carried out to determine the DPMO score and *sigma* value which is useful for measuring and determining

the value of sigma capabilities in the company. Assessment is carried out according to output result *defects* in units of *Defects Per Million Opportunity* (DPMO). The duration of data collection activities for level inspection *defects* calculation started from step first defining the *control chart* (P - Chart). Calculations directly performed could view in one period first the following :

Table 4.
Sigma. Capability Output Values

No	Production quantity	Number of defective products	Proportion	CL	UCL	DPO	DPMO	Percentage Yield	Sigma
September I	1450	39	0.027	0.039	0.055	0.0090	8966	99.10	3.87
September II	1285	55	0.043	0.039	0.055	0.0143	14267	98.57	3.69
September III	1380	47	0.034	0.039	0.055	0.0114	11353	98.86	3.78
September IV	885	51	0.058	0.039	0.055	0.0192	1909	98.08	3.57
October I	1830	49	0.027	0.039	0.055	0.0089	8925	99.11	3.87
October II	1745	44	0.025	0.039	0.055	0.0084	8405	99.16	3.89
October III	1695	59	0.035	0.039	0.055	0.0116	11603	98.84	3.77
October IV	1730	44	0.025	0.039	0.055	0.0085	8478	99.15	3.89
November I	1254	61	0.048	0.039	0.055	0.0162	16215	98.38	3.64
November II	484	33	0.068	0.039	0.055	0.0227	22727	97.73	3.50
November III	901	59	0.065	0.039	0.055	0.0218	21828	97.82	3.52
November IV	1361	48	0.035	0.039	0.055	0.0118	11756	98.82	3.77
December I	1349	58	0.043	0.039	0.055	0.0143	14332	98.57	3.69
December II	677	62	0.091	0.039	0.055	0.0305	30527	96.95	3.37
December III	1558	47	0.030	0.039	0.055	0.0101	10056	98.99	3.82
December IV	1416	59	0.041	0.039	0.055	0.0139	13889	98.61	3.70
Amount	21000	815	Average	0.039	0.055	0.0150	14533	98.55	3.71

Based on results from processing data above value from I (DPMO) of 8966 where can be interpreted that every one million orders package goods *have a* defect of 8966 *defect* products. For each value of capability sigma company's average value is 3,87 sigma which

means that the company is needed there is increased quality in-process production and product is produced.

C. Analyze Stage

Advanced stages in improvement quality deep step control level defect product or

can find out the cause occurrence of the *defect* porosity, carried out analysis cause effect using 5 factors:

1. Human Factor

Saturated, is a factor which is caused by work which is repeated Fatigue and lack of concentration, actually, factor this is caused by factor work physical which is caused by because there is factor pressure in work so in does work worker will quickly feel tired and as a result of this fatigue also will cause every worker to become less concentrated in doing work.

2. Raw Material Factor (Material)

Raw material is not good, because in selection raw material skin or in sorting raw material less done with good, and also in hadling less right.

3. Method Factor

The method that used is not accurate, only performs inspection at the end of process production by separating product both and defective without there is repair directly.

4. Environmental factor

The air temperature high, due to lack of roof cover sun rays at every station factory.

5. Engine Factor

The press machine for combining the upper and the inner does not operate optimally because the machine is old and worn out.

After causes occur defects are found in the process operation manufacture shoes type PDL, the stage next is to determine the cause is dominant from the five main factors. As for the step that did, namely with analysis of cause-effect on workforce involved in process production of shoes type PDL

D. Improve stage

This stage is the stage in making an improvement plan repair will do through the implementation of kaizen with matrix 5W+ 1H. This plan will be compiled according to questions that are in the matrix with giving answers, that make it easier for a factory to carry out and to carry improvement quality and can help minimize defects to product shoes type PDL.

Table 6.
Repair Plan Matrix (5W + 1H)

No.	Dominant Cause	Who	What	Where	when	Why	How
1.	Inspection no regular	Man	Conduct regular inspections of the production division	The process of processing raw materials until the <i>finished goods are good</i>	When the activity operation takes place	For minimize product disabled	- Mapping of quantities, and production activities and rescheduling - Direct inspection of activities that are considered prone to defects)
2.	Sew not enough neat	Man	Out collar stitch broken-down	Department sewing	When sewing Upper	The sewing process is too sideways	
3.	Upper disabled	Upper Material	disabled		When operator hold needle noton purpose about Product	Operator not careful and stuckneedle	-Improve accuracy skills for employees - The use of needles should be more observant for employees

DepartmentAssembling

E. Stage Control

The final stage of the approach to DMAIC is controlling. This stage has not been carried out or is implemented in the scope of the company, so that is given in this stage to party company is advised to always review the project's repair which is currently done. In this stage need there is a record or history of repair data so can

do a comparison whether the process can is better than with process repair before. Some of the tools that can use to do this are a *check sheet*, performance baseline, *quality report*, map *control*, and documentation.

Seven Tools Method

1. Check sheet

A *Check sheet* in this research is used to classify the type of defects and the number of

defects [16]. *Check Sheet* form a sheet designed simply contains a list of things needed for recording data so that users can collect data easily.

Tabel 7.
Accurately

No	Month	Total Products	Total Defect	Percentage
1	September	5000	192	3.84%
2	October	7000	196	2.80%
3	November	4000	201	5.03%
4	December	5000	226	4.52%
	Total	21000	815	16.19%

2. Pareto chart

The Pareto diagram is one of *the* tools quality assurance used to find out the sequence problem biggest based frequency which got

from *sheet* Basically diagram. Pareto is a bar graph that shows problems based on a sequence number of events.

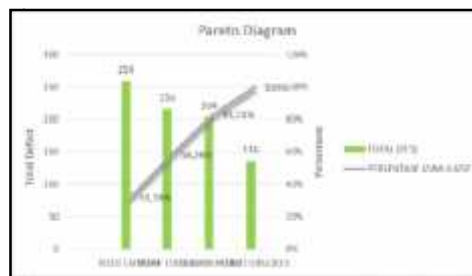


Figure 1. Pareto Diagram

3. Histogram

A histogram is a tool like a bar chart that aims to show the frequency distribution of defective products [17]. In the results of the research that is implemented into the histogram, it can be seen that the overlapping

skin has the highest distribution frequency value which indicates that the *overlap defect* is the highest type of defect at the defect level among other types of defects as shown in Figure 2.

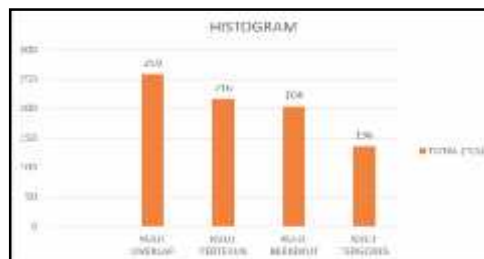
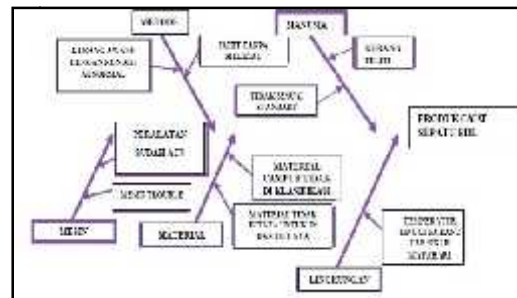


Figure 2. Histogram

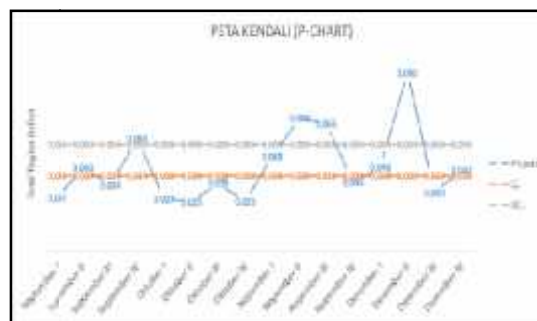
4. Fishbone Diagram

The effect diagram or *fishbone diagram* is part of *seven tools* used to analyze the causes of problem main that occur. Problems-existing problems are then analyzed further for

obtained suggestions for improvements to the cause of a problem or condition and are commonly referred to as a cause-and-effect diagram.



5. Control Chart



Based on Figure 4, no proportion exceeds the limit, so there is no need for improvement

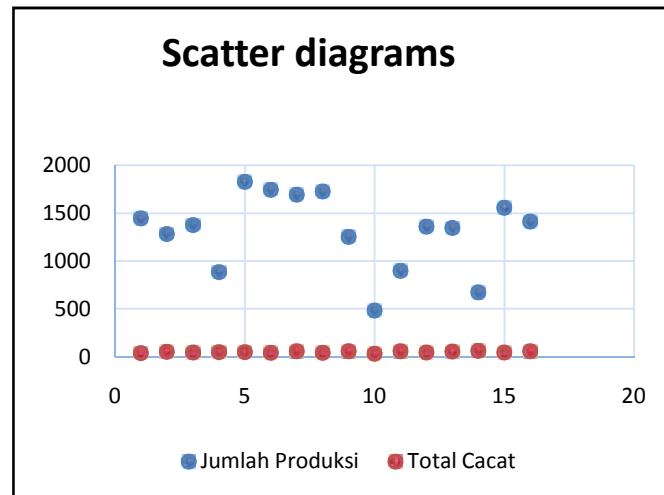


Figure 5. Scatter Diagram

7. Stratification

Stratification describes the attempt to categorize disability issues into smaller groups that are easier to evaluate [20].

The data grouping or stratification was carried out based on the types of overlapping skin

defects, flexed leather, wrinkled skin, and scratched skin on DPL brand shoes at CV. YUNANDA.

Table 9.
Stratification

No	Defect Type	Total (Pcs)
1.	Overlap Skin	259
2.	Bent Skin	216
3.	Wrinkled Skin	204
4.	Scratched Skin	136
	Total	815

IV. CONCLUSION

Based on the research that has been done, the following conclusions are obtained:

1. Defects Defects that occur during process production shoes PDL amounted to 815 pcs from total production amounted 21000 pcs result value with percentage defects product 4.0475%, where there are 4 types of defects, namely overlap defects of 259 pcs, skin defects bent by 216 pcs, wrinkled skin defects 204 pcs and scratched skin defects by 136 pcs.
2. Obstacles faced for CV. Yunanda from the human factor, namely operator working not according to standard, less skilled and not running SOP (Worker rationale standard).

3. To minimize the type of disabled product on PDL Shoes especially on defects which keep happening over and over again and in the same area, it is necessary to have a check er or double check in order not to escape *defects* again.

4. Proposed improvements obtained from this research are the use of *checksheet* cycle work, performing supervision to employees, and implementation of preventive maintenance machines which . I hope that can improve the performance of I on the maintenance of the engine, I add the blower.

Suggestion

As for the suggestions from this research are: It is necessary to carry out supervision routinely on process production to give

directions and input to an operator if work does not according to SOP. The next research, will discuss a defect which is dominant, only that is more detailed.

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Scheduling The Production Process Using Genetic Algorithm Method In Optimization Improvement PT. Kemasan Ciptatama Sempurna

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Abstract— PT. Kemasan Ciptatama Sempurna is a company engaged in manufacturing styrofoam. In the company concerned, the order system is still manual, where the order process only depends on the order. This results in a less efficient scheduling system as evidenced by the ineffectiveness of the scheduling system when some orders from various consumers place orders simultaneously. The method used in this study uses a Genetic Algorithm approach, by choosing this method in this study can improve problems in the company so that the scheduling system can run according to the wishes of consumers both in terms of scheduling time that has been agreed with consumers. The results of the research using the Genetic Algorithm method in production using genetic algorithms, the best time in scheduling production capacity is 2699 seconds, this is an increase in the efficiency of the production process as evidenced by the previous production activity process of 3600 seconds (corner production process), thus saving time by 901 seconds as well as the total time of the production process using a job shop. can be reduced by selecting an alternative in the production job shop using a genetic algorithm with a value of 0.023 seconds on the 11th chromosome.

Keywords: Styrofoam, First Come First Served, Genetic Algorithm, Makespan.

I. INTRODUCTION

The production scheduling system of PT. Ciptatama Perfect Packaging in its implementation uses the rules of first-in, first-out, *First Come First Serve* (FCFS) orders. Regarding FCFS rules, there are short and long processing times. The first order will be produced first. In a job especially in order need to run through a queue. Seen in the production scheduling process, the resulting product is not by the proven schedule of 5

products the production process time on the corner type product takes 2 hours with an hourly production target of 78 pcs, elbows take 3.1 hours with an hourly production target of 63 pcs, buoy takes 1 hour with an hourly production target of 34 pcs, sheet takes 0.8 hours with an hourly production target of 112 pcs, the box takes 2.3 hours with an hourly production target of 121 pcs. While the production target from supplier needs per day for angles is 1320 pcs, production targets from supplier needs per day for elbows are 440 pcs, production targets from supplier needs per day for floats are 548 pcs, production targets from supplier needs per day for sheet 2400 pcs, target production from supplier needs per day for 900 pcs boxes. So, for the corners it requires an additional product of 0.47% per month, for elbows it requires an additional amount of product of 0.72% per month, for floats it requires an additional number of products of 0.99% per month, for sheets it requires an additional number of products of 0.93% per month, for the box requires an additional number of products of 0.96% per month.

From the problems that have been researched in getting problems in production scheduling. To solve this problem, the genetic algorithm method is used to make scheduling effective and efficient, especially for PT. Ciptatama Perfect Packaging has many types of products so it requires a more scheduling process effective in determining alternative solutions in the scheduling process for each type of product. Based on this, efforts are needed to anticipate production scheduling. To find out efforts to increase production scheduling, several methods can be used, including the genetic algorithm method.

According to (Ilhamsah et al, 2017) (Kenneth, 2009) scheduling is the process of allocating machine resources to select tasks within a certain period of time (in Widodo, 2014). The allocation of machine resources is

adjusted to the work included in the production process, so as to minimize delays. According to (Alfandianto et al, 2017) in (Suriadi, 2011) and (Kurniawan, 2014) the genetic algorithm approach aims to optimize the occurrence of delays, production flow time and production time, production flow time and production time. It is hoped that with the use of effective scheduling, all orders can be completed on time with efficient resources. The scheduling of the genetic algorithm method aims to determine the smallest completion time with the largest *fitness value* (Triswara et al, 2019).

After identification and development with the above method, the company is expected to know the factors that influence production schedules to get an efficient time and analyze each of the most dominant factors on the level of sequencing of production scheduling. And it is hoped that after this activity, the company can implement Production scheduling planning using the analysis that has been done so that the production process time becomes more efficient.

II. LITERATURE REVIEW

A. Styrofoam

Products are defined as several characters marketed to obtain organizational goals and complement the needs and expectations of product users, product innovation is an interest and creates change to carry out activities and achieve planned results (Pratiwi, 2017). Product attributes include packaging, brand, label, presentation, and product quality guarantee. *Styrofoam* is generally pure white. The shape is simple and light. *Styrofoam* made from styrene copolymer is often used as food wrappers because it can prevent leakage and can to maintain its shape when held. According to Wirahadi (2017), the characteristics of *Styrofoam* are usually solid and can melt at higher temperatures. The basic material needed in the manufacture of *styrofoam* is EPS (*expanded polystyrene*).

B. Production scheduling

Referring to the research of Nasution (1999), Scheduling is a good measure of aggregation planning. Actual orders in this phase are assigned to specific resources (plant, workers, equipment) for the first time. The workflow is then executed in each machining

center to make the best use of the available capacity (K. Z. Gao et al., 2020). Production scheduling is the determination of the arrangement of the amount of work to be carried out. Scheduling is a stage of production control that implements work in sequences according to its priorities and then completes the implementation of the plan at the right time and in the right order (Sutji, 2000). Scheduling production is a strategic part of creating a manufacturing plan and manipulating how in which painting collections and resource allocations are managed. Scheduling is a way of organizing, deciding, and finding out the available time and resources to deliver the expected results (Heri, 2017). Production is the process of converting raw materials into finished goods or adding value to a product (goods and services) to meet the needs of the community. The perpetrators of this production activity are called producers (both individuals and organizations), while the goods produced are called products (goods or services).

C. Priority Dispatching Rules

The priority of *dispatching rules* better known as dispatching rules with *scheduling in advance* is a scheduling technique that uses the *First Come First Serve* (FCFS) principle. Using this rule, the existing jobs are carried out according to the order in which they arrive (Amin and El-Bouri (2018). The measurement of working time can be done with two events, direct and indirect (Wignojosoebroto in Roidelindho). (2017). An example of measuring working time directly is with a sampling technique or what is known as *work sampling* and the stopwatch method (*stopwatch time study*) (Asrawati, 2021).

Sari and Darmawan (2020) define standard time as the time required for someone who has an average completion ability to complete work which is usually used as a standard for completing work. a job. Standard time can be used by the company to find out the optimal number of workers needed in a production process (Beauty, 2018). The steps needed to find the standard time are as follows: Measurement Introduction, Uniformity Test Data with steps Calculating the average of the sub-average prices group, Calculates the actual standard deviation of time settlement (Meng et al., 2019), Calculating the standard deviation of the sub mean price distribution group, Calculating the degree of accuracy of each

operator, Calculate the confidence level, Determine the upper control limit (BKA) and the lower control limit (BKB), Sufficiency Test Data, Timing Standard with steps, Counting cycle time average, Calculate normal time, and Calculate standard time. Production scheduling with the integration of genetic algorithm methods can be classified based on several criteria (Nahmias, 2000):

- Forward *scheduling the scheduling* operation starts from the date the order is received in advance. Consequently, there is an inventory of raw materials until they are in turn processed.
- Backward *scheduling the scheduling* technique starts from the time of completion of the last operation. The advantage is to reduce the inventory of semi-finished goods (*work in process*).

Planning Production aims to minimize the amount of production and distribution scheduling costs, and the second objective function tries to minimize the amount of initial weight and delivery delays (Gahm et al., 2016). To validate the practical application of our framework, a case study of a furniture manufacturing company producing specialty items was considered (Fang et al., 2016), and experimental data were derived. (Mohammadi, et al. 2019). Based on real data, the model is first optimally solved by the constraint method, and then the *Hybrid Particle Swarm Optimization* (HPSO) algorithm is developed to solve the model for medium and large-sized problems in a reasonable time. We discuss the benefits of integration by comparing the results of the proposed model with separate approaches. The results show that companies can establish the right rational balance between costs and customer concerns, and they can use integration policies as leverage to increase customer satisfaction without the system experiencing a significant increase in total operating costs. Production planning can also be defined as a process to produce goods in a certain period according to what is predicted or scheduled through organizing resources such as labor, raw materials, machinery, and other equipment (Deng & Wang, 2017). Thus, forecasting is an integral part of production planning (Buffa & Sarin, 1996).

