

# Application design to help predict market demand using the waterfall method

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**Abstract:** Covid-19 has not been defeated make the economy unstable. The government increases purchasing power with a stimulus. The government's stimulus for PPnBM 0% of cars is a breath of fresh air. Sales rate increases. Even so, the ups and downs keep happening. Sales are unstable. In one to three months, five cars can be sold. It could also take 3 to 6 months, only 1 unit. Must make a strategy to avoid overcrowding of units. Like PT. Suka Fajar Ltd Medan. Companies engaged in the sale of Mitsubishi cars. As operating costs increase, management limits the acceptance of car shipments. This policy has fatal consequences. When consumers want to buy a particular car unit, it is not available. Incidents like this happened more than five times. The company's image is not good. Researched to design and build applications that can make predictions—collaborated with the linear regression. To be directed and sequential, the waterfall is used. Ensuring the application is suitable for testing with the black box. Research leads to the conclusion that the application is designed and built according to what is needed.

**Keywords:** sales prediction, linear regression, waterfall, black box, Mitsubishi cars

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## Introduction

The situation that hit the world will significantly affect human life like now, where Covid-19 has not been conquered [1], [2]. Economic conditions became unstable. People's purchasing power is also unstable. The government strives to increase people's purchasing power with a stimulus that aims to stabilize economic conditions [3], [4]. Various subsidies are disbursed so that people can buy what they need. The regulation of the economy becomes balanced. One of the stimuli carried out by the government is the issuance of PPnBM regulations of 0% for car category vehicles [5], [6], [7].

The stimulus provided by the government is a great opportunity for business actors engaged in selling and buying cars. The level of sales is increasing because people are starting to buy cars for personal use and business needs [8], [9]. Affordable prices are one of the reasons people buy cars. Nevertheless, the ups and downs of sales still occur. Purchase rates are classified as unstable. In 1 to 3 months, five cars can be sold. However, it could also be in 3 to 6 months only 1 unit; it could even be no sales at all.

Such conditions must, of course, be a concern. Unstable sales do not mean nothing is sold at all. Therefore, a strategy must be made to avoid the accumulation of car units in the Showroom. The accumulation of car units will make conditions uncomfortable, and operational costs will increase. It happened at PT. Suka Fajar Ltd Medan. A business sector that focuses on selling Mitsubishi cars. During the Covid-19 pandemic, car sales were unstable. The company's management continued to take deliveries of new cars, causing a buildup. As operating costs increased, management decided to limit the acceptance of car shipments. This policy is fatal because when consumers want to buy a specific car unit, it is not available, and the consumer has to pivot (make an order and wait for the order to arrive). This kind of incident did not happen once but more than five times. Of course, it is not very good if it is left like that. It could be that the company's image is not good in the community. Computer technology can be a solution to this problem [10]. Ni Luh Windy [11] conducted research to solve problems such as those faced by PT. Suka Fajar

Ltd Medan. It is suggested that the application by applying the linear regression method can be a solution. This method can make predictions for future needs [12], [13].

Kurniadi [14] also researched to make predictions regarding what customers' habits are. The goal is to improve service. Kurniadi uses the linear regression method in his research. Alvin [15], in his research, also uses the linear regression method in predicting the durability of high-speed ships. Similarly, research conducted by Rizky et al [16], made predictions to anticipate inventory in warehouses. Also used linear regression method. In addition to using the linear method, research conducted by [11], [15], [16], [14] also utilizes applications built with specific programming languages. So to solve the problems experienced by PT. Suka Fajar Ltd. Medan, it is possible to use applications built using a programming language in collaboration with the linear regression method [17], [18].

The research will be conducted to design and build applications that can predict market demand for car products at PT. Suka Fajar Ltd Medan. To support the strength of the application will be collaborated with the linear regression method [19]. The Waterfall method is used for the stages of designing and building a directed and sequential data application [20]. To ensure whether the application that is built is appropriate and answers the problems experienced by PT. Suka Fajar Ltd Medan will be tested using the black box method [21].

