

## EFFICIENCY ANALYSIS ON TRADITIONAL MARKET IN SALATIGA, AN APPLICATION OF DATA ENVELOPMENT ANALYSIS

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### ABSTRACT

*Salatiga City is one of the cities in Jawa Tengah that has revitalized all traditional markets. The research objective was to analyze the comparison of the efficiency level of traditional markets in Salatiga. The quantitative research method with the analytical tool used is the Data Envelopment Analysis model of Charnes, Cooper, and Rhodes (CCR). The research object is eight traditional markets in Salatiga City. The dependent variable of this research is the efficiency value of traditional markets in the City of Salatiga. The independent variables in this study include two variables, namely the input and output variables. Research findings when data collection is that the two UPTDs as market managers have different categories of managed market management. The results of the study were that the eight markets had different results. The results of four markets are efficiency, two markets have inefficiency results, and two markets cannot be analyzed. Research suggestion is to achieve efficiency in traditional markets that are not efficient can be achieved when referring to market value efficiency.*

**Keywords:** *Data Envelopment Analysis (DEA), CCR models, Traditional market*

### 1. INTRODUCTION

This study aims to analyze the comparison of the efficiency level of traditional markets in Salatiga with the Data Envelopment Analysis Method. Badan Pusat Statistik (BPS) (2019) that Central Java has a total market of 1,482 units and is the second largest market in Indonesia. Salatiga City is one of the cities in Central Java that is revitalizing all traditional markets. The implementation of revitalization in Salatiga City was followed by the application of digitalization on the withdrawal of retribution for traditional markets (Pemerintah Kota salatiga, 2019). The application of digitizing the trade levy is a step from the Office as an innovation to pursue the target of retribution for local revenue (PAD) (Provinsi Jawa Tengah, 2021). The implementation of revitalization has the aim of increasing trading centers by generating the interest of traders and buyers to re-transact in traditional markets.

The traditional market of Salatiga City applies a 3-year rental-free policy for market participants in the newly built markets. Traditional markets in the area help run the economy so that it increases in line with the increase in the number of necessities of life which results in slow market development (Sitohang et al., 2020). Traditional markets are one of the economic wheels for business people. Major and Tannous (2020) said that traditional markets are pedestrian markets that are accessible to the public including buildings that have alleys, plazas and many shops. The market is a place where people gather to carry out buying and selling and social activities. The market is also called a closed area outside or indoors which is permanent or temporary.

Ren, Shih and McKercher (2014) describe revitalization as a program of rebuilding buildings that are outdated and fail to meet the needs of contemporary or potential users. Revitalization is one of the government's steps in maintaining the existence of traditional markets in the current era. Adiyadnya and Setiawina (2015) argue that revitalization is a form of program issued by the government related to the development of urban development. This program was issued to remove the bad image that is usually attached to traditional markets. Revitalization has the aim of repairing weaknesses in traditional markets so that visitors to traditional markets can increase.

The revitalization of traditional markets has variations in several places. The core of the revitalization program is a series of integrated and comprehensive actions designed to solve problems, promote sustainable development, and increase the competitiveness of regional development (Kiss, 2007). The Ministry of Trade is of the opinion that the concept of revitalizing traditional markets is a physical and non-physical redevelopment related to market management and integration with other sectors. Physical market building revitalization has the aim of improving the market image from a bad impression.

Physical revitalization must be accompanied by non-physical revitalization including economic, management and social revitalization. Economic revitalization is rebuilding to increase income and accommodation of informal and formal economic activities in traditional markets. Management revitalization is a redevelopment that focuses on the process of placing market traders, financing/capital of revitalization programs, and standard operating procedures for market services. Socio-cultural revitalization is the rebuilding of a market environment that can improve the dynamics and social life of the community.