III. METHOD

1. Genetic Algorithm Method

algorithm (GA) is a solving procedure in finding and finding a *value* that has a basis in biological development g genetics capable for complete happening timetable which clash (Josie, 2017). *Step by step* will be applied GA based on procedure standard choice individual from process natural based on rule genetics, whereas in natural by ongoing To do election use defense personnel which has ability *survive* tall as well as eliminate individuals who have a weak *survival ability* (K. Gao et al., 2019). with the process of interbreeding between related individuals will result in changes ingene (K. Z. Gao et al., 2020). This gene change does not only occur in crossbreeding but can also occur because of gene mutations and adaptation processes. at a certain time (often known as the word generation), the population will more many loads individuals which is good (Christian et al., 2021).

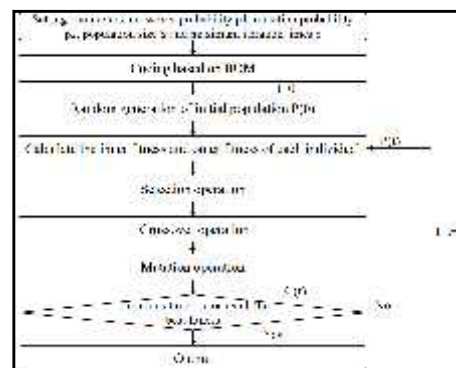


Figure 1: Organism Process Flow

Population initialization is a step that will change a *problem* into individual forms that are substituted for up to 1 to more chromosomes with a special code (Yuan et al., 2019). The size of a population is related to the problems to be solved and the types of genetic operators to be applied. After getting the population size, the chromosomes in the population just had to can conduct initialization for to *next step* (Laksono, et.al, 2016). *Fitness Value* (Score *fitness*), is the score origin something function special which is used individual evaluation. For Individuals in the population who have high *fitness* the possibility to be maintaining is greater (Suwirmayanti, et.al, 2016). Function *fitness* is capable of direct use of function destination or

can also be a little modification of function destination. (Santosa and Ai, 2017). A Genetic algorithm is a method to find the optimal solution by simulating the natural evolution process (Zhang et al., 2017). Selection, crossing, and mutation of chromosomes in the process of biological evolution leads to the evolution and evolution of organisms that are arranged in a flow process (Putra, 2018).

2. Flowshop Scheduling

Flowshop Scheduling is scheduling the production process of each job that has a production process sequence and goes through the machine that same (Baker 1974). Scheduling Flowshop is usually characterized by existence something one-way process flow and machines arranged in series. Every job that will be solved must pass all machines with the order machine which came in the process (Lu et al., 2017). Description of the Flowshop scheduling model according to Hejazi and Saghafian (2005):

A set of machines, = {1,2, . . .,} (1)

Jobs, = {1,2, . . .,}. (2)

Each machine can only process one job at the same time and each job is only processed once at each stage.

3. Chromosomes M

Chromosome M are individuals present in one population; chromosomes are also a combination of genes – genes that make up a certain value. The coding representation used in the genetic algorithm is a representation of random keys. This representation encodes a gene by generating a random number between (0,1). The random value in position i determines the order in which the city arrives in the VRP path. An example of a VRP path can be seen in the following figure:

4. Fitness

The fitness function is used for the chromosome evaluation process to obtain the desired chromosome. This function distinguishes the quality of the chromosomes to find out how well the chromosomes are produced.

1. The fitness value is a measure of whether a solution is expressed as an individual, or in other words, the fitness value states the value of the objective function.
2. The genetic algorithm has the aim of maximizing the fitness value or finding the maximum fitness value.

The criteria used in this selection

process is that this criterion is a fitness function criterion. each path in the initial population has been calculated as the distance, fitness value, fitness probability and cumulative fitness probability. The stages of calculating its fitness are as follows:

1. Distance traveled per lane (Z_i) (3)

2. Total distance of the entire line ($\sum_{i=1}^N Z$) (4)

3. The fitness value of each path ($\sum_{i=1}^n f$) (5)

4. Looking for total fitness ($\sum_{i=1}^N f$) (6)

5. The probability of each path $p_i = \frac{f}{\sum_{i=1}^N f}$ (7)

6. Cumulative probability of each path (q_i) (8)

Furthermore, the selection of a path that produces the next population is done by taking N random numbers r with $0 < r < 1$ and comparing the random numbers with the cumulative probability of fitness of each path. Settlement steps are carried out by P (generation) is a population of one generation, then simply GA consists of steps starting with the activity [start] Generation = 0, followed by Initialization of the initial population, randomly, then [Fitness] Perform a search for fitness and probability values on each chromosome, [Replace] Repeat the process as many chromosomes in the population, [Selection] Compare all probability values until the smallest value is obtained and [Test] If the final condition is met then stop and display the solution from the population.

IV. RESULTS AND DISCUSSION

1. Production Capacity

The company data used in the completion of this final project are data related to the styrofoam production process starting from production process data, production capacity data, production results in data, and company demand data in the production process for the June - August period in 2021.

Table 1. Production Capacity

Types of products	Production capacity	Production result	Number of Requests
Corner	108,000	93,600	99,000
Elbow	132,000	75,600	86,000
Lifebuoy	50,400	40,800	51,000
Sheet	141,600	134,400	180,000
Box	153,600	145,200	167,500

After determining the related

variables, it is necessary to determine the limits that affect the problem. Constraints are made to limit the fitness function and as a stopping criterion used in the iteration process. The limitations used in the final project include the total number of goods produced must be equal to the number of requests for each destination.

2. Operation Process Data

To be able to solve this production process scheduling problem, takes some data that will be used to obtain optimal production process scheduling solutions and to carry out a comparative analysis. The data needed include data on machines and production processes.

The explanation from the table is that in the pillaring process, the first process goes through the first machine, the second process goes through the second machine, the third process is carried out by the third machine, the fourth process, and the last process is carried out by the fifth machine.

Table 2: Machine Code

Machine	Code
Expander	1
Box dryer	2
Compression	3
Pierre Block	4
CNC	5

From the description of the table above, it can be seen that the production process is carried out according to the machine sequence, the machine sequence is based on the code set starting from code 1 which is the initial process to code 5.

is the last process. Furthermore, the determination of the time of the production process.

Table 3: Operation Process

No	Job Producti on	Number of machines(units)				
		1	2	3	4	5
1	Corner	1	2	3	4	5
2	Elbow	1	2	3	4	5
3	Lifebuoy	1	2	3	4	-
4	Sheet	1	2	3	4	-
5	Elbow	1	2	3	4	-

Table 4: Production Job Process Time

Job	Processing Time				
	1	2	3	4	5
Corner	285	240	262	236	177
Elbow	277	214	231	241	237
Lifebuoy	216	289	198	247	-
Shett	271	199	243	267	-
Box	261	263	239	237	-

3. Initialization of Initial Population

In determining this initialization, we can see the value of everyone or genes and the *fitness value* of each individual or gene.

Table 5. Chromosomal Probability Results

Chro moso me	Binary	X	Fitness
V1	1 0 1 0 0 0 0 1 1 0 1 0 1 1 0 1 0 0 0 0 0 0 1 0	2.066	0.8147
V2	1 0 0 1 0 0 0 1 1 1 0 0 1 0 0 1 0 0 1 0 0 1 1 0	6,067	0.9058
V3	1 0 0 0 0 0 0 1 1 0 1 0 1 1 0 1 1 0 1 1 0 0 0 1	4,670	0.1270
V4	1 1 0 0 1 0 1 0 0 0 1 1 1 1 1 1 0 0 0 1 1 0 1 0	0.422	0.9134
V5	1 1 1 1 0 1 0 1 1 1 0 0 0 1 0 0 0 0 0 0 0 1 1 1	1,213	0.6324
V6	0 1 0 1 1 1 0 0 1 1 1 1 0 1 0 0 1 0 0 1 1 0 1 1	2,840	0.0975
V7	1 0 1 1 1 1 1 1 0 0 0 0 1 1 0 1 0 1 0 1 0 0 1 1	2,568	0.2785
V8	0 1 0 0 1 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 1 1 1 0	7.222	0.5469
V9	1 1 1 1 0 1 0 1 1 0 1 0 0 0 0 0 1 0 1 1 0 1 1 0	6.013	0.9575
V10	0 0 0 0 0 1 0 0 1 0 1 1 0 1 0 1 0 1 1 0 1 0 1 1	6.786	0.9649
V11	0 0 0 0 0 0 0 0 1 1 1 1 1 0 1 1 1 1 0 1 0 1 0 1	5,355	0.1576
V12	0 0 0 0 1 1 0 1 1 0 0 1 1 0 1 1 1 0 1 0 0 0 0 1	11,667	0.9706
V13	0 1 1 0 0 0 1 1 0 1 0 1 1 0 0 0 1 0 1 0 0 1 0 0	5.062	0.9572
V14	1 0 0 1 1 0 1 0 0 1 1 0 0 0 1 0 0 0 1 0 1 1 0 0	0.257	0.4854
V15	1 1 0 0 1 0 1 1 0 0 1 1 0 1 0 0 1 1 1 0 1 0 0 1	7,113	0.8003
V16	0 0 1 1 1 0 0 1 0 0 0 0 1 1 0 1 0 1 1 1 1 1 0 0	5.162	0.1419

V17	1 1 1 0 0 0 0 0 1 0 0 0 0 0 1 0 1 0 0 0 0 1 0 0	6,870	0.4218
V18	0 0 1 1 0 0 0 0 0 0 1 1 0 0 1 1 1 1 1 1 1 1 1 1	6,311	0.9157
V19	0 1 1 0 0 0 1 0 0 0 0 1 1 1 0 1 1 1 0 0 1 1 1 0	5,369	0.7922
V20	0 1 0 1 1 0 0 0 0 1 1 0 0 0 1 0 0 1 1 0 1 0 1 0	6,714	0.9595
V21	1 1 1 1 0 1 0 1 0 0 1 1 1 1 0 0 1 1 1 0 1 0 1 1	3,501	0.6557
V22	1 1 1 1 1 1 0 1 0 0 1 1 1 1 1 0 0 0 0 1 1 0 1 0	4,732	0.0357
Total		11.6847	

The total *fitness* is 13325, so *fitness relative* (PK) of each chromosome up to chromosome 22 in the same way the results of 22 relative fitness values produce:

0.072, 0.077, 0.010, 0.078, 0.541, 0.008, 0.023, 0.046, 0.081, 0.082, 0.013, 0.083, 0.081, 0.041, 0.068, 0.012, 0.036, 0.078, 0.067, 0.082, 0.056, 0.003. Then proceed by randomizing the chromosomes so that the values are 0.617, 0.499, 0.708, 1.145, 0.898, 0.464, 0.430, 0.596, 0.345, 0.560, 0.682, 0.357, 0.467, 0.627, 0.629, 0.624, 0.733, 0.231, 0.288, 0.451, 0.453, 0.409. The crossover value generated in the probability value is 0.25 with a total time of 2699 seconds, 0.45 with a value of 4589, followed by a crossover probability value of 0.6 with a total time of 6478 seconds and a crossover probability value of 0.9 with a value of 9718 seconds. The results of determining random values on chromosomes produce the 4 smallest fitness values in the table below:

Table 6: Selected Crossover Probability

Chromosome	Binary	X	Fitness
V3	1 0 0 0 0 0 0 1 1 0 1 0 1 1 0 1 1 0 1 1 0 0 0 1	2,801	0.028
V7	1 0 1 1 1 1 1 1 0 0 0 0 1 1 0 1 0 1 0 1 0 0 1 1	2,134	0.032
V11	0 0 0 0 0 0 0 0 1 1 1 1 1 0 1 1 1 1 0 1 0 1 0 1	1,799	0.023
V22	1 1 1 1 1 1 0 1 0 0 1 1 1 1 1 0 0 0 0 1 1 0 1 0	8,317	0.024

4. List Programming

List programming as input using software Matlab (*.m) which is used in the solution that will use the Genetic Algorithm tools already

contained in the Matlab software.

A. Determine the number of populations in the genetic algorithm.

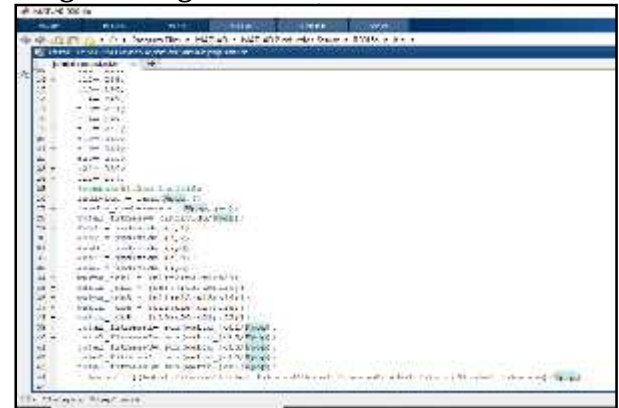


Figure 2: Awakening the individual

After carrying out the process of inputting the number of populations in generating individuals, the limits for determining the value limit in chromosomes are 22 chromosomes, which are produced in the following figure:

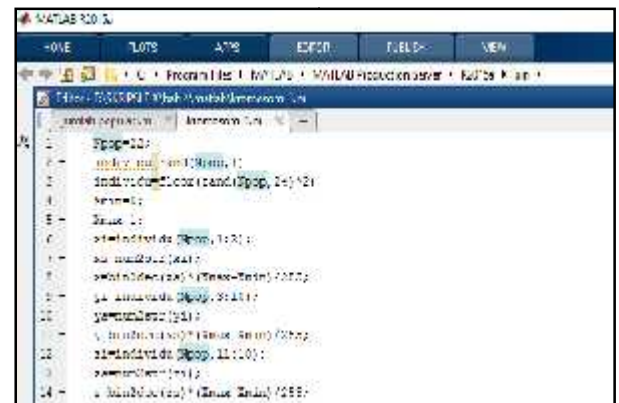


Figure 3. Determination of chromosome values

After the process of determining the value of the chromosome, the next step is to determine the crossover of the genetic algorithm as a process of choosing a random position by exchanging the characters in the string with the function of producing child chromosomes from the combination of the gene materials of the two parent chromosomes and the crossover probability is determined to control the crossover frequency.

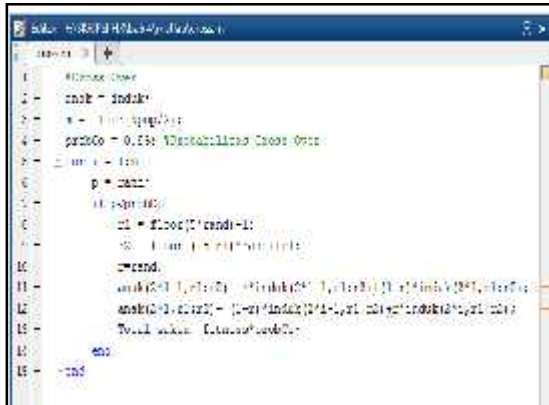


Figure 4. The results of determining the crossover

The next step is to generate random numbers using LCM as follows to connect and produce the latest chromosomes that are better and can be used with optimal chromosome values and followed by a reshuffle in determining the better chromosome values



Figure 5: LCM

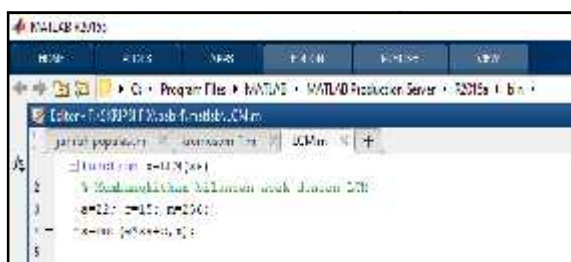


Figure 6: Reshuffle chromosome probability values

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The last activity is a chromosomal mutation which is selected from 4 alternative values of the most optimal chromosome that can be used as an alternative solution in determining the scheduling of the production process.



Figure 7. Mutation of the production schedule

V. CONCLUSION

The production process using genetic algorithms obtained the best time in scheduling production capacity of 2699 seconds, this was an increase in the efficiency of the production process as evidenced by the previous production process of 3600 seconds (corner production process), thus saving time 901 seconds by determining the chromosome value. Of the 22 production processes produced, each product produces the best fitness value in the angle production process with a fitness value of 0.1270 seconds on a compression machine, so that the optimal use of the production process can be done using a compression machine to reduce production *lead time*. Thus, the total production time can be reduced due to the selection of alternatives in the production job shop using a genetic algorithm with a value of 0.023 seconds on the 11th chromosome.

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Application of the Single Moving Average, Weighted Moving Average and Exponential Smoothing Methods For Forecasting Demand At Boy Delivery

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Abstract— Boy Delivery is a delivery service in the city of Lamongan that has been operating for about 4 years. Boy Delivery has an average of 12,000 demand per month. However, the high demand was not accompanied by good demand management, Boy Delivery often piled up and even rejected several due to the unavailability of drivers at that time, this was due to an incorrect prediction of demand. Therefore this research was conducted to help forecast future demand using the Single Moving Average, Weighted Moving Average, and Exponential Smoothing methods. Of the three methods, the Single Exponential Smoothing method was obtained as the best method with the most accurate results with a smaller error of 5.481%.

Keywords : Forecasting; Moving Average; Exponential Smoothing; MAPE.

I. INTRODUCTION

Ride-hailing services, commonly known as online motorcycle taxis, are currently one of the largest service products in Indonesia. Data as of January 2020 from We Are Social 2020-Digital 2020 Indonesia shows that 21.7 million Indonesians using ride-hailing services or 75% of internet users in Indonesia are users of the ride-hailing service application [1]. A large number of service users makes many delivery services come with various concepts, as happened in the city of Lamongan. Lamongan itself is a city in East Java with a population of 1,186,300 people. In Lamongan itself there are dozens of large-scale delivery services such as Gojek, Grab, and Uber as well as local delivery services. On the 452nd anniversary of Lamongan, there were at least eight local delivery services that took part in enlivening the activity. One of the most well-known local delivery services is Boy Delivery Lamongan. Boy Delivery has been operating for 4 years, with dozens of MSME partners, and

various health facilities with hundreds of drivers who have very flexible working hours which are divided into 3 shifts every day. Currently Boy Delivery has three types of transportation fleets namely motorbikes, cars, and pick-ups. Various services provided by Boy Delivery include ordering food delivery, goods, money transfers, as well as services other than delivery, namely moving services, stove services, and house cleaning. The large number of services provided by the Lamongan delivery boy has also resulted in a large demand from the public for these services. At least on average, there are 12 to 13 thousand demands that have been completed each month. Demand often causes the delivery service to be in overloaded condition, forcing customers to wait and even cancel orders. This causes losses both commercially and in terms of the customer's assessment. This overload condition is due to the number of drivers that do not match the demand at that time. This is because management cannot predict the demand in the coming period. One thing that can be done now is to add drivers, but limiting the number of drivers is still being done to maintain the income of the drivers. So that another solution is needed, namely in the form of demand forecasting in the future.