## Methodology

In this research, application development will be carried out to make predictions. In building the application in question, linear regression is used to manage forecasts, waterfall to build the system, and a black box to check whether the entire system is desired. The stages or steps that become the method in this research are:

### 1. Analysis with Linear Regression method

Analysis with linear regression is used to predict the extent of changes in the dependent variable (bound) if manipulation or changes are made to the value of the independent variable (free). Based on this, it is formed by nature [22]:

$$Y = a + bX \tag{1}$$

With Description:

- Y : Independent Variable (Bound)  
Predicted/Estimated
- a : constant (x=0)
- b : regression coefficient
- x : variable is not dependent (independent)

In order to obtain the value a and value b, the following properties are used:

$$a = \bar{Y} - b.\bar{X} \tag{2}$$

$$b = \frac{\sum XY - n.\bar{X}.\bar{Y}}{\sum X^2 - n.\bar{X}^2} \tag{3}$$

Next is to get the increase in the number of cars sold. To get it by:

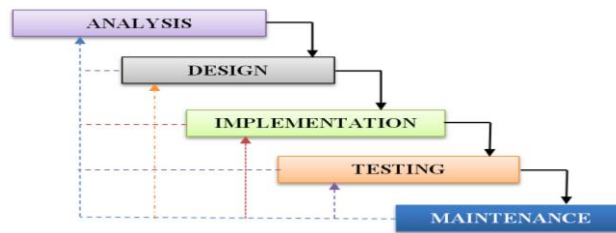
$$MS = \frac{Req\ company}{Req\ industry} \times 100\% \tag{4}$$

With Description:

- MS : Market Share
- Entrepreneur's Req : Request from company
- Industrial Req : Demand from industry

### 2. Waterfall Method

The waterfall method is a step or steps taken to design and build applications. The shape is like Figure 1 [23].



**Figure 1.** Stages of the waterfall method

The stages contained in Figure 1 have the following explanations: 1) Analysis. It is the first stage in building an application. Where will be seen what the need is; 2) Design. After knowing what the needs are, do the design or design the form of the application; 3) Implementation. Finished in the design or designed, the application is built using a computer-based programming language; 4) Testing. The completed application is tested whether there are still errors or errors in the application menu; 5) Maintenance. If there are still errors, then repairs are made until the application runs appropriately [24].

3. Test Application with Black Box

Test the application, which refers to each part of the application that is built. The application test with a black box is the final test, followed by the validation test.

**Results and Discussions**

**Results**

The results were predicted using linear regression method to see the condition of sales. The form is in Table 1.

**Table 1.** Accumulation of cars sold on a regular basis

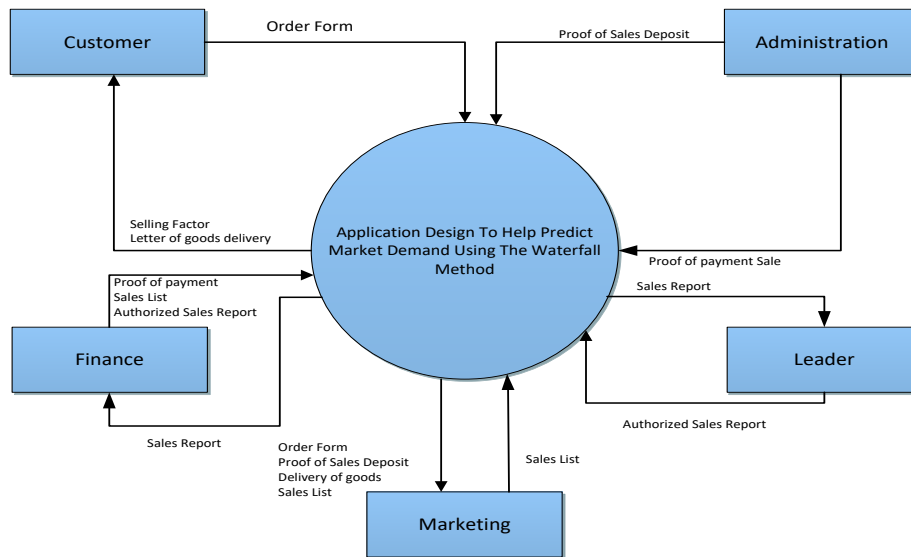
Period/Year	Y	X	X <sup>2</sup>	XY
Jan until Mar/ 2020	10	-2	4	-20
Apr until Jun/ 2020	11	-1	1	-11
Jul until Sep/ 2020	12	0	0	0
Okt until Des/ 2020	11	1	1	11
Jan until Mar/2021	12	2	4	24
Σ	56	0	10	4

So it will be found:  $X=0/5=0; Y=56/5=11,2$ . Next :  $b=(4-5.0.11,2)/(10-5.0^2)=0.4$ . Then  $a=11,2-0,4.0=11,2$ . The results of linear regression analysis are  $Y=11,2+0,4X$ . Prediction results in the following month:  $Y=11,2+0,4(3)$ . Thus  $Y=11,2+1,2, Y=12.4$ . It is concluded that sales for the next month are predicted to be at 12.4, which is then rounded up at 12. Then MS or Market Share, namely demand from companies and demand from industries, is shown in Table 2.