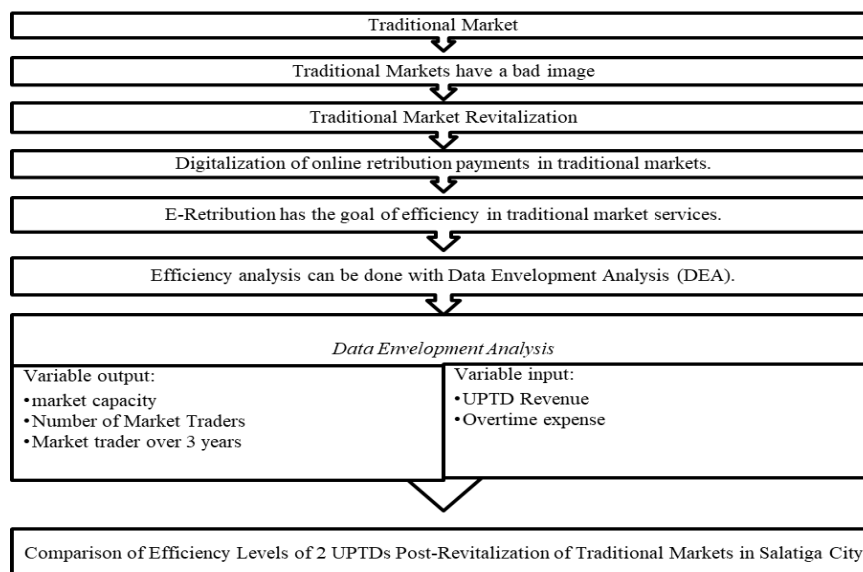
Exploration of economic and social attitudes in the revitalization program has a perception of sustainability and influences on community involvement in traditional markets. The partnership between the people and the government is effective because it allows the people involved to take control of the process. Variables of economic activities and social activities have a positive influence in supporting environmental aspects. Of these two variables, economic activity is more dominant in influencing environmental aspects than social activities (Gravitiani et al., 2019).

After the traditional market revitalization process in Salatiga City, the competition between modern markets and traditional markets can still be seen. Traditional markets are just starting to emerge, but the interest of traders to sell in the market has not increased. Traditional market management is the responsibility of market managers and market users. The achievement of different target markets makes the performance of traditional markets need to be analyzed. Performance measurement of traditional markets can be done with efficiency analysis to determine the level of efficiency of traditional markets (Murbarani, 2018).

Efficiency is the comparison value between the input variable and the output variable. Efficiency measurement can use the Data Envelopment Analysis (DEA) method. Widiyana and Indiyanto (2017) explain that Data Envelopment Analysis (DEA) is an important tool used to evaluate and improve the performance of a company or factory. The application of DEA analysis includes performance evaluation and benchmarking in hospitals, banks, education institutions, and others. Widiarto et al., (2017) explain that DEA is a linear programming method of non-parametric efficiency assessment to determine the efficiency assessment of decision-making units that involve many inputs and outputs. The Decision Making Unit is also called the Decision Making Unit (DMU) which means the company or factory that is the object of research from the DEA.

Previous research explains if DEA analysis is used to analyze the efficiency of the performance of a company or factory. Widiyana and Indiyanto (2017) argue that DEA research can help measure the level of efficiency so that the five branches of the Heaven Store which are the object of research can improve service quality after knowing the comparison of the efficiency and inefficient results of the five branches. Murbarani (2018) argues that traditional markets that have been revitalized have both efficiency and inefficiency results in the DEA analysis. Research on traditional markets in Surakarta proves that there are 24 traditional markets analyzed. The 24 traditional markets resulted in 9 efficient markets and 15 inefficient markets. Fatimah and Mahmudah (2017) explain the DEA analysis on the object of research 103 elementary schools in Jakarta. The results of the analysis prove that only 14 elementary schools have efficiency scores, while the other 89 elementary schools have inefficiency scores. Niswati (2014) argues that the DEA analysis on the branch company of PT. XYZ has a three-pronged efficiency result and two branches has a lower-efficiency value, which is below one ( $<1$ ).

The description of the background above, it is known that efficiency analysis using the DEA method needs to be carried out to determine the achievement targets of each market. The level of achievement of different traditional markets makes the efficiency of traditional markets in Salatiga City need to be analyzed to determine the efficiency level of traditional market management in Salatiga City. This study will analyze the efficiency level of traditional markets that have been revitalized in Salatiga City with the Data Envelopment Analysis Method.



**Figure 1. Research Concept**  
Source: Widiyana and Indiyanto 2017

The framework of thought in this study begins with buying and selling transactions that occur in the traditional market of Salatiga City. Transactions that occur in traditional markets have decreased every year because of the bad image of traditional markets. The Salatiga City Government then implemented a revitalization program and the construction of a new market according to the government's recommendation according to Law number 7 of 2014 concerning Trade. The implementation of the revitalization program in traditional markets is also accompanied by the implementation of E-Retribution payments. Electronic payments are assessed by the market manager, namely UPTD, as an efficiency of market management. Traditional market efficiency analysis can be known by using Data Envelopment Analysis (DEA) analysis tools. DEA analysis with input and output variables regarding traditional market management. This study will analyze the comparison of the efficiency levels of 8 traditional markets in Salatiga City. The result of the research is a comparison of the efficiency levels of eight traditional markets after the revitalization of traditional markets in Salatiga City.