Forecasting is defined as a scientific estimate (educated guess). In Every decision-making concerning the situation in the future, there must be a forecast that underlies the decision-making. In a more specific sense, in general, forecasting is a prediction of a value. One of the most common of these forecasts is the forecast of product demand or sales for the coming period [2]. One of the arts in forecasting is choosing the best forecasting model and being able to identify and respond to historical activity patterns from data. previous research by [3] used the Weight Moving Average and Exponential Smoothing methods to forecast the demand for paving products on The CV. Berlian Abadi. In another study by [4], In this study, forecasting was carried out for an

office stationery shop (ATK) using three methods namely Simple Moving Average, Weighted Moving Average, and Exponential Smoothing, both studies used time series data of past demand or supply as basic data. Time series is based on a sequence of data points that are equidistant in time (weekly, monthly, quarterly, etc.). Popular and commonly applied time series models in demand forecasting are moving averages, exponential smoothing, and trend projection [5].

In this study, we want to forecast demand for the coming period to solve existing problems, as well as compare the forecasting results with the three methods namely Single Moving Average, Weighted Moving Average, and Exponential Smoothing which are most appropriate to the existing data and case studies.

II. LITERATURE REVIEW

A. Forecasting

Demand planning in general is better known as forecasting. Forecasting is a method or method used to predict, predict or estimate a value in the future or period to come by using data from the previous period as the basis [3]. Forecasting is very useful for preparing us for conditions that might occur in the coming period. Forecasting is also within the company so that the company can see an overview for decision-making [4]. Predictive accuracy is an important thing for forecasting, namely how to measure the suitability between existing data and forecasting data. There are several calculations commonly used to calculate the total forecasting error. Several methods commonly used are mean absolute deviation (MAD), mean squared error (MSE), and mean absolute percent error (MAPE) [6].

B. Metode Single Moving Average (SMA)

Single Moving Average is a forecasting method used to predict values in the next period by calculating the average of the data for the last period. Moving Average, this method is done by calculating the average of the actual data from several periods [7]. Forecasting with a single moving average is done to reduce randomness or randomness in time series data, this can be achieved by calculating the average of several values together and eliminating some positive and negative errors that interfere with data values [4].

C. Metode Weight Moving Average (WMA)

The moving Average (MA) is the average value of data movement. Moving Averages can be used to smooth data. Meanwhile, one variant of MA is the Weighted Moving Average (WMA). The equation used in determining the forecast value with WMA is by weighting each data. the weighting gives a greater value to the last data. WMA is used to estimate data based on trends in previous data [8].

The calculation of the weighted moving average method for each historical period has a different weight, the greatest weight is given to the most recent historical data in each period compared to the previous historical data this is because the data in the most recent WMA method is data that represents the situation, or is relevant in the predictions made [9].

D. Metode Single Exponential Smoothing (SES)

Exponential Smoothing is a prediction method by assigning a smoothing value to a set of existing data in previous observations to predict a value in the future. [10]. In the Exponential Smoothing method, there is an exponentially weighted moving average for all past observed values [11].

If the actual historical data is volatile or unstable from time to time then we choose an alpha value that is close to 1, otherwise, if the actual historical data is stable from time to time then we choose an alpha value that is close to 0 [12].

E. Error

This error is the result of subtracting the actual data minus the forecasting results. The following is the equation used to determine the value of the forecasting error:

$$Error = Dt - Ft \quad (1)$$

F. MAD (Mean Absolute Deviation)

MAD is the value that is noticed first in the error of a prediction result. This value is determined by taking the deviation value and then dividing it by the number of periods (n) [13]. What needs to be remembered here is that MAD is the error value that appears and becomes the first parameter of the success of a model [6].

(2)

$$MAD = \frac{\sum |Actual Data - Forecasting|}{n}$$

G. MSE (Mean Square Error)

MSE is an error measure used to assess the average error that arises as a result of reducing actual data with forecasting results then squared, the results are then divided by the number of periods [14].

$$MSE = \frac{\sum |Actual Data - Forecasting|^2}{n - 1}$$

H. MAPE (Mean Absolute Percent Error)

MAPE is a value used to measure a relative error. MAPE is considered more accurate than MAD, this is because MAPE contains the percentage of error from the forecast made, in the output of forecasting results against real demand for certain periods whose results will provide information about the percentage of errors including too high or too low [15].

Table 1 MAPE success indicators

Value of MAPE	Conclusion
< 10 %	Very good
10 % - 20 %	Good
20% - 50%	Sufficient
> 50 %	Bad

III. METHODOLOGY

This research is a quantitative study by analyzing demand data from November 2021 - October 2022 for Boy Delivery Services. The data obtained is secondary data from Boy Delivery monthly reports. This study aims to predict the order demand for Boy Delivery which refers to previous historical data using the Single Moving Average (SMA), Weighted Moving Average (WMA), and Exponential Smoothing methods (ES). Data from predictions with the three methods are then assessed for standard error to determine which method is best for making the forecast. Data processing uses the help of POM QM Software concerning calculations using moving average formulas (period $n = 3$) and exponential smoothing ($\alpha = 0,87$)

The POM QM program is a computer program used to solve problems in the field of production and operations that are quantitative. Attractive graphical displays and ease of operation make POM for Windows an alternative application to

assist decision-making, such as determining the appropriate combination of products to obtain maximum profit [16]. And the following is the flow of problem-solving in this study.

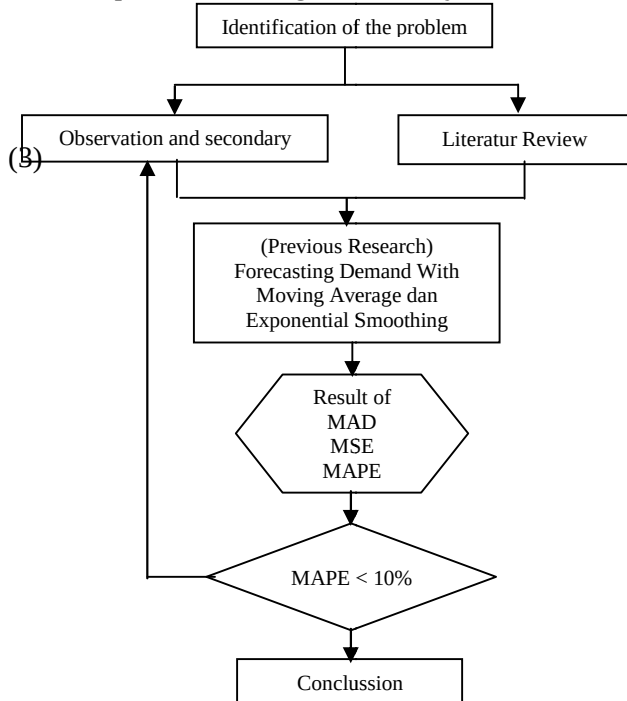


Figure 1. Flow Chart Research

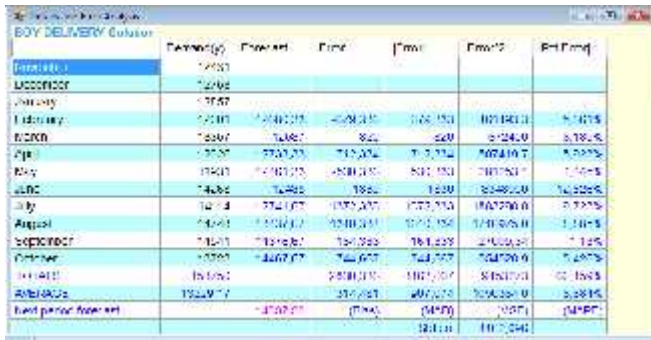
IV. RESULT

Data processing using the POM QM software in this study began by entering all historical data on Boy Delivery demand, using a period of $n = 3$ on the moving average and so that $\alpha = 0.87$ was obtained on exponential smoothing so that the results for each method were obtained as follows:

A. Moving Average (MA)

Measure	Value
Error Measures	
Bias (Mean Error)	314,481
MAD (Mean Absolute Deviation)	907,074
MSE (Mean Squared Error)	1050061,0
Standard Error (denom=n-2=7)	1162,066
MAPE (Mean Absolute Percent Error)	8,684%
Forecast	
next period	14337,33

Figure 2. Output Moving Average Solution



Period	Forecast	Actual	Error	MAPE	MSE	MAAD
January	12680.33	12680	0.33	0.0026%	0.11	0.18
February	12537	12537	0	0%	0	0
March	12537	12537	0	0%	0	0
April	12738.33	12738	0.33	0.0026%	0.11	0.18
May	12461.33	12462	-0.67	0.0054%	0.44	0.22
June	12438	12438	0	0%	0	0
July	12741.67	12742	-0.33	0.0026%	0.11	0.18
August	13437.67	13438	-0.33	0.0026%	0.11	0.18
September	14376.67	14377	-0.33	0.0026%	0.11	0.18
October	14467	14468	-1	0.0069%	1	0.33
November	14338	14338	0	0%	0	0

Figure 3: Output Moving Average and Errors

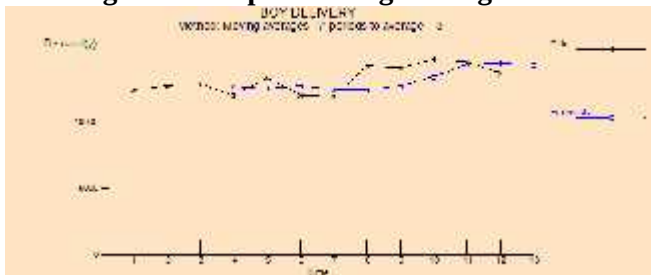


Figure 4: Output Graph Moving Average

Figure 2 shows a bias (mean error) of -314.841, MAD of 907.074, MSE of 1050364, standard error (denom=n-2=7) of 1162.096, MAPE of 6.684%, and for the next period forecast of 14338 or demand forecasting for the November 2022 period of 14338 demand.

In figure 3 moving average details and errors, the forecast or demand in February is 12680.33 or 12680 demand, in March there is 12537 demand, in April there is 12738.33 or 13279 demand, in May there is 12461.33 or 12462 demand, in June it was 12438 demand, in July it was 12741.67 or 12742 demand, in August it was 13437.67 or it was 13438 demand, in September it was 14376.67 or 14377 demand, and in October it was 14467, 67 demand or 14668 demand. Furthermore, Figure 3 is a graphical image of a comparison between actual data and forecasted data using the SMA method.

A. Weighted Moving Average (WMA)



Measure	Value
Error Measures	
Bias (Mean Error)	-269.262
MAD (Mean Absolute Deviation)	890.205
MSE (Mean Squared Error)	1021500.0
Standard Error (denom = n - 2 = 7)	1146.018
MAPE (Mean Absolute Percent Error)	6.588%
Forecast	
next period	14230.76

Figure 5: Output Weighted Moving Average Solution

Figure 6: Output Weighted Moving Average and Errors



Figure 7: Output Graph Weighted Moving Average

Figure 5 shows a bias (mean error) of -269.262, MAD of 890.205, MSE of 1021500.0 standard error (denom=n-2=7) of 1146.018, MAPE of 6.588%, and for the next period forecast of 14230.76 or demand forecasting in the November 2022 period of 14231 demand.

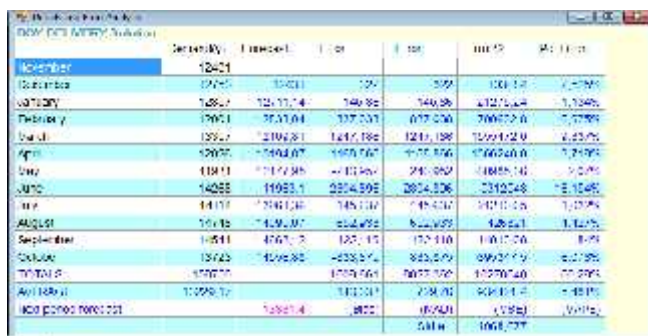
In figure 6 the weighted moving average details and errors obtained forecast or demand in February of 12721.48 or 12722 demand, in March of 12455.4 or 12556 demand, in April of 12803.08 or 12804 demand, in May of 12445.92 or 12446 demand, in June 12303.64 or 12304 demand, in July 12982.08 or 12983 demand, in August 13639.36 or 13640 demand, in September 14429.92 or 14430 demand, and in October there were 14504.76 demand or 14505 demand. And Furthermore, Figure 7 is a graphical image of a comparison between actual data and forecasted data using the WMA method.

B. Single Exponential Smoothing (SES)



Measure	Value
Error Measures	
Bias (Mean Error)	-146.333
MAD (Mean Absolute Deviation)	729.76
MSE (Mean Squared Error)	934421.4
Standard Error (denom=n-2=9)	168.677
MAPE (Mean Absolute Percent Error)	5.481%
Forecast	
Next period	13831.4

Figure 8: Output Single Exponential Smoothing Solution



Month	Year	Forecast	Error	SMA	MA	MAPE
December	2021	12431	-146.333	12431	12431	5.481%
January	2022	12711.14	-146.333	12711.14	12711.14	5.481%
February	2022	12839	-146.333	12839	12839	5.481%
March	2022	12110	-146.333	12110	12110	5.481%
April	2022	13195	-146.333	13195	13195	5.481%
May	2022	12178	-146.333	12178	12178	5.481%
June	2022	11964	-146.333	11964	11964	5.481%
July	2022	13969	-146.333	13969	13969	5.481%
August	2022	14096	-146.333	14096	14096	5.481%
September	2022	14664	-146.333	14664	14664	5.481%
October	2022	14557	-146.333	14557	14557	5.481%
November	2022	13832	-146.333	13832	13832	5.481%
December	2022	12431	-146.333	12431	12431	5.481%

Figure 9: Output Single Exponential Smoothing Detail and Errors

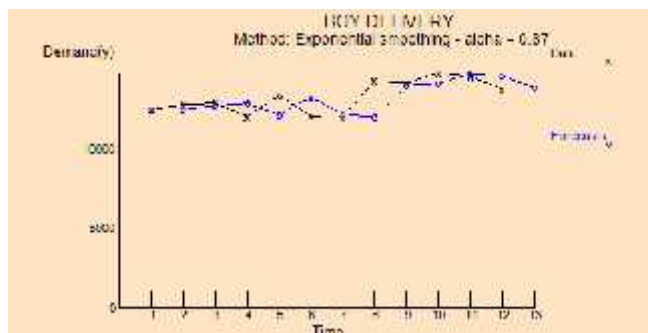


Figure 10: Output Graph Single Exponential Smoothing

Figure 8 shows a bias (mean error) of -146.333, MAD of 729.76, MSE (mean squared error) of 934421, 4 standard errors (denom=n-2=7) of 168.677, MAPE of 5.481%, and for the next period forecast of 13831.4 or demand forecasting in the November 2022 period of 13832 demand.

In Figure 9 Single Exponential Smoothing details and errors, the forecast or demand in December 2022 is 12431 demand, in January it is 12711.14 or 12712 demand, in February it is

12838.04 or 12839 demand, in March it is 12109.81 or 12110 demand, in April 13194.87 or 13195 demand, in May 12177.95 or 12178 demand, in June 11963.1 or 11964 demand, in July 13968.36 or 13969 demand, in August it was 14095.07 or 14096 demand, in September it was 14663.12 or 14664 demand, and in October it was 14556.88 demand or 14557 demand. Furthermore, Figure 10 is a graphical image of a comparison between actual data and forecasted data using the SES method.

V. CONCLUSION

Based on the error values obtained for each method used, the smallest error is obtained when the Single Exponential Smoothing method is used, namely 5.481%. So the forecast value is obtained for the period December 2022 - October 2023 using this method, namely in December there was 12431 demand, in January there was 12712 demand, in February there was 12839 demand, in March there was 12110 demand, in April there was 13195 demand, in May there was 12178 demand, in June there was 11964 demand, in July there was 13969 demand, in August there was 14096 demand, in September there was 14664 demand, and in October there were or were 14557 demand.

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Influence of Safety Management Practices on Safety Performance with Safety Knowledge as Intervening Variable in Safety Representative

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Abstract— Phosphoric acid production companies have a lot of potential hazards that can lead to work accidents. The preventive actions taken by the company are by establishing a SHE (Safety, Health, and Environment) division and appointing a safety representative. Based on the results of the safety patrol record, it turns out that there are still a lot of unsafe actions and unsafe conditions that occur and the value of the frequency rate in 2021 is worth 0.23. This study aims to determine the influence of safety management practices on safety performance mediated by the safety knowledge of 40 safety representatives. The method used to analyze the relationship between variables is PLS-SEM (Partial Least Square – Structural Equation Modeling). The results showed that there was a positive and significant influence between safety management practices on safety performance with a p-value of 0.018. In addition, safety management practices also have a positive and significant impact on safety performance mediated by safety knowledge with a p-value of 0.004 and a VAF value of 49,59%. Recommendations that can be given are in the form of implementing safety training, installing safety signs in the workplace, updating and socializing standard operating procedures for work, and implementing safety talks and safety briefings.

Keywords: safety knowledge, safety management practices, safety performance, safety representative.

I. INTRODUCTION

A Phosphoric acid production company is a chemical industry that has a fairly high risk of work accidents. Based on Keputusan Menteri Tenaga Kerja Nomor 187 Tahun 1999 concerning the Control of Hazardous Chemicals

in the workplace, this company is classified as an industry with big potential for danger because it produces hazardous chemicals. The potential for this large accident has prompted the company to form a SHE (Safety, Health and Environment) Division which is expected to be able to develop good safety management practices. According to Vinodkumar & Bhasi (2010), Safety management practices are policies, strategies, procedures, and activities implemented by a company to target the safety of its workers. Another effort made is by appointing a safety representative for each work unit to supervise all work to optimize all safety and health programs that have been prepared.

The COVID-19 pandemic has caused safety representatives to become passive in carrying out their roles. So that there is a phenomenon of the lack of worker participation in solving safety problems in the workplace, safety communication in the company, and safety promotion policies. Another factor that influences the implementation of safety management practices is not optimal is the safety knowledge of safety representatives. This is evidenced by data that in 2021 the company has a frequency rate of 0.23. It can be concluded that there is at least 1 work accident that eliminates working days occurs for every 1,000,000 working hours of people. So, it is necessary to increase safety knowledge to reduce the potential for workplace accidents. According to Vinodkumar & Bhasi (2010), knowledge of workers about safety procedures will affect worker safety. In addition, the record from the results of routine safety patrols which note that there are still many unsafe actions also strengthens how the safety performance of workers is not yet optimal. Safety performance is a work behavior related to safety (Griffin & Neal, 2000).