**Table 2.** Total market share figures

Period/Year	P	I	MS	K
Jan until Mar / 2020	10	100	10%	5%
Apr until Jun / 2020	13	260	5%	5%
Jul until Sep / 2020	15	300	5%	0%
Okt until Des / 2020	17	600	3%	2%
Jan until Mar / 2020	18	900	2%	1%

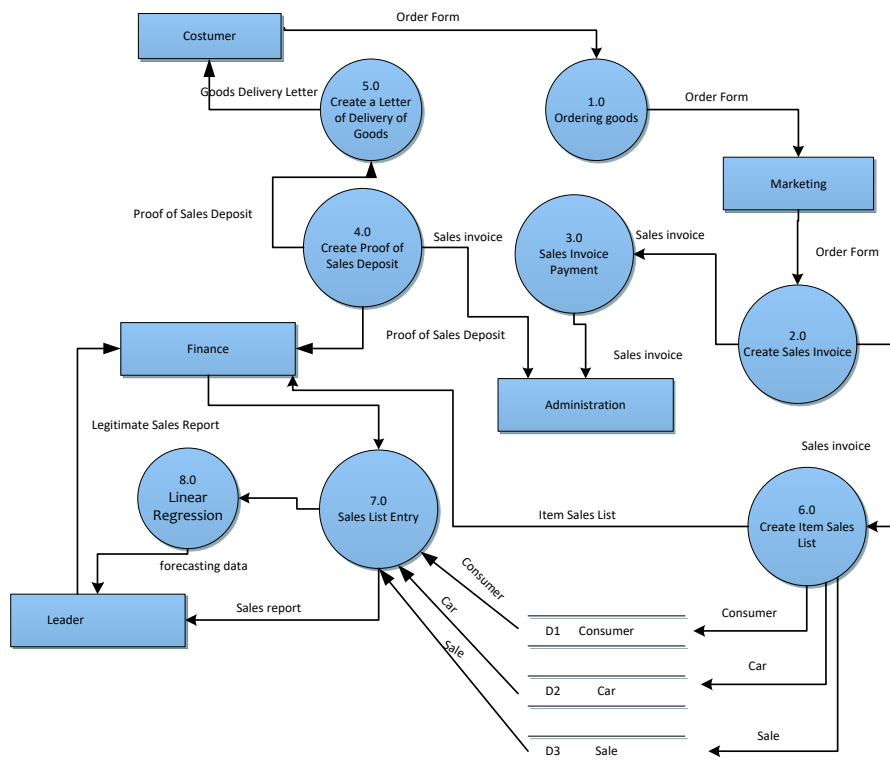
Next, the context diagram describes the application entity to be built, as shown in Figure 2.



**Figure 2.** Context diagram actualization

In Figure 2, it can be seen that five entities are part of the application, including; customers, finance, marketing, administration, and leadership. Each entity has an unbroken task and correlation with one another.

Based on the context diagram above, a data flow diagram is then built, as shown in Figure 3:

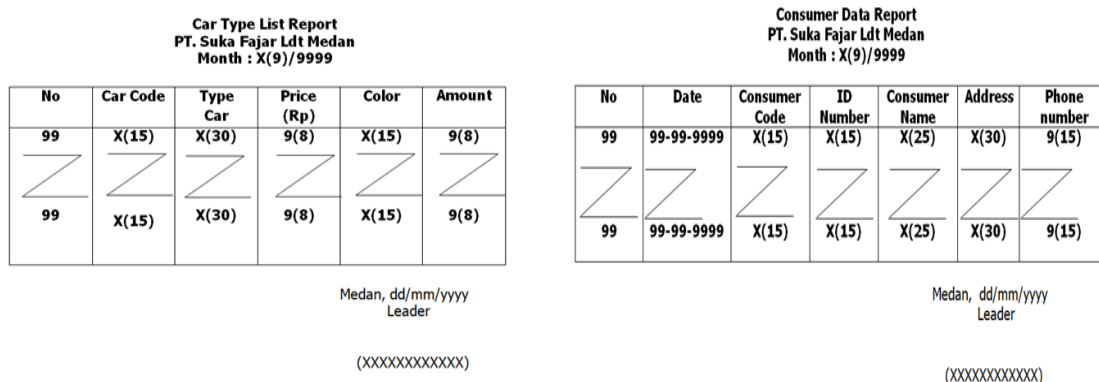


**Figure 3.** Data flow diagram

The data flow diagram is described in more detail according to the application to be built. The entities are precise, as shown in Figure 2. In Figure 3, each entity is described what its part is.