## 2. RESEARCH METHOD

This study uses efficiency analysis to analyze eight traditional markets in Salatiga City. The object of research is a traditional market that has been revitalized. There are 12 traditional markets in Salatiga City, with eight revitalized traditional markets and four still in progress. The four traditional markets are closed until the revitalization project is completed, according to the market manager. Eight traditional markets that have been revitalized have service innovations, namely E-Retribution. The research was conducted by taking a sample of eight traditional markets that have been revitalized and have implemented E-Retribution.

Data analysis was carried out using quantitative methods, namely the Data Envelopment Analysis (DEA) analysis tool. Creswell (2013) argues that quantitative methods involve the process of collecting, analyzing, interpreting, and writing the results of a study. Quantitative methods exist in surveys and experimental research that are concerned with identifying samples in the population, determining the type of design, collecting and analyzing data, presenting results, making interpretations, and writing research consistent with surveys or experimental studies. The following analysis tools in research:

### (1) Data Envelopment Analysis (DEA)

DEA is a tool to evaluate and improve the performance of a business of goods or services. The selection of DEA analysis is used to determine the level of efficiency of traditional markets in Salatiga City. Widiyana and Indiyanto (2017) argue that the DEA application is used for performance evaluation and benchmarking in educational institutions, hospitals, bank branches, production plans and others.

The DEA approach is used to separate purely technical efficiency from scale efficiency. CRS in the Charnes, Cooper, and Rhodes (CCR) models. Constant Return to Scale (CRS) is a confounding scale and technical efficiency effect. CRS is a measure of the maximum efficiency of the output and input that is weighted and has the same lower limit value on each DMU so as to produce a constant value comparison. The approach is used to determine which practices operate differently on increasing/decreasing the yield scale limit and can assign changes to the efficiency rating model after the scale effect is taken into account so that it can be concluded if the DEA approach is taken into account for the efficiency scale measurement (Milliken et al., 2011).

The DEA Analysis Formula are as follows:

$$h_s = \frac{\sum_{i=1}^m u_{is}y_{is}}{\sum_{j=1}^n v_{js}x_{js}} \quad (1)$$

$h_s$  = Traditional Market efficiency

$u_{is}$  = the value of the output weight i of the Traditional Market s

$y_{is}$  = total output i from Traditional Market s

$v_{js}$  = value of input weight j from Traditional Market s

$x_{js}$  = the number of input j, which is produced by Traditional Market s, is calculated from j = 1 to n.

The following is a linear transformation performance measure that maximizes:

Maximizes 
$$h_s = \sum_{i=1}^m u_{is}y_{is} \quad (2)$$

Obstacles 
$$\sum_{i=1}^m u_{is}y_{is} - \sum_{j=1}^n v_{j}x_{js} \leq 0, s = 1, 2, \dots, N \quad (3)$$

$$\sum_{j=1}^n v_{j}x_{js} = 1 \text{ dan } u_i \text{ dan } v_j \geq 0$$

## (2) DEA Analysis Phase on Excel Solver

Ray and Chen (2015) argue that a number of alternative data from performance can explain in detail a non-parametric approach that can be applied to various situations and is very useful when input and output price data are not available. The non-parametric DEA method was introduced by Charnes, Cooper, and Rhodes (CCR) in 1978. The following are the stages of DEA analysis using an Excel solver (Ray & Chen, 2015):

(a) Excel Solver is used to measure the efficiency of all input and output units in the sample at once.

(b) Visual Basic for Application (VBA) Macro to measure the cost efficiency of a factory/company.

The use of the DEA Cost model applies the data for the traditional market of Salatiga City. This data set includes eight objects of observation. Input-output data are the results obtained from direct interviews with UPTD managers.

(c) The analysis uses 3 outputs and 2 inputs. The DEA model can be expressed as follows:

First, initial analysis using CCR stage with orientation towards output. Then, import data into Excel spreadsheet Solver with column A steps recording the name of the Decision Making Unit (DMU) that has been determined, columns B to F recording showing the original data for output and input. VBA Macro will direct to save the data analysis which will appear after clicking "OK". The results of data analysis will appear after "save". The next step is to type "exit" then the results of the data analysis will be divided into 9 sheets. The 9 sheets have summarized the DEA analysis so as to facilitate research such as slack, summary, score, weight, weightdata, rank, projection, and graph.