Based on the facts, the researcher intends to research on the influence of safety management

practices on safety performance intervened by safety knowledge. Previous research conducted by Vinodkumar & Bhasi (2010) said that there is a positive and significant influence between safety management practices and safety performance with intervention by safety knowledge. One method that can analyze this research is Partial Least Square – Structural Equation Modeling (PLS-SEM) using SmartPLS software. This method is used to determine the relationship between indicators and latent variables, which in this study contained safety management practices, safety knowledge, and safety performance. In addition, this method can find out how safety management practices affect safety performance intervened by safety knowledge. So, this research can be used to improve the safety performance of the safety representative.

II. RESEARCH METHODOLOGY

The population of this research is all safety representatives in each work unit in the phosphoric acid production company, totaling 40 people. Sampling was carried out using a saturated sampling technique, which means that the entire population was assigned as a sample. This is because the population is relatively small. Questionnaires were distributed to 40 safety representatives using google form media and researchers also received 40 responses, which means all respondents have filled out the questionnaire.

The Questionnaire used in the study contained 52 statements, 34 of which were safety management practices questionnaires from the research of Vinodkumar & Bhasi (2010) to measure the perception of safety representatives regarding the practices, roles, and functions created by the company to improve the safety and health of workers. The safety management practices questionnaire is composed of several indicators, namely Management Commitment (MC), Safety Training (TR), Worker's Involvement in Safety (WI), Safety communication and feedback (CO) Safety rules and procedures (SR), and Safety Promotion Policies (SP). Furthermore, there are 6 statement items that are also indicators of safety knowledge from the research of Vinodkumar & Bhasi (2010) to measure safety representative knowledge of safety procedures and practices in the workplace. The next safety knowledge

indicator will be written as Z1, Z2, Z3, Z4, Z5, and Z6 to make it easier to explain. Finally, there are 12 safety performance statements from the same research, namely Vinodkumar & Bhasi (2010) to measure the perception of safety representatives on work behavior related to safety that has been carried out in the workplace. Safety performance has 2 indicators that compose it, namely safety compliance (COM) and safety participation (PAR). Overall, there are 50 positive statement items and the remaining 2 are negative statement items. Furthermore, each statement item will be assessed using a Likert scale from 1 to 4 as follows :

	Strongly Disagree	Disagree	Agree	Strongly Agree
Positive statement items	1	2	3	4
Negative statement items	4	3	2	1

Next is to test the validity and reliability of each questionnaire item with SPSS Software. The value of the questionnaire item's validity is seen from the calculated r-value which must be greater than the r-table value, which is 0.320. While the reliability value is seen from the value of Cronbach's alpha coefficient which must be greater than 0.6. A Hypothesis test is using the PLS-SEM method through the SmartPLS software and calculations to find out how influential safety knowledge is as an intervening variable on indirect effects can be done using the VAF (Variance Accounted for) formula, which is as follows (Kusmeri, 2018):

$$VAF = \frac{a \times b}{(a \times b) + c} \times 100\%$$

Where: a = effect of the independent variable on the intervening variable

b = effect of the intervening variable on the dependent variable

c = effect of the independent variable on the dependent variable

If the calculation result of the VAF value is above 80%, it shows the role of the intervening variable as a full mediation. However, if the VAF value is between 20% - 80%, it shows the role of the intervening variable as partial mediation. And if the VAF is less than 20%, it means that there is no intervention or mediation

effect from the intervening variable or no mediation (Hair Jr et al., 2013; Kusmeri, 2018). The research hypotheses to be tested include:

H1: Safety management practices have a significant effect on safety performance

H2: Safety management practices have a significant effect on safety performance by being intervened by safety knowledge

III. RESULT AND DISCUSSION

The result of the validity and reliability test by using SPSS software shows that all the questionnaire items are valid and reliable based

on the assessment conditions. All the questionnaire items have a calculated r-value greater than 0,320 and a value of Cronbach's alpha coefficient greater than 0.6.

The research hypotheses were tested using the PLS-SEM analysis method using the SmartPLS software. PLS-SEM consists of two stages there are evaluation of the measurement model and the structural model (Haryono, 2016). The following figure is the research model to be tested which is modified from Rosalita et al. (2016) and Vinodkumar & Bhasi (2010).

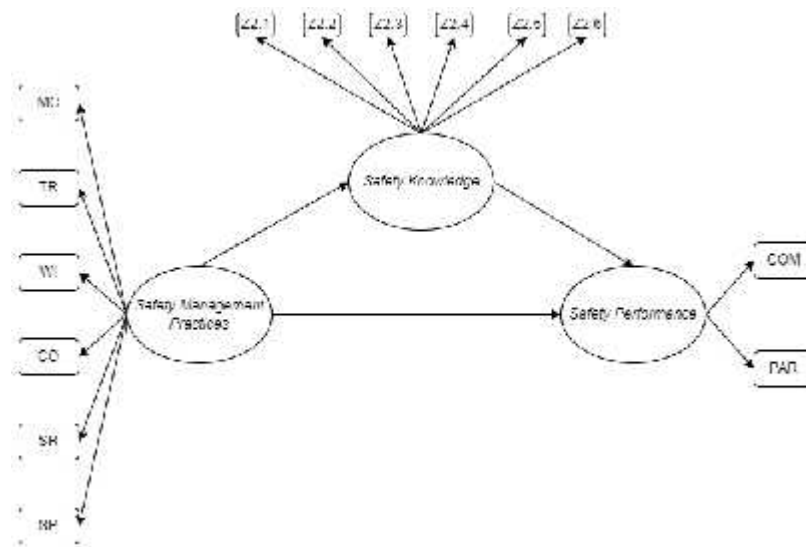


Figure 1: Research model

In this study, an evaluation was carried out on the reflective model. Evaluation of the measurement model tests the validity and reliability of all latent variables and their indicators. The first examination is individual item reliability which aims to see the magnitude of the correlation value between each indicator and its construct. This examination is seen from the loading factor value which must be ≥ 0.5 to be accepted (Hair et al., 2014; Effendi et al., 2019). Next is the examination of the composite reliability value, which is to see how reliable the variables of the research model are. According to Haryono (2016), the acceptable CR limit value is ≥ 0.7 and will get a satisfactory predicate if the CR value is ≥ 0.8 . Equal to CR, the next examination is to see how reliable a variable is by looking at the AVE value. The minimum AVE value to be said to be reliable is 0.5 (Haryono, 2016).

According to Table 1, all of the indicators have an acceptance limit value of loading

factor which is more than equal to 0,5. So, it can be declared that all of the indicators in this research are valid. CR value dan AVE value in table 2 show that all variables have acceptance limit value which is for CR value more than equal to 0,7 and AVE value more than equal to 0,5. It shows that all variables are reliable.

Table 1 Loading Factor

Variables	Indicators	Loadings
Safety Management Practices	MC	0,838
	TR	0,831
	WI	0,827
	CO	0,863
	SR	0,923
	SP	0,879
Safety Knowledge	Z1	0,890
	Z2	0,615
	Z3	0,902
	Z4	0,926
	Z5	0,891
	Z6	0,870
Safety Performance	COM	0,858
	PAR	0,896

Table 2 CR and AVE Value

Variables	CR	AVE
Safety Management Practices	0,945	0,741
Safety Knowledge	0,942	0,732
Safety Performance	0,870	0,769

The second evaluation of this stage is the evaluation of discriminant validity which is carried out in two events, namely by looking at the value of cross-loading and the Fornell-Larcker criterion. Cross-loading can provide information about the relationship of indicators to the construct compared to other constructs (Haryono, 2016). In Table 3, it can be seen that all the indicators that make up the research variables have a greater value on the association construct compared to other constructs. The MC, TR, WI, CO, SR, and SP indicators have the highest cross-loading values for safety management practices. Meanwhile, indicators Z1 to Z6 have the greatest cross-loading value on safety knowledge as well as COM and PAR indicators which have the greatest cross-loading value on safety performance. Because the correlation value is higher than other constructs, it can be said that the measurement model already has good discriminant validity. While on the Fornell-Larcker criterion, the discriminant validity test is carried out by looking at the results of the correlation between variables in the form of the $\sqrt{\text{AVE}}$ value (Haryono, 2016). Table 3 shows the $\sqrt{\text{AVE}}$ value of each variable and the correlation between variables (vertical element), where the value of the diagonal element (0.862; 0.785; 0.855, and 0.877) is greater than the value of the vertical element (correlation with other variables). Thus, the discriminant validity conditions with the $\sqrt{\text{AVE}}$ value have been met.

Table 3 Cross Loading

Indicators	Safety Management Practices	Safety Knowledge	Safety Performance
MC	0,838	0,557	0,633
TR	0,831	0,485	0,523
WI	0,827	0,579	0,579
CO	0,863	0,468	0,475
SR	0,923	0,388	0,509
SP	0,879	0,564	0,615
Z1	0,535	0,890	0,623
Z2	0,373	0,615	0,510
Z3	0,529	0,902	0,756
Z4	0,534	0,926	0,621
Z5	0,620	0,891	0,661
Z6	0,450	0,870	0,591
COM	0,548	0,587	0,858
PAR	0,598	0,703	0,896

Tabel 4 Fornell-Larcker Criterion

	Safety Management Practices	Safety Knowledge	Safety Performance
Safety Management Practices	0,861		
Safety Knowledge	0,599	0,855	
Safety Performance	0,654	0,739	0,877

After passing the evaluation of the measurement model, the next step is to evaluate the structural model to test the model so that the existing hypothesis can be accepted or rejected. The t-value used as a reference can be a C.R (critical value) value with a value of ≥ 1.96 or $P \leq 0.05$. If the p-value ≤ 0.05 , then H_0 is rejected, which means that there is a significant relationship between the variables. In addition, there is an evaluation of the R-square value carried out to find out how significant the influence between the variables tested is. The criteria for the R^2 value consist of three classifications, namely the R^2 value of 0.67 (substantial), the R^2 value of 0.33 (moderate), and the R^2 value of 0.19 (weak) (Haryono, 2016).

Tabel 4 T-test Value

	Original Sample (O)	P-Value	Explanation
Safety Management Practices -> Safety Performance	0,330	0,018	$H_{0,1}$ rejected
Safety Management Practices -> Safety Knowledge-> Safety Performance	0,324	0,004	$H_{0,2}$ rejected

Tabel 5 R-square Value

	R-Square
Safety Knowledge	0,359
Safety Performance	0,616

Based on the analysis test results, it is known that hypothesis 1 has a p-value of 0.018. This

explains that there is a significant and positive influence between safety management practices

on safety performance. The result of the R-square value is 0.616, which means that the variables of safety management practices and safety knowledge contribute 61.6% in shaping safety performance. These results indicate that safety management practices play an important role in building good safety performance. However, considering that there are still many unsafe actions from safety representatives, it is necessary to improve every indicator of safety management practices. An increase in safety management practices will affect on increasing the safety performance of safety representatives so that work accidents can be avoided. This is in line with the research of Kamilah et al. (2021) which states that there is a significant influence of safety management practices on safety performance through its 6 indicators.

Furthermore, hypothesis 2 has a p-value of 0.004, which means that there is a significant and positive influence between safety management practices on safety performance being intervened by safety knowledge. This is in line with the results of Perera's (2021) research which states that there is a positive and significant influence between safety management practices and safety performance with intervention by safety knowledge. The R-square value of 0.359 means that the variable safety management practices contribute 35.9% to forming safety knowledge. This R-square value proves that there must still be improvements in safety management practices that focus on increasing safety knowledge so that the safety performance of safety representatives can be implemented even better. The results of research with safety knowledge as an intervening variable prove that the roles, functions, and policies of top management are still lacking in increasing safety representative knowledge about safety. The impact is not only felt by the safety representative, but also by all workers in each work unit who should receive a transfer of knowledge about workplace safety from the safety representative. If that happens, the safety performance of all workers will also be poor and increase the potential for workplace accidents. Several recommendations can be made by companies to improve worker safety knowledge through safety management practices, namely holding safety training, conducting safety talks and safety briefings as well as socializing SOPs.

The result of VAF calculation from the role of safety knowledge as an intervening variable is 49,59%. The VAF results mean that the role of safety knowledge in its role as an intervening variable that also influences the relationship between safety management practices and safety performance is 49,59%. This condition is called partial moderation where before and after the existence of safety knowledge as an intervening variable, safety management practices still affect safety performance.

IV. CONCLUSION

Based on the analytical test that has been carried out, it can be seen that there is a significant and positive direct effect between safety management practices on safety performance with a p-value of 0.018. In addition, there is also a significant and positive indirect effect between safety management practices on safety performance with intervention by safety knowledge with a p-value of 0.004 with a VAF value of 49,59% that indicate a partial mediation condition. Recommendations that can be given to companies are conducting safety training, carrying out safety talks and safety briefings, and socializing SOP.

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Business Model Design Based on Blue Ocean Strategy Based for Eco-Friendly Sativa Mouthwash

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Abstract—Sativa mouthwash based on 3% nigella sativa extract contains thymoquinone which can reduce the porphyromonas gingivalis bacteria that causes gingivitis and bad breath. Based on the inhibition zone test it can reduce the E faecalis bacteria that causes cavities. Oral hygiene and health have a broad impact on the condition of the immune system of all organs of the human body. Such a great opportunity for the development of the world of health, it is necessary to develop a business strategy for Sativa mouthwash products through the Business Model Canvas and its blue ocean strategy. Problems that often occur to consumers with a tropical climate in Indonesia are oral health problems and concerns about product safety for the health of other organs. This research method uses descriptive analysis with case studies on Sativa brand mouthwash products. The results of the SWOT analysis are in quadrant I (1.610928; 2.326923), indicating that there are still many strengths and opportunities for the development of the Sativa mouthwash product business. Progressive action is needed through the redesign of the Business Model Canvas, followed by the preparation of the Blue Ocean Strategic using a four-step framework, including no longer using unprofessional key partners, reducing waste in the production and distribution process, increasing value propositions, and creating a unique and attractive web for educating community about the importance of oral health and the importance of using mouthwash that is safe and eco-friendly.

Keywords : *Nigella Sativa*, SWOT, BMC, BOS.

I. INTRODUCTION

Nigella sativa or habatussauda or better known as black cumin is found in Southeast Asia, including Indonesia. In Indonesia, Nigella sativa extract has been widely used for traditional medicine such as cough, asthma, bronchitis, influenza and eczema. Nigella Sativa Extract is an antioxidant, antimicrobial, antitumor and stimulating effect on the body's immune system. Nigella Sativa extract contains 18.4-24% thymoquinone (TQ) as the main ingredient of essential oil. In oral health care, the use of mouthwash containing Nigella Sativa extract has been studied in the long term to be effective in reducing plaque by 20-35% and can reduce gingivitis by 25-35%[1].

The use of mouthwashes that still contain 5-25% alcohol can cause dry mouth problems, increase the risk of oral cancer and affect the surface of composite resin fillings [2]. In general, oral health and hygiene problems can be prevented by using mouthwash. In terms of side effects and efficacy, herbal antiseptic mouthwashes have better prospects than mouthwashes containing alcohol [3]. Nigella sativa-based mouthwash product innovation is an alternative to obtain products that are clean, healthy, safe, eco-friendly and sustainable. As a product of continuous innovation, a business development model is needed so that it can be evaluated periodically and continuously to meet the wishes of its customers. The Business Model Canvas visualizes the way an organization creates, captures and delivers value [4]. The Business Model Canvas is divided into nine blocks consisting of customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structures. The nine blocks cover four main business areas, namely customers, supply, infrastructure and financial feasibility, which provide an overview for

businesspeople on market response and direct decision making against competitors [5].

Based on the results of the SWOT analysis, a new Business Canvas Model can be developed which is then continued with the Blue Ocean Strategic using the Four-Step Framework, namely no longer using naughty or unprofessional Key Partners, conducting intense evaluations of Key Activities to reduce waste that still often occurs in the production process and its distribution, increasing Value Propositions as products that have their own characteristics or uniqueness and creating websites, advertisements and other events that are unique and interesting in order to educate the public about the importance of health and care for teeth, gums and oral cavity and the importance of using drugs Safe, alcohol-free and eco-friendly mouthwash.

Research Problem

The formulation of the problem in this study is: "How to develop a more effective strategy for selling Nigella Sativa-based mouthwash products through the SWOT, BMC and BOS Analysis approach?"

Research Objective

This research has objectives to be achieved, which is:

1. Identify the BMC of Nigella Sativa-based mouthwash products
2. Conduct a SWOT analysis on the Nigella Sativa-based mouthwash product business system
3. Prepare BOS for the development of Nigella Sativa-based mouthwash products

Research Benefit

This research is expected to provide the following benefits:

1. For the company to develop a new strategy to increase sales productivity of Nigella Sativa based Sativa mouthwash
2. For readers to get an overview of the business and health benefits of Nigella Sativa-based Sativa mouthwash products

Research Scope

The scope of this research focus on:

1. This research was carried out by utilizing the data and conditions at the time the research was conducted
2. This research was completed only up to the BOS preparation stage

Research Output

The output of this research are:

1. Industrial Engineering Journal

2. Addition of Teaching Materials for Innovation and Creative Industry Management Courses

II. LITERATURE REVIEW

A. Nigella Sativa

Nigella Sativa (habbatussauda) in Indonesia is known as black cumin. In English it is called black seed, while in Arabic it is called al-habba al-barakah, namely seeds that bring blessings. Nigella Sativa is native to Southern Europe, North Africa and South Asia. Narrated in Al Bukhari, the Prophet Muhammad SAW recommended the use of Black Seed as a medicinal ingredient. Nigella Sativa seeds are dark black in color which contain oil with various nutritional content namely oleic (omega 9), linoleic (omega 6), linolenic (omega 3) essential oils, phytosterols, alkaloids, thymoquinone, dithymoquinone, thymohydroquinone and thymol which are efficacious for building the immune system body, maintaining health, and curing disease. [6].