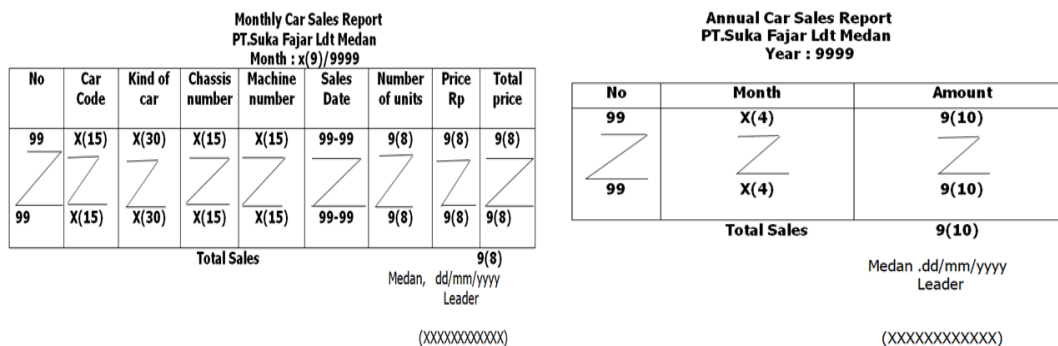
Based on Figure 2 and Figure 3, the output menu design and data input menu design are shown as follows:

1. Car Type Report Design and Customer Data Report Design  
Car Type Report Design and Customer Data Report Design can be seen in Figure 4.



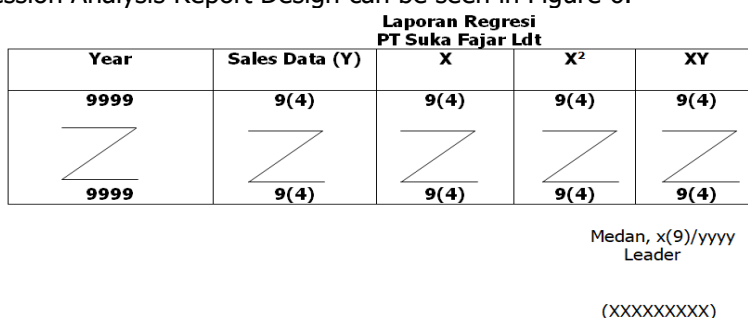
**Figure 4.** Car type report design and customer data report design

2. Draft Monthly Car Sales Report and Draft Annual Car Sales Report  
Draft Monthly Car Sales Report and Draft Annual Car Sales Report can be seen in Figure 5.



**Figure 5.** Monthly car sales report design and a draft of annual car sales report

3. Linear Regression Analysis Report Design  
Linear Regression Analysis Report Design can be seen in Figure 6.



**Figure 6.** Design of linear regression analysis report

After the report design, there is also a data input menu design. Its function is to input/enter data to be processed according to their needs. As for the plan:

1. Car Data Input Design and Customer Data Input Design  
Car Data Input Design and Customer Data Input Design can be seen in Figure 7.

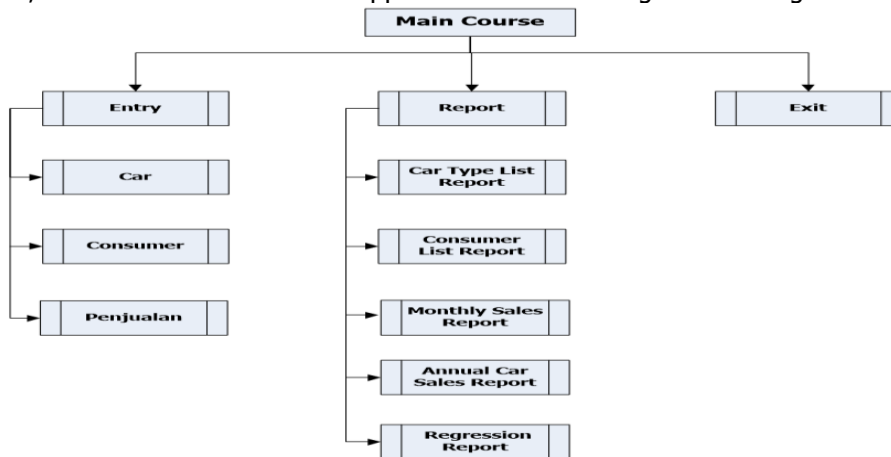
**Figure 7.** Car data input design and customer data input design

2. Sales Data Input Design

Sales Data Input Design can be seen in Figure 8.