## 3. RESULTS AND DISCUSSION

The findings of the study during data collection were that the two UPTDs had different managed markets. This difference makes the two UPTDs have differences in the number of personnel, market capacity, and challenges faced.

UPTD is under the auspices of the Salatiga City Trade Office. UPTD management of the market is not like the management of a private company which has the authority to manage its own territory. The UPTD still has links with the above agencies, namely the traditional market revenue and expenditure department, the budget requirements draft that was submitted in the previous year. The powers of the UPTD are as follows:

(1) Submitting complaints or information from market traders to the Trade Office regarding market maintenance.

(2) conducting surveys and schedules for repairing traditional markets.

- (3) Delivering information from the government to be conveyed to market traders.
- (4) Distribute market retribution fees to the Trade Office.
- (5) carry out control to maintain market safety, comfort, and cleanliness.

DEA analysis using Excel Solver version 8 with CCR model – output oriented. The following are the results of the analysis of input and output data in table 1.

**Table 1. Results of input and output data analysis**

DMU	(O) Market Capacity (Kiosk)	(O) Traders (People's)	(O) Traders > 3 years (People's)	(I) Revenue (Month)	(I) Overtime Expense (Month)
Raya I	1212	1058	240	Rp28.179.000	Rp900.000
Raya II	879	641	324	Rp21.375.000	Rp900.000
Blauran I	778	778	110	Rp17.328.000	Rp900.000
Blauran II	119	119	8	Rp2.571.000	Rp900.000
Ayam	150	133	19	Rp6.420.000	Rp900.000
Oprokan Owing Buah	60	60	0	Rp1.800.000	Rp900.000
Oprokan Raya II	15	15	0	Rp450.000	Rp900.000
Eks Hasil	78	78	4	Rp3.510.000	Rp900.000

Source: Dinas Perdagangan 2021a, 2021b, 2021c, 2021d, 2021e, 2021f, 2021g, 2021h

**Table 2. DEA Score Analysis on Excel Solver**

DMU	Score	Reference (Lambda)	Score	Reference (Lambda)	Score
Raya I	1	Pasar Raya I	1		
Raya II	1	Pasar Raya II	1		
Blauran I	1	Blauran I	1		
Blauran II	1	Blauran II	1		
Ayam dan Ikan	0,5173	Blauran I	0,299	Blauran II	0,484
Oprokan Owing Buah	0,7202	Blauran II	0,7		
Oprokan Raya II					
Eks Hasil					

Source: Secondary and Primary data processed 2021

**Table 3. Projection DEA input variable on Excel Solver**

No	DMU	Monthly			
		Pendapatan (Rupiah)		Biaya Lembur (Rupiah)	
		Data	Projection	Data	Projection
1	Pasar Raya I	Rp. 28.179.000	Rp. 28.179.000	Rp. 900.000	Rp. 900.000
2	Pasar Raya II	Rp. 21.375.000	Rp. 21.375.000	Rp. 900.000	Rp. 900.000
3	Blauran I	Rp. 17.328.000	Rp. 17.328.000	Rp. 900.000	Rp. 900.000
4	Blauran II	Rp. 2.571.000	Rp. 2.571.000	Rp. 900.000	Rp. 900.000
5	Pasar Ayam	Rp. 6.420.000	Rp. 6.420.000	Rp. 900.000	Rp. 704.195,8
6	Oprokan Owing Buah	Rp. 1.800.000	Rp. 1.800.000	Rp. 900.000	Rp. 630.105
7	Oprokan Raya II	-	-	-	-
8	Eks Hasil	-	-	-	-

Source: Secondary and Primary data processed 2021

**Table 3. Projection DEA output variable on Excel Solver**

Monthly							
No	DMU	Kapasitas Pasar (Kios)		Jumlah Pedagang (per Orang)		Jumlah Pedagang >3 tahun (per orang)	
		Data	Projection	Data	Projection	Data	Projection
1	Pasar Raya I	1212	1212	1058	1058	240	240
2	Pasar Raya II	879	879	641	641	324	324
3	Blauran I	778	778	778	778	110	110
4	Blauran II	119	119	119	119	8	8
5	Pasar Ayam	150	289,97	133	289,97	19	36,73
6	Oprokan Owing Buah	60	83,31	60	83,31	0	-
7	Oprokan Raya II	-	-	-	-		
8	Eks Hasil	-	-	-	-		