Figure 1. Nigella Sativa Oil. (Junaedi, 2011)

Professor ELDakhakny (1960) reported that Nigella Sativa oil was able to soothe and heal inflammation. In 1995, scientists at the Pharmacology Research Laboratories, Department of Pharmacy, Kings College, London, found that Nigella sativa oil inhibited the growth of eicosanoids and exhibited antioxidant cell activity[7]. Nigella Sativa extract can inhibit and kill the growth of Streptococcus mutans starting at a concentration of 3% as shown in table 1 below:

Table 1. The results of the inhibition diameter of the methanol extract of black cumin seeds (*Nigella Sativa*) against *Streptococcus mutans* bacteria [8]

Konsentrasi ekstrak methanol biji jintan hitam	Diameter hambatan (mm)			Rata-rata Daya Hambat mm
	I	II	III	
3%	0,70	0,72	0,65	0,69
4%	0,61	0,65	0,60	0,62
5%	0,75	0,71	0,71	0,73
6%	0,84	0,86	0,79	0,83
7%	0,77	0,73	0,81	0,75

Nigella sativa extract showed significant antibacterial activity against bacteria that cause periodontitis and pulpitis. At a concentration of 3%, it has the highest inhibition against periodontitis-causing bacteria, namely *P Gingivalis*, *Aggregatebacter Actinomyces-temcomitans* and *E Faecalis* compared to 0.1% doxycycline and 1% metronidazole. *Nigella Sativa* extract in the antioxidant test, has free radical scavenging activity at a concentration of 3%. Cytotoxic test on fibroblast and osteoblast cell cultures concluded that *Nigella Sativa* 3% had viability above 90%[9]. According to Mahfouz and el-Dakhakhny (1959) nigellone and thymoquinone in *Nigella Sativa* are very effective in curing respiratory disorders, anti-inflammatory, anti-pain and antioxidants which function to remove toxins in the body. In traditional medicine, the benefits of *Nigella Sativa* are: promoting childbirth, treating ulcers, asthma, blood sugar, cholesterol, diphtheria, coughs, influenza and chicken pox[10].

B. Oral Cavity Diseases

Diseases of the oral cavity are still common in Indonesia, including the formation of dental caries due to microorganisms originating from carbohydrates that stick to the teeth and gums. In every ml of saliva there are 10 to 200 million bacteria. One of the bacteria that is often found is *Streptococcus mutans*[11]. Injuries to the tissues of the oral cavity caused by bacteria, trauma, chemicals or heat, these tissues will release various substances that cause tissue changes which are called inflammation. Inflammation or inflammation is a process that includes tissue damage, changes in local circulation, infiltration into the area of injury,

local cell proliferation and new cell growth. In conditions where the oral cavity is inflamed, the administration of *Nigella Sativa* Extract will affect changes in the quantity of immunocompetent cells which increase for the healing process[7].

In the field of periodontal disease, *Nigella Sativa* Extract is able to inhibit the growth of supragingival plaque bacteria. Experiments on wistar rats, *Nigella Sativa* Extract therapy in drinking water has a lower periodontal index and significantly lower number of sub-gingival bacteria compared to the control group. Through in vivo studies, administration of *Nigella Sativa* Extract helps in the prevention of periodontal disease because it reduces alveolar bone resorption. Administration of periodontal chips containing *Nigella Sativa* Extract in chronic periodontitis showed significant clinical improvement compared to the chitosan group. In the endodontic field, intracanal antiseptics is a fundamental step in root canal therapy. Root canal irrigation material sodium hypochlorite (NaOCl) shows excellent antimicrobial activity but often causes toxic effects on periapical tissues, so an irrigation fluid that is antibacterial and non-toxic is needed. The herbal product *Sativa* mouthwash has been shown to significantly inhibit the *E faecalis* bacteria equivalent to 2.5% and 5% NaOCl solutions[9]. Clinical trials of *Nigella Sativa* Extract showed a bactericidal effect with a maximum inhibition zone of 26 mm in diameter for *Enterobacter cloacae*, 22 mm in diameter for *Streptococcus oralis*, 21 mm in diameter for *Streptococcus anginosus*, 20 mm in diameter for *Staphylococcus epidermides*, and 16 mm for *Enterobacter cloacae*, *Streptococcus oralis*, *Streptococcus anginosus*, *Staphylococcus epidermides* and *Enterococcus durans*[12]. Another study was to compare the response of histopathological pulp with *Nigella Sativa* Oil Extract and formocresol in experimental animals, showing mild to moderate vasodilatation with some inflammatory cells and a continuous odontoblastic layer. Whereas administration of formocressol showed advanced inflammation with severe vasodilatation and infiltration and degeneration of inflammatory cells. Thus the application of *Nigella Sativa* Oil Extract succeeded in maintaining the vitality of the pulp, so that it can be developed into a good pulpotomy agent in clinical practice[13]. In the field of oral medicine, ulceration of the oral cavity is a painful lesion resulting from mild local trauma to significant systemic conditions including haematological, gastroenterological, dermatological,

immunological, and malignant diseases such as cancer. Treatment with Nigella Sativa Oil Extract was successful in healing oral ulcers and accelerating the healing of the lesions, as it inhibits the growth of pathogenic organisms at the lesion site, which can slow down the healing process. In the field of oral surgery, Nigella Sativa Extract is reported to induce bone healing in the extracted tooth socket and result in more rapid formation of bone trabeculae. Al Hijazi and Mohammed in 2013 gave Nigella Sativa Extract in the form of powder or oil to samples of 24 male rabbits and compared healing with the other side of the mouth (group control)[14]. The results showed osteoid formation in the first week and trabecular bone formation in the 6th week. Herbal plants can be used as a mixture of graft materials because they can increase osseointegration. Al Najar and Mohammed in 2009 investigated the effect of Nigella Sativa Oil Extract on the surface of bone implants and stated that coated implants had much better torsional resistance than uncoated implants, and there were no adverse tissue reactions. Nigella Sativa extract has important antioxidant, anti-bacterial, anti-inflammatory and cytoprotective potentials, so it has great opportunities in herbal medicine in the field of dentistry[15]. The development of Nigella Sativa extract formulations in nano biotechnology can be analyzed for the development of dental materials in the future [9].

C. Sativa Mouthwash



Figure 2. Prof. Dr. Ernie Maduratna Setyawati, drg., M.Kes., Sp.Perio(K) [16]

Prof. Dr. Ernie Maduratna Setyawati, drg., M.Kes., Sp.Perio(K) as a lecturer at the Faculty of Dentistry Universitas Airlangga. Apart from teaching, Prof. Dr. Ernie Maduratna Setyawati, drg., M.Kes., Sp.Perio(K) as a Professor in Periodontology is always committed and actively contributes to the creation of innovative national

dental health products. Prof. Dr. Ernie Maduratna Setyawati, drg., M.Kes., Sp.Perio(K) succeeded in downstreaming and patenting several studies in the field of periodontics including Antimicrobial Topical: Tetracycline Gel (tetracycline gel from local antimicrobials), Periobrush (toothbrush for early detection of inflammation) gums), Nigella Sativa Mouth Wash (antibacterial, antioxidant, and anti-inflammatory mouthwash).

Sativa mouth wash is based on natural ingredients from Nigella Sativa and tea tree oil. Functions against bacterial, fungal, and viral attacks in the oral cavity. Maintain cleanliness of the oral cavity and canker sores. Contains habatussauda extract which can strengthen the defenses of teeth and gums against cavities and gingivitis. How to use: Pour 10 cc (using a bottle cap with a size). Gargle for 30 seconds then spit and rinse with clean water. Already registered with BPOM.



Figure 3. Sativa Mouthwash Product [17]

D. Bussines Model Canvas

The concept of a business model evolved with the development of e-business. In the Business Model Generation book, business models are used to describe the rationale for how organizations create, deliver and capture important elements related to economic, social and others. [18]. The Business Model Canvas is a canvas approach that is presented in a visual form in the form of a painting canvas which is very easy for the reader to understand. Of the various existing model forms, the Business Model Canvas is the most unique, consisting of 9 elements of business activity areas outlined on 1 canvas sheet. namely: Customer Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key activities, Key Partnerships, and Cost Structures as follows:

Customers Segments

Differentiation of human groups or organizations to determine goals in providing benefits for the company. To increase customer satisfaction, segmentation is needed so that it focuses on developing its business strategy based on characteristics, habits, needs and others.

Value Propositions

In the form of products or services that create value for certain customer segments which make the reason customers choose products and services from these companies because they have advantages in solving problems and meeting consumer needs.

Channels

Media for companies to communicate with consumers to deliver value propositions.

Customer Relationships

Guidance in maintaining the continuity of the company's relationship with consumers.

Revenue Streams

Income received by the company from consumers for the value proposition provided by the company.

Key Resources

The main resource needed to provide added value to consumers as well as an important company asset to determine the company's success in operating its business model.

Key Activities

The main activities a company must perform to make its business model work.

Key Partnership

Collaborative partners who make business models run well. Companies create alliances to optimize their business models, reduce risk, or acquire resources.

Cost Structure

Description of expenses or costs required to run the business process. These 9 elements are the elaboration of the 4 main pillar designs that must exist in a business. The four pillars are: offers, customers, infrastructure, and financial [18]. Bastian & Coes, 2014 stated that the Business Model Canvas focuses on implementing the basic ideas to create value in an organization. Through the Business Model Canvas, you can see a complete and detailed picture of the business model regarding the key elements of the business that is being run. An effective step to assess the integrity of the entire business model is to combine SWOT analysis

(Strengths, Weaknesses, Opportunities, Threats) through the Business Model Canvas (BMC) followed by the Blue Ocean Strategic[19].

E. SWOT Analysis

SWOT analysis according to David, Fred R., 2011[20]:

1. Strengths
Resources, skills, situations, conditions or other advantages possessed by the company.
2. Weakness
Limitations or deficiencies related to resources, skills and capabilities that hinder company performance.
3. Opportunities
Important conditions and situations that benefit the company in achieving its goals.
4. Threats
Important unfavorable conditions or situations that could pose a threat to the company. Richard L. Daft (2010) states that SWOT analysis includes efforts to identify strengths, weaknesses, opportunities and threats to determine company performance. Meanwhile, Pearce and Robinson emphasized that SWOT analysis is part of the company's strategic management process in identifying strengths, weaknesses, opportunities and threats [21]. SWOT analysis is formulating a strategy through understanding the strengths and weaknesses of the products or services we offer in facing market opportunities and threats[22].

F. Blue Ocean Strategy

Kim and Mauborgne (2005) define a new market space that is not tight with elements of competition. Value innovation is the spearhead of the Blue Ocean Strategy [23]. Value innovation is created to influence the cost structure and offerings for consumers. Cost savings are made by eliminating and reducing factors that become points of competition in the industry. To realize the Blue Ocean Strategy through value innovation, an analytical framework is needed, namely a four-step framework as follows: eliminate, reduce, increase, and create. The high potential of Blue Ocean Strategy includes three complementary qualities, namely: Focus (not spreading its efforts to all the main factors of competition), Divergence (moving away from players by looking for and seeing alternatives instead of comparing), Attractive Motto (able to convey, advertise and offer products clearly and

honest[24]. The term Blue Ocean refers to industries or markets that have not yet emerged or are not yet competitive. Demand in Blue Ocean is created and not contested, so the size of the market and demand in the market are unlimited. The Four-Step Framework with the Eliminate-Reduce-Increase-Create Scheme is part of the Blue Ocean Strategic, covering:

- a. Eliminate, removing that is an alternative to eliminating factors that become obstacles in competing for businesspeople.
- b. Reduce, a process of reflecting on whether the products produced so far are effective, right-on target and not overly designed to just follow or win the competition.
- c. Raise, a process to encourage companies to increase their potential.
- d. Create, a creative and innovative step for businesspeople in finding new ideas that are measurable and can be implemented as well as encouraging the emergence of new requests thereby contributing to an increase in Revenue Stream.

III. RESEARCH METHODOLOGY

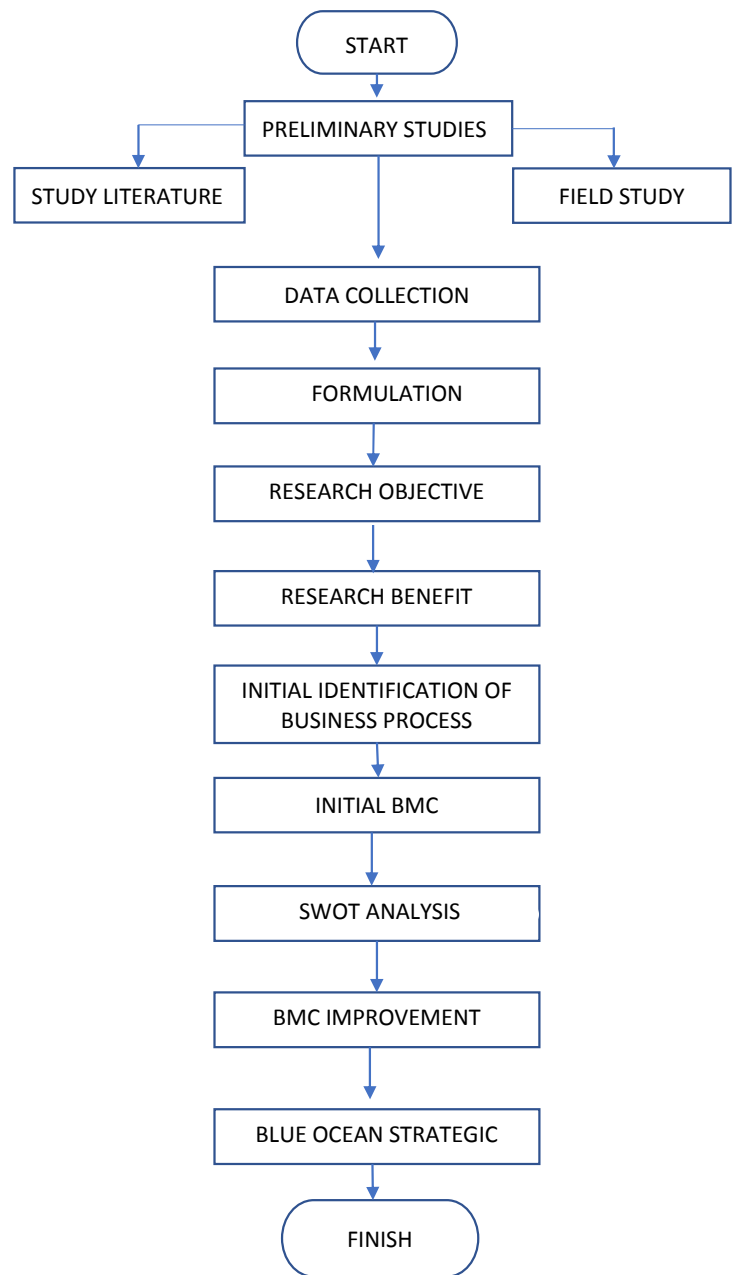


Figure 4. Research Flow Chart.

IV. DISCUSSION

A. Initial Business Model Canvas

Initial Business Model Canvas				
Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
Raw material suppliers Production building owner Freight forwarding agent endorse PDGI Development Department Dental Clinic	Procurement of raw materials Production Marketing and sales Product development and design	Eco-friendly product Contains Nigella Sativa Extract Anti-inflammatory Antimicrobial Antioxidant There is a clear measure at the right dose Prevents plaque formation	Promotion Customer Service Community	Mouthwash users all ages Men and women who care about oral hygiene and health
	Key Resources	Prevent bad breath	Channels	
	HR Production Equipment Raw material Fund Production place	Prevent thrush Prevent dental caries Prevent dry mouth Maintain oral hygiene Safe for all ages Alcohol free	Online shop retail store endorse Dental clinic	
Cost Structure		Revenue Stream		
Raw material costs Cooperation fee Direct labor costs Factory overhead costs (variable and fixed) Non-production costs and taxes		Sales at a price of IDR 25,000 per 200 cc unit		

Figure 5.Initial Business Model Canvas (Osterwalder dan Prigner 2012)

B. SWOT Analysis

STRENGTH	WEAKNESS
Contains Nigella Sativa 3% Contains Thymoquinone as antibacterial and antifungal at low concentrations Contains tea tree oil Protects teeth from disease and cavities Protects teeth from bacteria, viruses and fungi Anti-inflammatory Antioxidant Antimicrobial Anti-tumour Reduces plaque bacteria Removes plaque bacteria Prevent bad breath Prevent thrush Prevent dental caries Prevention of the spread of the covid virus Prevents dental plaque and other periodontal diseases The gingival surface and colour return to normal Use 4 weeks 2 times a day to cure gingivitis complaints Gingivitis preventive measures Treatment of gingivitis Improve oral hygiene Freshen breath Provides stimulation to the body's immune system Eco-friendly product Concentration of 3% can reduce free radicals up to 90% As a substitute product for synthetic drugs which are relatively more expensive Synthetic drug substitute products that have side effects on the body	Limited customers who have realized the importance of dental and oral health Product information to the public is not optimal The use of social media is not optimal There are no colour variants yet There are no flavours yet There are no scent variants yet There are no packaging variants yet Brand Image has not been able to dominate the market Customer surveys for quality improvement have not been maximized Raw materials easily imitated by new competitors Marketing personnel have not worked optimally There are not many partners Overhead costs have not been controlled optimally

Does not contain alcohol Can be used for people with dry mouth Can be used for people with canker sores Can be used for people with pain when swallowing / chewing It can be used for people with oral cavities and gums who are sensitive to alcohol Safe to use for toddlers with the dosage recommended by the dentist Safe for the elderly who have decreased organ function with the dosage recommended by the dentist Cleaning the oral cavity There is a clear size and the right dose Safe Minimize side effects Pleasant Economical Practical Effective	
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Figure 6. SWOT Analysis on Strength and Weakness

OPPORTUNITY	THREAT
It is human nature to appear healthy, smell good with an attractive and cheerful smile The Covid outbreak has made everyone aware of oral hygiene and health The incidence of dental caries is still relatively high Nigella sativa raw material sources are abundant and have commercial potential Customer complaints of mouthwash containing alcohol Customer complaints about mouthwash that feels stinging and hot Customer complaints about mouthwash which has a side effect of dry mouth Customer complaints about mouthwashes that have a negative impact Customer complaints about the inconvenience of using other mouthwashes Customers are concerned about the safety of using other mouthwashes Customer complaints about mouthwashes that cause irritation or canker sores Customer complaints about sensitive oral health conditions Enthusiasm of elderly customers for oral health conditions The impractical use of other mouthwashes that must be rinsed Instructions for use or dosage of other mouthwash that are not appropriate Customer concern about the contribution to the emergence of oral cancer Green Consumerism is increasingly realizing the importance of environmentally friendly products Green Consumerism makes people aware of their rights to get safe products Great opportunity for expansion to fill various market segments Cooperation with hospitals, hotels, resorts, corporate, dental clinics and other health clinics Suitable for customers who require high practicality or mobility	Opportunities for consumers to buy substitute products are getting tighter The emergence of new competitors Consumers who are increasingly intelligent, critical, creative, and selective in choosing products Competitors who have better networks and partners Competitors that have better distribution channels Better known competitors and manage the market Relationships decreased due to not meeting expectations Depends on only one stream of income Certain raw material supply constraints Threats to the quality of raw materials Increase in the price of raw materials The emergence of other innovative products that are better Unprofessional partners Partners who cooperate with competitors High tax fees Electricity and other costs have increased significantly