**Figure 8.** Car data input design and customer data input design

The existence of a report menu design per section according to the application being built, accompanied by an input menu design to enter data as needed, then the application structure is also designed which includes the position of the data input component, the position of the report component, and the button to exit the application. For the design form in Figure 9:



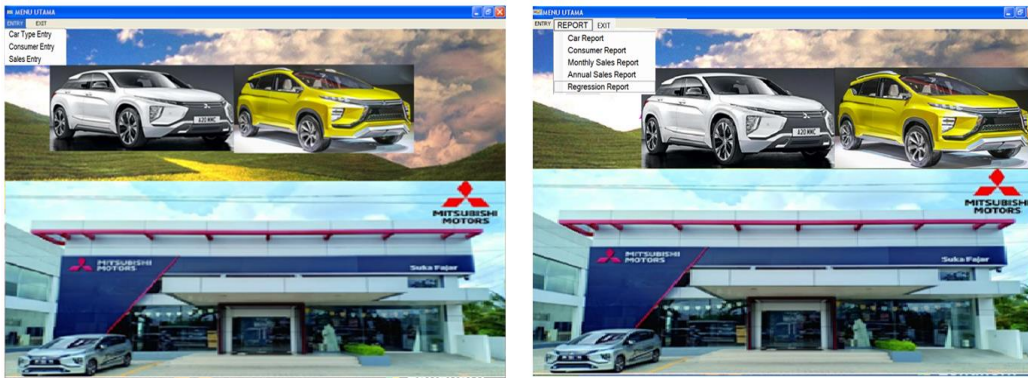
**Figure 9.** Application main menu design

**Discussions**

After the design or design is carried out, application development refers to the design or design that has been made. For the application menu in the form of implementation, as follows:

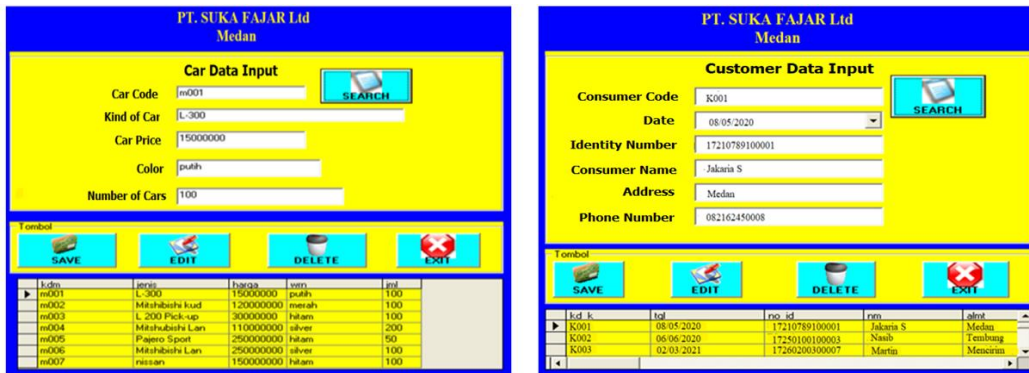
1. Main Menu Actualization Form and Report Menu Actualization Form

Main Menu Actualization Form and Report Menu Actualization Form can be seen in Figure 10.



**Figure 10.** Main menu actualization form and report menu display

2. Car Data Input Actualization Form and Customer Data Input Actualization Form  
Car Data Input Actualization Form and Customer Data Input Actualization Form can be seen in Figure 11.



**Figure 11.** Car data input actualization form and display of customer data input

3. Sales Data Input Actualization Form  
Sales Data Input Actualization Form can be seen in Figure 12.



**Figure 12.** Car data input actualization form and display of customer data input

4. Update Car Data Report and Update Customer Data Report  
Update Car Data Report and Update Customer Data Report can be seen in Figure 13.