Source: Secondary and Primary data processed 2021

**Table 4. Slack Analysis on input-output variable to DMU**

DMU	Slack Revenue	Slack Overtime Expense	Slack Market Capacity	Slack Total Traders	Slack Total Traders > 3 years
Pasar Raya I	0	0	0	0	0
Pasar Raya II	0	0	0	0	0
Blauran I	0	0	0	0	0
Blauran II	0	0	0	0	0
Pasar Ayam	0	195804,234	0	32,864	0
Oprokan Owing Buah	0	269894,982	0	0	5,596
Oprokan Raya II					
Eks Hasil					

Source: Secondary and Primary data processed 2021

Research data table 1 describes DMU using eight traditional markets with three output variables and two input variables. The data obtained is data in the period of months from the management of traditional markets. The research data obtained were processed using DEA analysis in Excel Solver. The results of the DEA analysis include analysis of scores, projections, and slack.

The results of the score analysis in table 2 describe the eight traditional markets showing that if only four markets are efficient, the four markets have a score of one. The traditional Oprokan Raya II market and the Ex Hasil market have empty results. A blank result proves the analysis cannot be known. The traditional market for Ayam dan Ikan and Oprokan Owing Buah has an inefficient result, which is less than one ( $< 1$ ). The Ayam dan Ikan Market has a score of 0.5173 and the Fruit Oprokan Market has a score of 0.7202. Analysis of lamda value on inefficient market refers to efficient traditional market value. The achievement of efficiency in the Ayam dan Ikan Market refers to the Blauran Market I value of 0.299 and Blauran Market II of 0.484. The achievement of efficiency in the Oprokan Owing Fruit Market refers to the Blauran I Market value of 0.7.

Table 3 and Table 4 explain that projection analysis is used as a reference for inefficient DMUs to be converted into DMUs that have efficient values. If the DMU is not efficient, if it is to be converted into an efficient DMU, the input and output values that are owned must be changed according to the projection value. Projection is the input/output value that should be generated or used by a DMU in the production process so that the DMU can have efficient results. The projection results are rounded up to facilitate the discussion of the DEA analysis. The data shows that the income input variable has the results of all DMU projections in accordance with the data. Differences in projections and data occur in one variable input overtime and three output variables, namely market capacity, number of traders, number of traders more than 3 years.

The projection results that are different from the data occur in the Ayam dan Ikan Market and Oprokan Owing Buah Market. The following is a projected analysis of the market that has different projection results from the data:

- (1) The Ayam dan Ikan Market has the following projected values:
  - (a) Table 3 explains that the input variable for overtime costs has a projected value of Rp. 704.196. Data value Rp. 900,000 means that the total overtime fee received by the Ayam dan Ikan market manager is Rp. 900,000. The analysis explains if the overtime cost is too high, so that the achievement of the DMU efficiency value for the Ayam dan Ikan market can be achieved if the data value is reduced to reach the projected value of Rp. 704.196.
  - (b) Table 4 explains that the market capacity output variable has a projected value of 83. The data value is 60 kiosks/los, proving that the fruit pickle market can accommodate as many as 60 traders. The analysis explains if the capacity at the Ayam dan Ikan Market needs to be increased to achieve efficiency results. The efficient achievement of DMU for the fruit pickle market can be achieved if the market capacity is increased to a total of 83 kiosks/los.
  - (c) Table 4 describes the output variable of market traders having a projected value of 83. The data value of 60 traders means that the Ayam dan Ikan market can accommodate as many as 60 traders. The analysis explains if the number of Ayam dan Ikan market traders needs to be increased to achieve efficiency results. The achievement of the efficient value of DMU for the Ayam dan Ikan market can be achieved if the market traders are increased to 83 traders per stall/los. The projected value of market traders has the same value as the projected market capacity.
  - (d) Table 4 describes the output variable of market traders > 3 years having a projected value of 37. The data value shows 19, proving that the Ayam dan Ikan market has 19 traders who have occupied market stalls for more than 3 years. The analysis explains that if the Ayam dan Ikan Market traders occupying more than 3 years must be increased to achieve efficiency values. The achievement of efficiency values in DMU can be achieved if there are an additional number of traders occupying stalls/los in the market up to 37 people.
- (2) The Oprokan Owing Fruit Market has the following projected values:
  - (a) Table 3 explains that the input variable for overtime costs has a projected value of Rp. 630.105. Data value Rp. 900,000 proves that the total overtime fee received by the fruit oprokan market manager is Rp. 900,000. The analysis explains if the overtime costs for the Oprokan Buah managers need to be reduced to achieve efficiency results. 630.105.
  - (b) Table 4 explains that the market capacity output variable has a projected value of 290. The data value of 150 proves that the Ayam dan Ikan market can accommodate as many as 150 traders. The analysis explains if the capacity of the Ayam dan Ikan Market needs to be increased to achieve efficiency results. The achievement of the efficiency of the Ayam dan Ikan Market DMU can be achieved if the market capacity is increased to accommodate 290 traders.
  - (c) Table 4 explains that the market trader output variable has a projected value of 290. The data value of 133 traders proves that the Ayam dan Ikan market accommodates 133 traders. The analysis explains if the number of Oprokan Owing Fruit traders needs to be increased to achieve efficiency results. The efficiency value can be achieved if the number of traders is increased to 290 people. The relationship between the available places in the market and the number of traders, makes the projected value of market traders have the same value as the projected market capacity.
  - (d) Table 4 describes the market traders' output variables > 3 years having empty results. The fruit market does not have traders who have occupied the kiosk for more than 3 years, so the projection results and data values show empty results.
- (3) The Oprokan Raya II market and the ex-product market have an empty score column. The analysis of market projections for Oprokan Raya II and ex-products has empty columns in table 3.3 and table 3.4. The empty column proves that linear programming has no solution to the market, so the DMU data includes an empty or infinite set. Rahmania et al (2014) describe DEA research including linear programming research. Program research has statements that are true as follows:
  - (a) A linear program that has no solution, then the data is an empty or infinite set.
  - (b) A linear program that has a feasible solution or a solution that will be implemented, then a solution based on the data also exists.
  - (c) If a linear program has an optimal solution, then an optimal basis solution also exists.

Table 5 describes the slack analysis. DMU slack or weakness is a condition where the DMU experiences a shortage when compared to other DMUs, so it is necessary to add other inputs and outputs. Slack occurs in input output variables with DMU Ayam dan Ikan Market and Fruit Owing Market. Four markets, namely Pasar Raya I, Pasar Raya II, Pasar Blauran I, and Pasar Blauran II have 0 results which indicate that there is no slack in data analysis. The Four Markets in the DEA analysis proves that it does not require additional inputs and outputs in the analysis because there is no slack in the data. Oprokan Raya II and Ex Results do not have analysis results because the analysis of efficiency scores does not know the results of the analysis.

The DMU of the Ayam dan Ikan Market and the Owing Fruit Market experienced a weakness in the DMU or slack. The Ayam dan Ikan Market experienced DMU weakness on overtime input and on the number of traders output. The value of slack in the Ayam dan Ikan market indicates the value that must be achieved if you want to increase its efficiency. The value that must be achieved by the Ayam dan Ikan market is Rp. 195,804 for additional overtime costs and 33 people for adding variable output to market traders. The Fruit Owing Market suffers from DMU weakness on the input of overtime and on the output of the number of traders more than 3 years. Slack in the fruit owning market indicates the value that must be achieved if you want to increase its efficiency, namely Rp. 269,894 for overtime costs and the addition of six people for the number of traders more than 3 years.

#### 4. CONCLUSIONS

The conclusion from the analysis of data envelopment at eight Traditional Markets in Salatiga City is as follows:

- (1) Eight traditional markets in Salatiga that become DMU have different analysis results. Four traditional markets have an efficiency score of 1. Two traditional markets have inefficiencies, namely 0.5 for the Ayam and Ikan market and 0.7 for the Oprokan Owing Buah market. Ayam and Ikan market must refer to Blauran Market I and Blauran Market II to obtain efficiency results. The Fruit Oprokan market must refer to the Blauran I market value to obtain an efficiency value. Oprokan Raya II and Ex traditional markets have no analysis results, data cannot be analyzed.
- (2) The projection value on the income input variable data has been efficient among the six DMUs, except for two DMUs, namely the Ex-Produce and Oprokan Raya II market. The Ayam and Ikan market and Oprokan Owing Buah markets have data results that need to be added or subtracted to match the projected results.
- (3) Weaknesses of DMU in the study occur in two traditional markets. The Ayam and Ikan market and the Oprokan Owing Buah market require additional inputs and outputs, if they are to achieve efficiency in managing these two markets.

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