Figure 7. SWOT Analysis on Opportunity and Threat

Strength Analysis

Table 2. Strength Calculation on SWOT Analysis

STRATEGIC FACTOR STRENGTH	WEIGHT	RATE	SCORE
Contains Nigella Sativa 3%	0,029703	5	0,14851
Contains Thymoquinone as antibacterial and antifungal at low concentrations	0,019802	5	0,09901
Contains tea tree oil	0,009901	5	0,0495
Protects teeth from disease and cavities	0,029703	5	0,14851
Protects teeth from bacteria, viruses and fungi	0,019802	5	0,09901
Anti-inflammatory	0,029703	5	0,14851
Antioxidant	0,019802	3	0,05941
Antimicrobial	0,029703	5	0,14851
Anti-tumour	0,019802	4	0,07921
Reduces plaque bacteria	0,029703	5	0,14851
Removes plaque bacteria	0,029703	4	0,11881
Prevent bad breath	0,019802	5	0,09901
Prevent thrush	0,009901	4	0,0396
Prevent dental caries	0,029703	5	0,14851
Prevention of the spread of the covid virus	0,019802	5	0,09901
Prevents dental plaque and other periodontal diseases	0,029703	5	0,14851
The gingival surface and colour return to normal	0,029703	5	0,14851
Use 4 weeks 2 times a day to cure gingivitis complaints	0,029703	5	0,14851
Gingivitis preventive measures	0,029703	5	0,14851
Treatment of gingivitis	0,029703	5	0,14851
Improve oral hygiene	0,019802	5	0,09901
Freshen breath	0,019802	5	0,09901
Provides stimulation to the body's immune system	0,009901	5	0,0495
Eco-friendly product	0,019802	5	0,09901
Concentration of 3% can reduce free radicals up to 90%	0,029703	5	0,14851
As a substitute product for synthetic drugs which are relatively more expensive	0,019802	3	0,05941
Synthetic drug substitute products that have side effects on the body	0,019802	3	0,05941
Does not contain alcohol	0,019802	5	0,09901
Can be used for people with dry mouth	0,019802	3	0,05941
Can be used for people with canker sores	0,009901	3	0,0297
Can be used for people with pain when swallowing / chewing	0,019802	4	0,07921
It can be used for people with oral cavities and gums who are sensitive to alcohol	0,019802	4	0,07921
Safe to use for toddlers with the dosage recommended by the dentist	0,019802	4	0,07921
Safe for the elderly who have decreased organ function with the dosage recommended by the dentist	0,029703	5	0,14851
Cleaning the oral cavity	0,029703	4	0,11881
There is a clear size and the right dose	0,029703	4	0,11881
Safe	0,029703	4	0,11881
Minimize side effects	0,029703	3	0,08911
Pleasant	0,029703	3	0,08911
Economical	0,019802	3	0,05941
Practical	0,029703	4	0,11881
Effective	0,029703	4	0,14851
TOTAL	1		4,42574

Weakness Analysis

Table 3. Weakness Calculation on SWOT Analysis

STRATEGIC FACTOR WEAKNESS	WEIGHT	RATE	SCORE
Limited customers who have realized the importance of dental and oral health	0,037037	1	0,037037
Product information to the public is not optimal	0,074074	2	0,148148
The use of social media is not optimal	0,111111	4	0,444444
There are no colour variants yet	0,037037	3	0,111111
There are no flavours yet	0,037037	2	0,074074
There are no scent variants yet	0,037037	2	0,074074
There are no packaging variants yet	0,111111	3	0,333333
Brand Image has not been able to dominate the market	0,111111	3	0,333333
Customer surveys for quality improvement have not been maximized	0,111111	4	0,444444
Raw materials easily imitated by new competitors	0,111111	4	0,444444
Marketing personnel have not worked optimally	0,074074	2	0,148148
There are not many partners	0,074074	2	0,148148
Overhead costs have not been controlled optimally	0,074074	1	0,074074
TOTAL	1		2,814815

Opportunity Analysis

Table 4. Opportunity Calculation on SWOT Analysis

STRATEGIC FACTOR OPPORTUNITY	WEIGHT	RATE	SCORE
It is human nature to appear healthy, smell good with an attractive and cheerful smile	0,057692	5	0,288462
The Covid outbreak has made everyone aware of oral hygiene and health	0,057692	5	0,288462
The incidence of dental caries is still relatively high	0,057692	5	0,288462
Nigella sativa raw material sources are abundant and have commercial potential	0,057692	5	0,288462
Customer complaints of mouthwash containing alcohol	0,057692	5	0,288462
Customer complaints about mouthwash that feels stinging and hot	0,057692	5	0,288462
Customer complaints about mouthwash which has a side effect of dry mouth	0,038462	4	0,153846
Customer complaints about mouthwashes that have a negative impact	0,057692	5	0,288462
Customer complaints about the inconvenience of using other mouthwashes	0,057692	4	0,230769
Customers are concerned about the safety of using other mouthwashes	0,019231	3	0,057692
Customer complaints about mouthwashes that cause irritation or canker sores	0,038462	5	0,192308
Customer complaints about sensitive oral health conditions	0,038462	5	0,192308
Enthusiasm of elderly customers for oral health conditions	0,019231	5	0,096154
The impractical use of other mouthwashes that must be rinsed	0,038462	5	0,192308
Instructions for use or dosage of other mouthwash that are not appropriate	0,038462	4	0,153846
Customer concern about the contribution to the emergence of oral cancer	0,057692	4	0,230769
Green Consumerism is increasingly realizing the importance of environmentally friendly products	0,057692	5	0,288462
Green Consumerism makes people aware of their rights to get safe products	0,057692	5	0,288462
Great opportunity for expansion to fill various market segments	0,019231	4	0,076923
Cooperation with hospitals, hotels, resorts, corporate, dental clinics and other health clinics	0,057692	4	0,230769
Suitable for customers who require high practicality or mobility	0,057692	4	0,230769
TOTAL	1		4,634615

Threat Analysis

Table 5. Threat Calculation on SWOT Analysis

STRATEGIC FACTOR THREAT	WEIGHT	RATE	SCORE
Opportunities for consumers to buy substitute products are getting tighter	0,076923077	2	0,153846
The emergence of new competitors	0,051282051	2	0,102564
Consumers who are increasingly intelligent, critical, creative, and selective in choosing products	0,076923077	3	0,230769
Competitors who have better networks and partners	0,076923077	2	0,153846
Competitors that have better distribution channels	0,051282051	2	0,102564
Better known competitors and manage the market	0,076923077	2	0,153846
Relationships decreased due to not meeting expectations	0,025641026	2	0,051282
Depends on only one stream of income	0,051282051	2	0,102564
Certain raw material supply constraints	0,051282051	3	0,153846
Threats to the quality of raw materials	0,076923077	3	0,230769
Increase in the price of raw materials	0,051282051	3	0,153846
The emergence of other innovative products that are better	0,051282051	1	0,051282
Unprofessional partners	0,051282051	1	0,051282
Partners who cooperate with competitors	0,076923077	2	0,153846
High tax fees	0,076923077	3	0,230769
Electricity and other costs have increased significantly	0,076923077	3	0,230769
TOTAL	1		2,307692

SWOT Analysis Graph

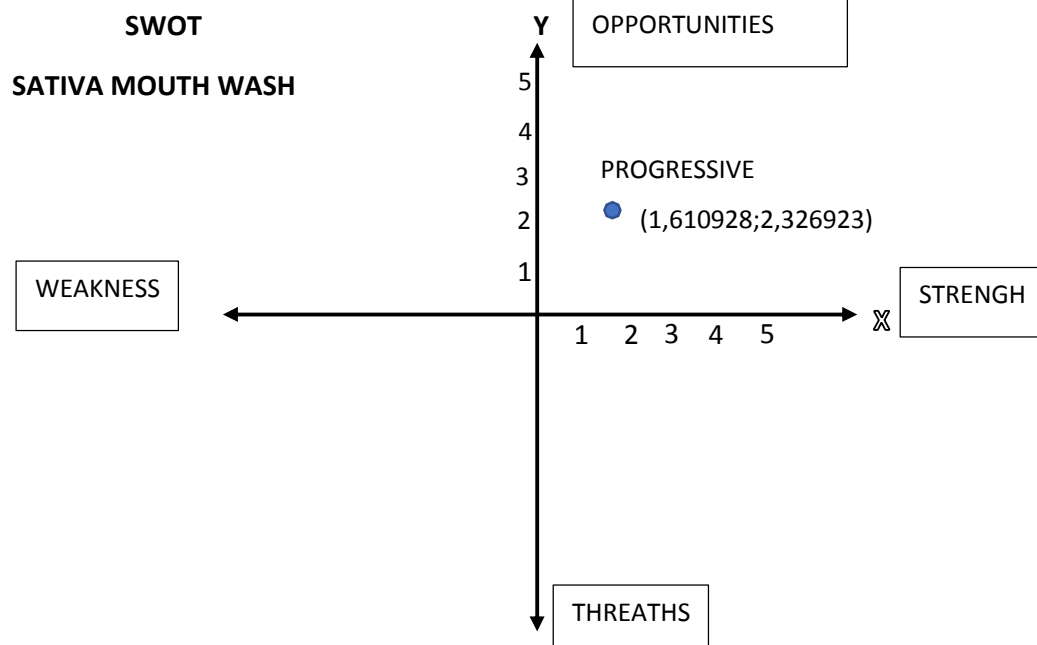


Figure 8. SWOT Analysis Graph

C. Redesign Business Model Canvas

Redesign Business Model Canvas

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
Raw material suppliers Production building owner Retail store owner Expo/exhibition committee Freight forwarding agent The owner of the e-marketplace site PDGI Community Development Department Environmental Lovers Community Advertising Agency Mini Market Supermarket Drugstore Hospital Hotel Resort corporate Dental clinic Other Health Clinics	Procurement of raw materials Production Marketing and sales Product development and design	Eco-friendly product Contains Nigella Sativa Extract 3% Based on the inhibition test, it can reduce the E Faecalis bacteria that causes cavities Contains Thymoquinone, can reduce Porphyromonas Gingivalis bacteria that cause gingivitis and bad breath Anti-Inflammatory Antioxidant Antimicrobial Anti-tumor Prevents plaque formation Prevent bad breath Prevent thrush Prevent dental caries Prevent other periodontal diseases Prevent the spread of the Covid 19 virus Prevent dry mouth Improve the body's immune system Maintain oral hygiene Freshen breath Safe for toddlers Safe for the elderly Safe for sensitive oral cavity Safe for all ages Does not contain alcohol Effective Economical Practical There is a clear measure of use at the right dosage	Promotion (expo, posters, endorsements, advertisements, social media) Customer Service Community Product Development (Variety of flavours, colours and sizes) Provision of product samples for new customers	Mouthwash users all ages Men and women who care about oral hygiene Men and women who care about oral health, teeth and gums
	Key Resources HR Production Equipment Raw material Fund Production place		Channels Expo Ads Online shop e-marketplace Retail store advertisement Health clinic advertisement Pharmacy ad Mini market advertisement Supermarket advertising Dental clinic advertisement ticktock Telegram You tube Twitter	
Cost Structure		Revenue Stream		
Raw material costs Cooperation Fee Direct labor costs Factory overhead costs (variable and fixed) Non-production costs and taxes		The selling price is IDR 35,000 per unit of 300 cc. Add another source of income: sponsorship/collaboration with various parties		

Figure 9. Redesign Business Model Canvas

D. Blue Ocean Strategic

Blue Ocean Strategic in this study uses a Four-Step Framework with the Eliminate-Reduce-Increase-Create Scheme:

- Eliminate is by not using endorsers in the Key Partners component to minimize the Cost Structure
- Reduce is by reducing waste which still often occurs in the Key Activities component, including in production and distribution activities to minimize the Cost Structure
- Raise is to improve the Value Propositions through periodic evaluations on the components of Channels, Customer Relationships, Revenue Streams, Key

Resources, Key activities, Key Partnerships and so that all can be integrated to realize the expected productivity.

- Create is by creating a solid Ecosystem Business for the development of sativa mouthwash. Among other things, the creation of a unique, interesting website is more intense to educate the public regarding dental and oral health and the importance of mouthwashes that are safe and environmentally friendly.

V. CONCLUSION

So far, materials, medicines and dental health products in Indonesia are still dominated by imported products with higher prices, so that patients must bear quite high health costs. As one of the downstream products for domestic dental health products, Prof. Dr. Ernie Maduratna Setyawati, drg., M.Kes., Sp.Perio(K) has created a Sativa Mouth Wash product which is made from natural Nigella Sativa and is environmentally friendly and abundantly available in Indonesia. Public enthusiasm for herbal products that are relatively safe and without side effects has initiated researchers to and their strategies to increase sales productivity and distribution systems. Based on the initial Business Model Canvas visualization for the Sativa Mouth Wash product, a SWOT analysis was compiled which shows the need for progressive action because it is in quadrant I position, namely: 1.610928; 2.326923. Seeing that there are still many strengths and opportunities for the development of the Sativa mouthwash product business, it is necessary to redesign the Sativa Mouth Wash Business Model Canvas to provide convenience and practicality in

carrying out business evaluations at any time or periodically. Then proceed with the preparation of the Blue Ocean Strategic through a four-step framework, including no longer using key partners who are less professional, for example, endorsement fees are too expensive and are not able to communicate Sativa Mouth Wash products to the public, reducing waste in the production and distribution process, including through quality measures. more intense control over each business process, increasing value propositions by adding to the uniqueness of the Sativa Mouth Wash product which is not yet available in other Mouth Wash products so that consumers feel more confident, safe, comfortable, and willing to pay to get the health they expect. Then create a good Ecosystem Business for the sustainability of Sativa Mouth Wash products, including creating a website that is unique and interesting, not boring to look at and follow so that people are increasingly aware of and care about oral hygiene and health which has an impact on the health conditions of other organs and the importance of using it. natural mouthwash that is safer, halal and environmentally friendly.

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Design For Longevity and Design For X: Concepts, applications, and perspectives

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Abstract— The scientific development of Design For X is very rapid. The definition of Design For X in question is Design for specific purposes. Starting from Design For Manufacture, Design For Sustainability developed into Design For Longevity. The goal of Design For Longevity is designed to extend product lifetime. Design For Longevity is a concept where products with a short lifespan have strived for longer life. As a new concept that develops in a fast-paced era and products shift with short trends, the DFL application is indispensable. This study used a bibliometric study approach using NVIVO analysis and combined with a descriptive qualitative study of the relationship between Design For Longevity and Design For X.

Keywords : perceived utility, perceived ease of use, attitude toward usage, behavioral intention, and mobile banking

I. INTRODUCTION

In principle, Design for Longevity is an effort to extend product life or lifespan [1]. This definition aims to assist product developers in actively considering product longevity when making decisions regarding product design [2]. The definition of Design for Longevity is designed that aims to design products with optimal lifetime, where optimal means considering the perspective of users, business, and resource efficiency when designing the lifetime of a product.

Cooper *et al.* (2013), estimates that product life is calculated based on the amount of use by consumers. The results of Cooper's research (2013) showed that the number of uses of knitwear was 111 times, shirts 58 times, jeans 233 times, socks 90 times, and shirts 83 times, while the average use of fashion products was 76 to 105 times. Meanwhile, research on how long fashion has been used by consumers, conducted

by Laitala dan Klepp (2020), shows that the average age of fashion products is 2.6 years. The research also shows that the total expected lifespan of fashion products is likely to be doubled to 5.2 years based on the study on (N = 46,857 garments). This estimate only includes clothing that is used by consumers of the first owner, and subsequent owners (either buying used clothing or donated clothing). Or still the first owner, but reused after being stored for a long time. The average use of fashion products in several countries includes Japan at 2.7 years, followed by the United States at 2.4 years, Germany at 2.2 years, England at 1.8 years, and China at 1.2 years [4].

In various studies on Design for Longevity, the age of fashion products has been measured by previous researchers consisting of their lifetime in units of years, the number of uses, and the number of owners until they are completely unusable and discarded. But no one has focused on Muslim fashion products yet. So that in this dissertation the focus of discussion is on Muslim women's fashion Design for Longevity. Design for Longevity itself does not only discuss fashion but also attempts to extend other types of products such as electronic products, automotive, toothpaste, smartphones, computers, Personal Computers, watches, GPS, and several other products.

New product development in the fashion sector is seen through all phases of the fashion life cycle, from production to use and disposal. Efforts to extend the life of fashion products are influenced by the early stages of new product development. Some of the efforts of fashion companies who want to extend the life of their products are by carrying out clothing take-back schemes, using recycled plastic to make new threads, using leftover fabrics, remaking discarded clothes, and increasing consumer awareness to take better care of their fashion products.

In the research previously written, one of

which was Goworek (2018), the term "Design for Longevity" was used which is relevant to extend the life of fashion. The sustainable fashion design literature proposes that designers are properly informed and able to influence the product development process. However, designers are not exclusively responsible for extending fashion products and other key business functions, including garment technology. Consumer habits in purchasing patterns, merchandising, and marketing also have an important part in extending product life.

Although the reuse of second-hand clothing or clothing persists. However, if the supply of fashion products exceeds demand and cannot be absorbed by the market, many fashion products will suffer damage. The term Design for Longevity has been used to measure the total life span of a product through fashion design and consumer behavior.

Several strategies to extend product life or Design for Longevity for fashion products had been carried out before the COVID 19 pandemic. The short life of fashion products is not because the product is damaged. Some of the reasons consumers no longer use fashion products are changes in shape, size, changes in taste, situational reasons, certain short-term fashion functions, changes in fashion or style, and other reasons [5]. So according to Laitala (2015) to design clothes so that they last longer, manufacturers must focus on material quality issues, design issues, and sizes.

For the fashion industry, 2020 was a year where things changed. Since a few years ago, fashion companies in Indonesia have been one of the largest non-oil and gas contributors to state income, during the pandemic, growth fell to minus 34.90% [6]. Consumer attitudes changed amid the pandemic, as many embraced the "less is more" or "less is more" approach which coincided with industry changes in the fashion cycle [7]. About 65 percent of consumers in a McKinsey survey conducted during the COVID-19 crisis said they plan to buy more durable, higher-quality goods, and overall, consumers find "newness" one of the least important factors. in making purchases [8].