**CAR TYPE LIST REPORT**  
PT. SUKA FAJAR Ltd Medan  
Month Mei/2020

No	Car Code	Kind of Car	Price	Color	Amoun
1	n001	L-300	15,000,000	putih	100
2	n002	Mitsubishi kool	120,000,000	merah	100
3	n003	L 200 Pick-up	30,000,000	hitam	100
4	n004	Mitsubishi Lan	110,000,000	cilver	200
5	n005	Pajero Sport	250,000,000	hitam	50
6	n006	Mitsubishi Lan	250,000,000	cilver	100
7	n007	nissan	150,000,000	hitam	100

**CUSTOMER DATA REPORT**  
PT. SUKA FAJAR Ltd Medan  
Month Mei/2020

No	Date	Code	Id Number	Name	Address	Phone
1	08/05/2020	K001	127101100001	Jakaria S	Medan	08216255890
2	01/05/2020	K002	127301010002	Nasib	Tebing	08237568901
3	23/05/2020	K003	127523040003	Martin	Meairim	08126356352
4	25/05/2020	K004	127202031004	Fadli	Selayang	08526574567
5	27/05/2020	K005	127110110004	Fathoni	Pakam	08116058934
6	30/05/2020	K006	127203040568	Lisa	Paya Geli	08126549023

**Figure 13.** Car data report actualization and customer data report actualization

- Update Monthly Sales Report  
Update Monthly Sales Report can be seen in Figure 14.

**MONTHLY SALES REPORT**  
PT. SUKA FAJAR Ltd Medan

Month Mei/2020

No	Car Code	Car Kind	Chassis	Machine	Sale Date	Amount	Price	Total
1	n001	L-300	RNGK90GT	MNJ45GDE	05/Mey/2020	2	17,000,000.00	34,000,000.00
<b>Total Sales</b>								<b>34,000,000.00</b>

**Figure 14.** Sales data report actualization

- Update Linear Regression Analysis Report  
Update Linear Regression Analysis Report can be seen in Figure 15.

**LINIER REGRESSION ANALYSIS REPORT**  
PT. SUKAFAJAR Ltd Medan

Amount	X	X^2	XY
10	-2	4.00	-20.00
11	-1	1.00	-11.00
12	0	0.00	0.00
11	1	1.00	11.00
12	2	4.00	24.00
<b>Sales For Next Year Are</b>			<b>12.40</b>

**Figure 15.** Linear regression analysis report actualization

After the implementation of each part in the application is displayed, the next step is to test the level of suitability for the use of each part in the application. For testing using the black box, the method can be seen in Table 3.



**Table 3.** Conclusion of Black Box Test

No	Test Type	Decision
1	Executing Apps	No Error
2	Enter Login	No Error
3	Entering Car Data	No Error
4	Entering Sales Data	No Error
5	Entering Customer Data	No Error
6	Show Car Data Report	No Error
7	Display Sales Data Report	No Error
8	Viewing Customer Report	No Error
9	Showing Regression Report	No Error
10	Show Sales per month	No Error
11	Show Sales per year	No Error

After that, a feasibility test is carried out for use. The test is carried out by providing a form to be filled out by the management of PT. Suka Fajar Ltd. Medan and its staff and employees. The number of filling sheets to be filled in was 60 people. The number of questions that must be filled in on the sheet that is distributed is 16 questions. The choice of filling consists of; Strongly Agree, Agree, Still Gray, Disagree, and Strongly Disagree. The results filled in on the question sheet that are distributed are then adjusted using the Likert scale. For adjustments, namely, Strongly Agree (5), Agree (4), Still Gray (3), Disagree (2), and Strongly Disagree (1).

After recapitulation, for each component, the following answers were found; Strongly Agree (231), Agree (537), Still Gray (275), Disagree (95), and Strongly Disagree (2). When added up, the total number is 4320—the number found in the whole accumulation. With the number of numbers accumulated and divided by the number of management, staff, and employees, the number 72 is found. For the number 72, if it is matched with conversion, it is categorized as Eligible. So that a correlation can be drawn if the application is categorized as Eligible.

## Conclusion

The stages carried out in the research on Application Design to Help Predict Market Demand Using the Waterfall concluded that the application designed and built was by what was needed by PT. Suka Fajar Ltd Medan. Part of the application can be appropriately used with the appropriate categories. For utilization, it is also in the Eligible category. The prediction menu can also run as expected. So with this application, PT. Suka Fajar Ltd Medan can exercise control over the sales made.

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