Indonesia is also one of the countries affected by COVID-19, so many factories and physical shops for Muslim fashion are closed and their

employees are on leave [9]. During the pandemic, Muslim fashion designers relied on online sales using e-commerce platforms, websites, or social media, so they inevitably turned to customer intimacy [10].

However, the COVID 19 situation turned out to be as predicted by the British Fashion Council and the American Designers Council. In a forum it was stated that the pandemic opened up opportunities for an industrial overhaul with a slow fashion approach or a longer-lasting fashion [11]. Design for Longevity for fashion products focuses on material choices and aspects that support the longevity of fashion products [12].

Design for longevity is part of the design concept for specific purposes (Design For X). The design concept for X is a design concept according to certain needs. In some cases, the well-known design for X includes Design For Manufacturing, Design For Assembly, Design For Sustainability, and so on. In subsequent developments, the scientific theorem regarding Design for X is very broad.

Engineering design guidelines, also known as Design For X or DfX are used by engineers to better the outcome of their design process to the X in question. For example, Design for Safety is a common DfX, used to ensure an engineer's final output minimizes the occurrence of harm to users. A potential management strategy for organizing and conveying requirements that arise from both internal operations and external supply chain partners is called Design for X (DfX).

Three main benefits can be derived from understanding how a DfX emerges: (1) identifying emerging DfXs could give engineering designers a competitive edge; (2) identifying emerging DfXs could help engineering design researchers better focus their work; and (3) engineering educators who specialize in engineering design could use this knowledge to create lesson plans and class assignments.

The Design for X"(DFX) shell is a generic framework that can be quickly and reliably customized or extended to create a range of DFX tools. The high degree of consistency and commonality among the resulting DFX tools is crucial for quick integration, trade-off analysis, and execution.

II. METHODOLOGY

From the bibliometric mapping of Design for Longevity, the research framework for this dissertation was designed as shown in Figure 1. From the wordcloud results, consumers and designers are important factors in the success of Design for Longevity. Therefore, this research is divided into two major groups, namely consumers or consumer's value and designers from the perspective of producer's value creations.

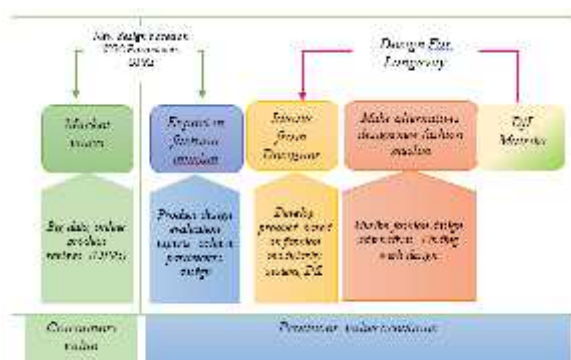


Figure 1. Design for Longevity Research Framework for Muslim Fashion Products Case

In the consumer area what is needed is the voice of the consumer, which is obtained from big data, and online product reviews to see what parameters are liked and disliked by consumers. Parameters obtained from the results of big data analysis are then examined and confirmed to be developed by designers and teams in the area of producer value creation. In this dissertation, the design of women's Muslim fashion products is evaluated to obtain the parameters that have the most influence on consumers. After determining the most influential parameters, the designer creates and develops the design at the idea from the design stage. Of all the stages to determine which alternative to choose, the entry into the DFL support system in this study is the DFL matrix, to find which design alternatives are feasible to produce.

In the situation before 2015, many companies did not support the development of Design for Longevity. However, it turns out that the development of companies that support long-life products is getting higher, as can be seen in the increasing interest in research on Design for Longevity. Especially during a pandemic, consumers and producers appreciate products that can last longer.

Companies that are not affected by trends or are short-lived are companies that have a timeless fashion model or can be used for a long time, for example, a leather fashion company [13]. However, the Design for Longevity approach seems to be in contrast to fast fashion which is a short-lived fashion product. However, in reality, several fashion brands have implemented DFL and have the principle that products that last longer will be worth the investment [14].

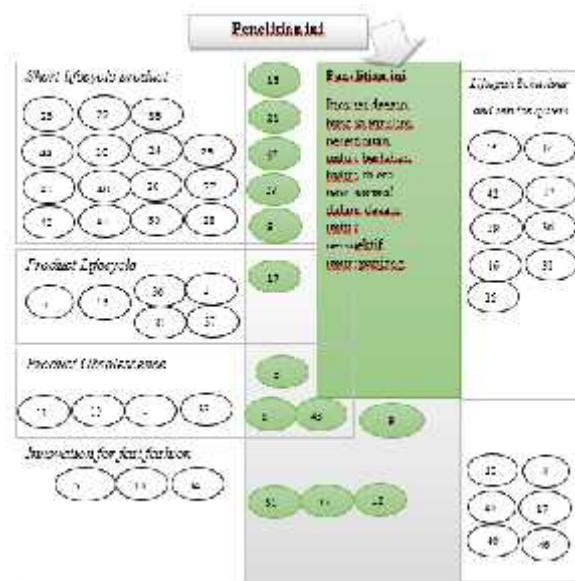


Figure 2. Research Areas as Case for Women's Muslim Fashion Design for Short Cycle Products in Design for Longevity

In Figure 2, it is shown that the gap in Design for Longevity exists between several short-lived product studies, namely short life cycle products, lifetime behavior, and service systems, product life cycles, product obsolescence, innovation for fast fashion, and design for X. This research is not just built -eyes of new ideas, but the novelty of research or novelty built from several previous researchers. Figure 3 is the basic idea of novelty or state of the art from the main concept of this dissertation research. The case study raised is Muslim women's fashion, which is a separate gap from the point of view of the type of fashion studied.

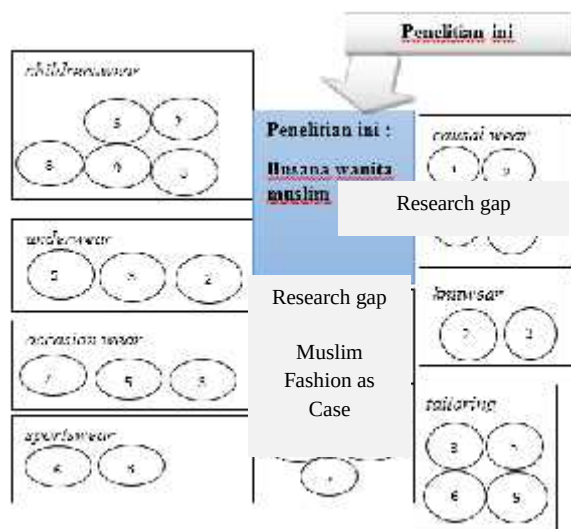


Figure 3. Research Areas Related to Types and Types of Fashion that Have Been Researched Previously

The gap in the types of clothing studied is shown in Figure 3. Previous research examined the types of fashion for children's wear, underwear, occasional wear, sportswear, electronic wear, denim, tailoring, knitwear, and casual wear. This type of Muslim fashion is a novelty in the case study that will be raised. Especially women's Muslim fashion. As explained in the previous chapter, the reason for conducting a study on women's Muslim fashion is that Muslims are the majority of the population, and the largest consumers in the Muslim fashion market are women [9].

Design for longevity in fashion products is a form of developing a design for specific purposes or design for X. As previously stated, Design for X (DFX), which is very well known, is designed for manufacturability, testability, installability, compliance, reliability, and other downstream factors is a crucial component of creating competitive, profitable products.

The DfX approaches demonstrate the complementary organizing principles, design for efficiency, and green design. Additionally, we group the DfX techniques based on three categories of perception 1) The scope of the product; 2) the system; and 3) the eco-system. The DfX concepts relate to efficiency in two ranges of perception: product scope and system scope. So the concept of design for longevity or

design to extend the life of a product is part of Design for Sustainability.

III. RESULT AND DISCUSSION

The focus of this research is to fill the research gap on the previous Design for Longevity shown in the following tables:

Table 1. Research Gap and Measured Parameters

Component	Parameters	Wordcount
Design for Longevity	A : business	472
	B : consumer	423
	C : design	961
	D : fashion non fashion muslim	671
	E : market	441
	F : model	506
	G : process	635
	H : product	1882
	I : sustainable	873
	J : system	484
	K : value	410
Product Development for fashion muslim based online product Review Voice of Customers validated by experts during Pandemic New Normal		GAP
Musim fashion modularity considers parts considering size, materials, uses		GAP

The development of Muslim women's fashion products is getting faster. The COVID-19 pandemic has affected Indonesian consumers' behavior, before the pandemic and during the new normal pandemic. Before the pandemic, people tended to shop in physical stores, with complex and glamorous designs. During the pandemic and new normal, we tend to shop at online stores and demand clothes that are simpler and more comfortable.

The focus of the research gap is

- Product development for Design for Longevity taking into account online Voice of Customer product reviews validated by experts during the pandemic and new normal

- Modular Muslim fashion taking into account size, material, and usability to design extensions taking into account the fashion component taking into account size, material, and usability.

Research gaps Design for Longevity research that considers the lifespan component of fashion

products based on online Products Reviews. Following are some previous studies on Design for Longevity, using the NVivo analytical bibliometry tool. Design For Longevity and Design For X are long-lived design concepts, which can be applied to short-lived products such as fashion cases. DFL as part of perspectives

Table 2. Design for Longevity Research Gaps Using NVivo Bibliometric Analysis

Reference in DfL	A : business	B : consumer	C : design	D : fashion non muslim fashion	E : market	F : model	G : process	H : product	I : sustainable	J : system	K : value	GAP : Women Muslim Fashion During Pandemic	GAP. Fashion Modular
1 : Files\A mixed-method study of design practices and design	3	1	36	20	0	3	7	20	40	2	0	0	0
2 : Files\A new model of sustainable product development proc	0	0	18	0	2	3	3	8	3	3	9	0	0
3 : Files\A survey on short life cycle time series forecasting	1	0	0	2	4	15	1	27	0	3	1	0	0
4 : Files\A sustainable application based on grouping genetic al	0	0	13	1	1	5	12	27	2	2	8	0	0
5 : Files\Closed-loop supply chain management- From concept	0	9	2	1	2	0	7	8	0	4	5	0	0
6 : Files\Clothing Durability Dozen Toolkit	3	13	3	2	4	2	8	13	3	3	3	0	0
7 : Files\Comparisons ~ women ' s garments manufacturing cos	5	0	9	15	10	2	2	15	0	5	0	0	0
8 : Files\Conceptualizing the circular economy- An analysis of	3	1	1	0	0	2	2	2	5	6	0	0	0
9 : Files\Critical Factors Affecting Sustainable Success of Soci	0	0	0	0	1	4	6	0	1	25	1	0	0
10 : Files\Design for adaptability (DFAD)— a new concept for	0	0	12	2	1	6	5	19	4	24	1	0	0
11 : Files\Design for longevity	1	9	17	10	4	2	2	2	4	3	1	0	0
12 : Files\Design for Remanufacturing ~ Methods and their App	2	0	25	0	1	10	14	31	1	0	2	0	0
13 : Files\Design for Sustainable Mass-Customization ~	2	0	63	0	13	2	35	116	23	8	11	0	0
14 : Files\Design for sustainable mass-customization- Design g	2	0	63	0	13	2	35	116	23	8	11	0	0
15 : Files\Design Refresh Planning Models for Managing Obsol	1	0	19	0	0	11	0	9	0	12	2	0	0
16 : Files\Developing a Decision Model of Sustainable Product	2	0	25	0	3	6	9	50	8	4	0	0	0
17 : Files\Developing a Decision Model of Sustainable Product	2	0	25	0	3	6	9	50	8	4	0	0	0
18 : Files\Does the effect of customer experience on customer s	0	2	2	2	5	4	4	9	5	3	9	0	0
19 : Files\Eco Design and Sustainable Manufacturing in Fashion	2	2	3	10	1	0	2	15	4	1	3	0	0
20 : Files\Factor affecting attitude and purchase intention of hus	1	35	2	32	24	8	3	28	2	1	16	0	0
21 : Files\Fast fashion- Response to changes in the fashion ind	1	19	7	47	19	0	7	12	0	0	1	0	0
22 : Files\Green Marketing ~ Promoting Green Consumerism fo	0	5	0	0	15	0	1	11	2	0	2	0	0
23 : Files\How Big Data Analytics Boosts Organizational Perfor	4	0	2	0	1	3	4	3	5	4	3	0	0
24 : Files\Limitation in large complex organizations- A case of d	0	0	4	0	1	4	7	3	0	2	1	0	0
25 : Files\Impacts of sustainable value and business stewardship	13	19	0	5	9	1	0	18	19	1	15	0	0
26 : Files\Inadequate Life- Evidence of Consumer Attitudes to	0	1	0	0	0	0	0	1	0	0	0	0	0

Table 3. Design for Longevity Research Gaps Using NVivo Bibliometric Analysis (advanced)

27 : Files\Innovation for a Sustainable Fashion Industry ~ A De	38	21	35	33	6	26	16	53	61	22	14	0	0
28 : Files\Integrating Environmental Requirements into Quality	0	0	10	0	1	1	3	17	2	2	6	0	0
29 : Files\Making clothing last- A design approach for reducing	0	5	19	0	0	1	0	10	5	3	1	0	0
30 : Files\Modelling environmental value ~ An examination of s	57	13	24	87	7	71	15	51	63	26	38	0	0
31 : Files\Planned obsolescence or planned resource depletion ~	0	7	11	1	0	1	6	34	4	3	0	0	0
32 : Files\Remanufacturing of Short Life-cycle Products	0	1	3	1	12	4	3	29	3	1	3	0	0
33 : Files\Sustainable fashion index model and its implication	0	7	3	20	1	13	1	18	35	5	12	0	0
34 : Files\Sustainable Operations Management	6	2	3	0	4	0	10	18	13	1	3	0	0
35 : Files\Sustainable process performance by application of Six	5	0	2	0	1	1	35	19	6	6	2	0	0
36 : Files\Sustainable Production Scheduling in Open Innovatio	0	0	0	0	1	0	2	4	0	2	1	0	0
37 : Files\Sustainable, smart and muslim-friendly tourist destina	0	0	0	0	5	0	0	4	2	0	0	0	0
38 : Files\Technology and counterfeiting in the fashion industry	0	6	0	8	3	0	3	11	0	9	1	0	0
39 : Files\Textile and Clothing Industry ~ An Approach towards	2	2	3	0	3	7	5	16	6	6	2	0	0
40 : Files\Textile and Clothing Industry- An Approach towards	2	2	3	0	3	7	5	16	6	6	2	0	0
41 : Files\The impact of covid-19 on sustainable business mode	52	1	2	3	11	26	21	3	18	6	13	0	0
42 : Files\The Influence of the COVID-19 Virus on the Luxury	0	4	2	7	8	0	0	0	0	1	1	0	0
43 : Files\The Waste Makers	5	6	5	2	15	0	1	23	0	2	0	0	0
44 : Files\Tools for sustainable fashion design- An analysis of t	4	0	25	17	0	2	8	9	30	11	2	0	0
45 : Files\Triple Helix- a sustainable economy for hijab SMEs i	9	1	3	0	2	3	0	3	5	2	0	0	0
46 : Files\UNDERSTANDING An awareness guidebook guide f	10	0	0	0	0	0	7	1	0	2	3	0	0
47 : Files\Will COVID-19 support the transition to a more susta	0	3	5	10	2	1	1	10	16	1	0	0	0
48 : Files\Young Chinese consumers' choice between product-r	0	15	5	9	2	1	2	20	22	2	5	0	0
PENELITIAN DISERTASI YUNIA DWIE NURCAHYANIE, et al		v	v		v	v	v	v		v	v	v	v

Table 2 shows very clearly the position of the research gap completed in this dissertation to fill in the gaps in the research pattern on Design for

Longevity, namely discussing Muslim women's fashion and efforts to extend fashion products with modular cutting fashion.

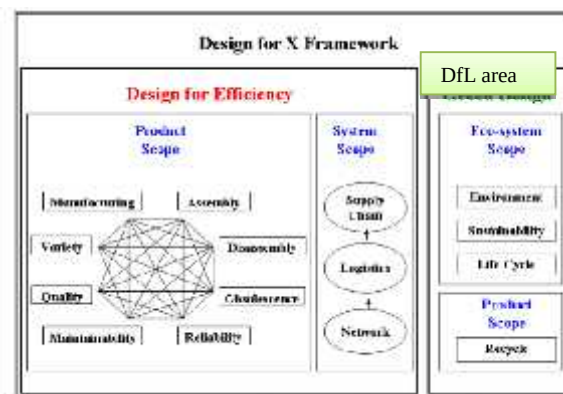


Figure 4. Framework for Design for X Perspectives

In the current era of digital technology development, the DfX theorem has undergone significant changes. Such as the application of smart design engineering: leveraging product design and development to exploit the benefits from the 4th industrial revolution DfX development as a system in 2020.

The industrial revolution 4.0 and society 5.0 era, require new products and business models adjusted to the rapidly changing market conditions, which calls for evolutions in design engineering. In this context, smart design engineering is here defined as a methodology used during the analysis and design of a product or a system, which can be composed of hardware, software, and/or services, and that Explicitly considers exploiting the technologies and opportunities from the 4th IR.

This work contributes to both design theory and practice: (i) it deepens the understanding of the necessary smart design engineering features and shows how these features impact the product design and development process as key dimensions (procedures, people, and tools); (ii) it maps the features' impact on PDDP's phases, thus providing practical directions for process improvement. To accomplish these results, a survey was performed on the initial features

presented in the literature, which helped to identify new features and to confirm their relationship to the 4th IR and their impact on the PDDP. These features were then analyzed against the 4th IR environment perspectives and core technologies, which led to an understanding of how they can be used to improve the PDDP.

The development of DfX and PDDP is inseparable from the concept of product sustainability. This is where the concept of Design For Longevity or efforts to extend product life is not only from material age, the concept of product development modularity but also from the concept of sustainability or efforts to prolong the supply chain, availability of raw materials, the readiness of the after-use process of the product itself.

IV. CONCLUSION

The conclusion from this article is that the development of Design For Specific Purposes or Design For X is experiencing rapid development. Starting from Design For Manufacture, up to Design For Sustainability which developed into various scientific branches. One of the scientific branches of Design For X is Design For Longevity. The purpose of Design For Longevity is various efforts to extend product life.

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The Usage of Monte Carlo Simulation to Predict The Sales of Sustainable Batik Products in Small Medium Enterprise

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Abstract--As an intangible cultural heritage, Indonesian Batik continues to develop and is increasingly in demand by domestic and foreign people. In the current era, the concept of making batik that is sustainable or more environmentally friendly has emerged, one of the efforts is in terms of coloring that uses natural dyes. This innovation produces softer batik colors aka soil colors, besides that the manufacturing process is longer than using chemical dyes, so the price is more expensive. With these changes, analyzing the development of sustainable batik sales is important to identify an increase in sales. This study aims to determine the prediction of sustainable batik sales with Monte Carlo simulations precisely and accurately. The data processed is batik production using natural dyes, then converted into probability distributions in the form of compulsive frequencies and then generated random numbers to obtain random numbers. After that, group the interval limit of the random number that has been obtained and continue with the simulation process so that it gets the simulation results and the percentage of accuracy using the Monte Carlo method. The results of the study on data processing from 2020 to 2021 have an accuracy of 90%. So this research is very appropriate for predicting sales for the next year.

Keywords: *Simulation, Monte Carlo, Identification, Batik, Sustainable*

I. INTRODUCTION

Batik is increasingly in demand by domestic and foreign people at various levels

and ages (Titisari et al., 2022). As a cultural heritage recognized by the world, Indonesian batik is growing and must be preserved, including improving the way it is made so as not to damage the environment. This is also to answer issues related to batik dyeing which is considered less environmentally friendly because it uses excessive chemical dyes and bleaches to produce carcinogenic waste. For this reason, it is necessary to have a solution to dealing with these problems by using environmentally friendly alternatives to change the method of making unhealthy batik.

The emergence of the concept of making batik that is sustainable or more environmentally friendly, one of which is in terms of coloring that uses natural dyes. This innovation produces softer batik colors, namely the colors of the soil. In addition to being believed to be more durable, does not fade easily, the manufacturing process with this natural dye is longer than using artificial dyes so it affects the more expensive price. When buying batik, people will choose and tend to compare based on price, motif, color, and design (Titisari et al., 2022).

Some studies examine the waxing process, there are also about the utilization of natural dyes, and several studies on wastewater from chemical dyes. Overall, sustainable batik production is still lacking, both in terms of quantity and innovation (Indarti et al., 2020). This is important of batik producers must participate in educating their consumers to be more aware of environmental issues related to batik making so that they can increase the production and sales of sustainable batik.

The uncertain market demand for sustainable batik products makes it difficult for Batik X SMEs to estimate the number of products that must be provided based on

market demand. Forecasting sales is the activity of estimating the number of sales of goods or services. When sales are accurately predicted, the fulfillment of consumer demand can be sought on time and can overcome the problem of stockouts so that they can meet consumer needs and satisfaction. When that happens, it is expected to increase batik sales in the future.

Based on these problems, it is necessary to simulate the number of sales in Batik X SMEs. Monte Carlo is a method used to produce the outcome of a probability distribution. The random process in Monte Carlo uses random numbers. This random number is a set of numbers whose probability of occurrence is the same (the probability of the number arising is the same) and the pattern of numbers that arise cannot be identified. The random numbers used in the Monte Carlo simulation are generated by computers (Nizar Nasution, 2016).

Monte Carlo simulations have a stochastic nature based on the use of random numbers and the possibility of identifying a problem. This method was previously used to solve quantitative problems with physical processes. Such as dice roll or card matching to derive samples (Dedrizaldi et al., 2019). Sufficient inventory is useful to minimize the capital that has been invested into such inventory. To find out the stock inventory in the future to avoid losses, a simulation process is needed that can predict the number of stocks of goods in the future (Manurung & Santony, 2019). A random number is a number that cannot be predicted to occur, a random number can be generated with a certain pattern called a distribution following a specified distribution function. Many algorithms or distribution methods can be used to generate random numbers. Random numbers are widely used in cryptography (data security). This *Monte Carlo* provides practical solutions to transport emerging problems in visual effects, feature animation, architectural design, and product visualization, and is currently widely used to render images in suitable industries (Novák, 2018). The basis of the Monte Carlo method is the experimentation of various possible elements using a random sample. The advantage of the Monte Carlo method is that it is a powerful numerical calculation tool for simulating statistical data, this simulation obtains accuracy values accurately from the

physical form of the observable system (Liu et al., 2019).

II. RESEARCH METHODOLOGY

The stages of research are:

1. Identify and understand the problem, then set research objectives
2. Observation of the location to make direct observations of activities at Batik X SMEs as well as data related to the material needed in the research.
3. Interviews or questions and answers with relevant parties to dig up information.
4. Literature study by collecting data and information by reading and studying books and research journals related to research.
5. Implementation by calculating to predict batik income specifically for sustainable products in the future with a web-based simulation application using the PHP & MySQL Database programming language by applying the Monte Carlo method calculation algorithm.
6. Testing the results by matching the results of the manual calculation of the Monte Carlo method with the results of the Monte Carlo method calculation.
7. Analyze the results to determine the accuracy of the results obtained from calculations in the application of the Monte Carlo method.

III. RESULT AND DISCUSSION

In building a simulation model several steps must be done:

3.1 Setting the Probability Distribution

Establishing the probability distribution can be done by dividing each frequency by the total frequency that exists. Then the formula for determining the probability distribution will be:

$$P = F/J \quad (1)$$

Where:

P = Probability Distribution;

F = Frequency;

J = Total frequency.

3.2 Building a Compulsive Probability Distribution

The Compulsive Probability Distribution can be sought from the summation of probability

distributions and compulsive distributions by summing the numbers on the probability distribution by the previous sum. The formula is:

$$DPK = AK + JA \quad (2)$$

Where:

DPK = The Compulsive Probability Distribution;

AK = Numbers on the Probability;

JA = The Previous Sum.

3.3 Determining random number intervals

Random number intervals can be determined based on the probability of occurrence and the cumulative probability obtained in the previous step. The determination of random number intervals is carried out on each variable. The function of this random number interval is to determine the boundary between one variable and another.

3.4 Generating Random Numbers

The generation of random numbers will result in a sequence of numbers and the result will later be able to know the probability. To generate random numbers in this study, the Mixed Congruent Method was used. Here's the formula from the Mixed Congruent Method:

$$Z_{i+1} = (d * Z_i + c) \bmod m$$

Where:

d = multiplier constant ($d < m$);

c = shift constant ($c < m$);

m = modulus constant ($m > 0$);

Z_i = prefix number (integers ≥ 0 , $Z_0 < m$).

3.5 Simulating the Monte Carlo Method

Simulation of the Monte Carlo Method is carried out by comparing and calculating random numbers that have been generated in the previous step with random number intervals.

The following are the stages of Monte Carlo Analysis in predicting an increase in sustainable batik sales in Batik X SMEs:

3.6 Grouping Sales Data

The data used to predict the increase in batik sales is sales data. One of the sales data is the sales data of sustainable batik products in 2020 in Table 1:

Table 1. Data on The Number of Sales In 2020

No	Month	Sum
1	January	256
2	February	255
3	March	186
4	April	182
5	May	229
6	June	271
7	July	197
8	August	223
9	September	292
10	October	193
11	November	198
12	December	185
Total		2657

From Table 1, there are 2,667 batik products sold, which are grouped to be able to conduct Monte Carlo Simulation in predicting an increase in sales at Batik X SMEs.

3.7 Calculating the Probability Distribution

Here is Table 2 which presents the probability distribution calculations based on the data presented in Table 2.

Table 2. Probability Distribution Data in 2020

No	Month	Frequency	Probability Distribution
1	January	256	0,10
2	February	223	0,10
3	March	186	0,07
4	April	182	0,07
5	May	229	0,09
6	June	271	0,10
7	July	197	0,07
8	August	223	0,08
9	September	292	0,11
10	October	193	0,07
11	November	198	0,07
12	December	185	0,07
Total		2667	1

The calculation of the probability distribution is obtained from the frequency divided by the total frequency.

3.8 Calculating the Cumulative Distribution

Here is the calculation of the compulsive distribution presented in Table 3.

Table 3. Cumulative Probability Distribution Data in 2020

No	Month	Frequency	Probability Distribution	Cumulative Probability
1	January	256	0,10	0,10
2	February	223	0,10	0,20
3	March	186	0,07	0,27
4	April	182	0,07	0,34
5	May	229	0,09	0,43
6	June	271	0,10	0,53
7	July	197	0,07	0,60
8	August	223	0,08	0,62
9	September	292	0,11	0,63
10	October	193	0,07	0,79
11	November	198	0,07	0,86
12	December	185	0,07	0,93
Total		2667	1	1

3.9 Determining the interval of a random number

Here is a table that presents random number intervals:

Table 4. Random Data Number Interval in 2020

No	Month	Frequency	Cumulative Probability	Random Number Interval	
				First	Last
1	Januari	256	0,10	1	10
2	Februari	223	0,20	11	20
3	Maret	186	0,27	21	28
4	April	182	0,34	29	35
5	Mei	229	0,43	36	44
6	Juni	271	0,53	45	54
7	Juli	197	0,60	55	60
8	Agustus	223	0,62	62	68
9	September	292	0,68	70	79
10	Oktober	193	0,79	80	85
November		198	0,86	86	94
12	Desember	185	0,93	95	100
Total		2667	1		

3.10 Calculate and generate random numbers

To determine the interval of random numbers calculated from the number sold of batik

products after calculating the random interval, then perform a random number calculation.

The calculation of random numbers is carried out by the mixed congruential generator method. Known value: $d=18, z=20, c=25, m=99$

Table 5. Random Numbers

No	Random Numbers
1	9
2	78
3	4
4	60
5	15
6	91
7	88
8	33
9	37
10	52
11	40
12	13

78, 4, 60, 15, 91, 88, 33, 37, 52, 40, and 13.

3.11 Simulation Results

The following are the results and simulations to predict the increase in sales of batik products.

Table 6. Prediction Simulation Results in 2021

Bulan	Random Numbers	Simulation Results
January	9	206
February	78	255
March	4	136

While Table 7 shows the results of the simulation of the prediction of the number of sales in the first 3 months of 2022 based on data in 2021

Table 7. Prediction Simulation Results in 2022

Bulan	Random Numbers	Simulation Results
January	9	282
February	78	276
March	4	285

IV. CONCLUSION

Monte Carlo simulations have been successfully applied to estimate sales of Batik X SME batik products in the dating period based on sales data in the past. The level of accuracy of comparison between simulation results and real data is obtained, namely 88% for 2021 and 90% for 2022.

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Analysis of Marketing Strategy in Increasing Sales Volume in the Onion Cracker Industry (Case Study of UMKM XYZ)

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Abstract— A marketing strategy is a plan used by business actors in marketing a product so that the product can compete in an increasingly tight business world. UMKM XYZ is one of the business actors in the cracker industry in the city of Bekasi. UMKM XYZ in the last year experienced a decline in sales levels. This was due to the lack of marketing strategies in marketing their products that could increase sales volume. This study aims to determine the marketing strategy to increase sales volume at UMKM XYZ. The marketing mix is one of the factors that can affect sales volume, the elements in the Marketing Mix are product, price, place, and promotion. This study uses qualitative research methods to examine more deeply the product, price, place, and promotion strategies in increasing the sales volume of UMKM XYZ. Data collection techniques using direct interviews and observation. This study concludes that the marketing strategy UMKM XYZ in increasing sales volume can do is to innovate products, expand the target market, and increase promotional activities using social media.

Keywords: marketing strategy, marketing mix, sales volume, onion cracker industry

I. INTRODUCTION

In the current era of globalization, business growth is very rapid, making it a challenge for business actors to struggle to win the competition in the business market and encourage companies to compete in

every product marketing activity to get consumers. Marketing activities play a critical role in business activities because they are positioned to provide value to consumers.

Marketing is a process of compiling an integrated communication intended to provide information about goods or services and their relationship to human needs and wants (Rina, 2011). Every business that is engaged in the field of products and services has a goal to stay alive and develop, which is divided into short-term and long-term goals. The purpose of UMKM XYZ in the short term is to win the hearts of consumers for the products it produces. In the long term, it is done to maintain existing products to keep attracting consumers. The cracker industry is one of the home industries with good potential to be marketed because crackers are complementary foods favored by many people from various circles. Crackers have good taste at relatively low prices. In this economic condition, it is proven that the cracker industry is more able to survive during crisis conditions. (Khoiriyah et al., 2012).

One of the crackers industry players in the city of Bekasi is UMKM XYZ. This cottage industry started operating in 2004 and produces onion crackers. In the production process, UMKM XYZ can make onion crackers using 12 kg of raw materials, producing 6 kg of onion crackers. The production process is carried out every three days. Moreover, UMKM XYZ can produce 700 kg to 750 kg of onion crackers within one year. Onion crackers are sold at various prices, starting from Rp. 10,000 to

Rp. 30,000 per pack according to the size.

The vast area of Bekasi city makes the ongoing marketing not followed by an increase. The level of sales of onion crackers at UMKM XYZ in 2021 experienced unstable conditions that tended to decrease. The following is a table of the sales volume of UMKM XYZ onion crackers for one year, which is divided into three periods.

Table 1.
Sales Volume

Periode	Sales Volume
January 2021 – April 2021	220 kg
May 2021 – August 2021	150 kg
September 2021 – December 2021	200 kg

Based on the results of interviews with UMKM XYZ owners, from January to April, sales of onion crackers reached 220 kg. From May to August, sales of onion crackers decreased quite drastically. UMKM XYZ was only able to sell 150 kg of onion crackers, and from September to December, sales of onion crackers stabilized again with sales of 200 kg.

The decline in the number of product sales can be caused by the lack of precise marketing strategies implemented by UMKM XYZ. In addition, the growing number of cracker industry players and having various kinds of cracker products that vary is a threat to the UMKM XYZ onion cracker business because there will be intense competition between local cracker industry players. Intense competition with other cracker industry players can be overcome by implementing appropriate and accurate marketing strategies.

Marketing strategy is the company's overall program in determining the target market and satisfying consumers by building a combination of marketing mix elements: price, product, place, and promotion (Kurtz, 2011). A marketing strategy is a way to market a product to increase the number of sales and make a superior product. One form of marketing strategy that can help in

marketing products is using a marketing mix that includes price, product, location, and promotion.

So, in this study, in determining the right marketing strategy, the 4P marketing mix concept (Price, Product, Place, and Promotion).

II. RESEARCH METHODOLOGY

This study focuses on the marketing strategy of the UMKM XYZ cracker industry. Moreover, the research method used is a qualitative method with a descriptive approach. According to Walidin, Saifullah, and Tabrani (2015), qualitative research is research that aims to gain a deep understanding of the problems that occur in humans and society. The types and sources of data used in this study are primary data and secondary data. The marketing strategy for the UMKM XYZ Onion Cracker product was compiled by collecting data by conducting interviews and observations to be analyzed using the 4P marketing mix concept (product, price, place, promotion).

III. RESULT AND DISCUSSION

1. The marketing mix strategy used by UMKM XYZ

The marketing mix consists of 4P (product, price, place, promotion). The four elements in the marketing mix are supporting factors in marketing designed by the company to market products to the target market. UMKM XYZ implements a 4P marketing mix marketing strategy which includes:

a. Products

Product is anything that is offered to be noticed, owned, or consumed, so that it can fulfill wants and or needs. Planning a product includes certain activities, such as the process of identifying products to differentiate them from competing products by branding and product unique markings.

The crackers produced by

UMKM XYZ have a different taste from other onion crackers because UMKM XYZ always prioritizes the quality of the products they produce. They use raw materials of good quality to maintain the quality of products produced by UMKM XYZ in their production.

b. Price

Price is the selling value set by the seller for the products produced to be purchased by consumers. According to the size, onion crackers produced by UMKM XYZ are sold for Rp10,000 to 30,000 per pack. The application of the price has been adjusted to the quality of the raw materials used and the size per package.

c. Place

Place means two meanings. First, the place is the selection and management of trade channels used to distribute a product or service. The distribution also includes the development of delivery systems and product trading. In addition, a place can also refer to the choice of marketing location for a product or service.

The distribution channel used in the UMKM XYZ cracker business is to collaborate with distributors at a trim level, such as food stalls, stalls, and retailers. With this distribution system, UMKM XYZ entrusts its products to shops that are its customers. In addition, UMKM XYZ can also receive purchases at the cracker production site. UMKM XYZ onion crackers' production location is in the same place as the owner's residence in Bekasi City, West Java.

d. Promotion

Promotion is one of the efforts used by the company in marketing its products. In other words, promotion is the company's way of introducing and disseminating the products produced by the company to attract consumer interest.

The promotions carried out by UMKM XYZ for their products are still relatively traditional, namely by word of mouth and from shop to shop.

2. Supporting and inhibiting factors of UMKM XYZ in increasing sales volume.

Based on the results obtained, several factors can support and inhibit UMKM XYZ in increasing the sales volume of onion crackers. These factors are very influential in carrying out each strategy and require UMKM XYZ to be able to face the challenges and opportunities that exist.

a. Supporting factors

1. The product's superiority lies in the quality of the raw materials used to create a different taste from similar products and services provided by UMKM XYZ, where UMKM XYZ offers delivery services without a minimum order and additional costs.
2. Prices are set by production costs so that pricing does not differ much from competitors and can retain consumers and get new customers.
3. The exact location of the business owner so that the owner can regularly monitor product quality, packaging, and others.
4. Promotions by UMKM XYZ in marketing their products are through word of mouth, where in general, consumers will have more confidence in the product quality because it has been felt by consumers themselves which allows consumers to buy the product.

b. Inhibiting factors

1. UMKM XYZ does not add product innovation. The decrease in sales volume of UMKM XYZ onion crackers can be due to a lack of product innovation so consumers feel bored with only one product.
2. The price offered by competitors is cheaper than the price offered by UMKM XYZ, so consumers have the potential to buy crackers from

competitors.

3. The lack of UMKM XYZ efforts in carrying out promotional activities through social media, such as Instagram, Facebook, Tiktok, and others.
4. The location is not strategic because

IV. CONCLUSION

Based on this study, several conclusions were obtained regarding the marketing strategy through the 4P (product, price, place, promotion) marketing mix in increasing the sales volume of UMKM XYZ onion crackers.

1. Factors that affect the decline in sales volume of UMKM XYZ onion crackers are the lack of marketing strategies carried out by UMKM XYZ and the lack of UMKM XYZ in product innovation so that consumers tend to feel bored if only one product is marketed. UMKM XYZ can innovate products such as adding new types of

it is in a residential area, so it is not easy to reach large vehicles.

crackers to be produced so that consumers can choose what type of crackers to buy.

2. In marketing its products, UMKM XYZ still uses traditional techniques such as word of mouth and house-to-house. To increase sales volume, UMKM XYZ can use social media assistance in marketing their products so that products can be widely known not only in one area.
3. The marketing strategy that UMKM XYZ can do to increase sales volume is to innovate products, expand the target market, and increase promotional activities using social media.

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