

Research Article

# Determining Sales Performance Efficiency in Bank X Using Data Envelopment Analysis (DEA) Model

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**Abstract:** *The profitability of the bank is determined by how well the salespeople can generate revenue through their activities. Bank X, a private-owned bank in Indonesia, faced a persisting challenge of performance discrepancy. This situation indicates the difference in the efficiency of the salespeople or Relationship Managers in creating output for the bank. The analysis focuses on the sixteen branches located in Jakarta. Using the two-stage Data Envelopment Analysis (DEA) model, the calculation considers input, intermediary measures, and output to be included based on the data acquired from each branch. The result shows that some branches scored perfect efficiency in processing input into intermediary measures and intermediary measures into output. These branches are compared to those with non-perfect efficiency results and compared across three different perspectives to understand their reasons for disparity: demography, competency, and personality of the salespeople. The study also discussed the possibility of differences in personality traits between branches with perfect efficiency and non-perfect efficiency. Furthermore, based on the DEA model, the result can provide for future implementation in human capital improvement.*

**Keywords:** *Data Envelopment Analysis (DEA), Performance Efficiency, Relationship Manager, Salespeople Performance.*

## I. INTRODUCTION

A lot of researchers and practitioners have defined sales performance as the evaluation of salespeople based on their activities and ability to produce output. Some applications of the latter are the measure of sales volume, revenue, and number of new accounts opened, and another measure that may capture the result of sales activities (Zalocco et al., 2009). The variables used for this metric should be able to reflect the performance of the organization—revenue, for example, has the ability to substitute for accounting earnings and profitability (Huang et al., 2015). Most banks in Indonesia apply a top-down organization where upper management has full control of revenue targets assigned to the branches under its wing of controls as well as the location distribution of the salespeople. This practice will consider the collective achievement of sales that are located in one branch as the branch's performance. Based on the collective target and achievement of RM in one branch, the stakeholders can evaluate the performance of the whole branch or unit. The branch that can generate the most output for the company is considered to be the most efficient branch, the best-practicing branch compared to the rest of the pool (Sherman & Ladino, 1995).

The Data Envelopment Analysis (DEA) method has been long used to evaluate sales performance efficiency. The DEA method is used to compare efficiency between decision-making units (Charnes et al., 1978), and each branch is seen as a set of inputs and outputs of performance. This method has been used to measure the efficiency of a bank's sales performance since being made public in 1978, including Sherman and Ladino (1995), Schaffnit et al. (1997), and Cook and Hababou (2001) who tested this method to review the efficiency of Canadian bank's branches. The popularity of this method was due to DEA's benefits, which are that it can identify the most efficient units against certain benchmarks, as opposed to other more popular methods such as regression analysis (Shewell and Migiro, 2016).

Based on these premises, this paper aimed to use the DEA method to review the efficiency of branch performance of a private bank in Indonesia (Bank X) and provide analysis based on the result presented by the model. This analysis will be limited to the data provided by the respective bank and only use variables that are included in the existing performance measurement scoring method.

## II. LITERATURE REVIEW

The Data Envelopment Analysis (DEA) Model was introduced by Charnes, Cooper, and Rhodes in 1978. The model focuses on evaluating the performance of the organization by determining the ratio of output over input. Such evaluation is often referred to as a commonly used metric of efficiency (Cooper et al., 2006). As a mathematical modelling technique, the DEA model started to become widely known as an index to measure performance efficiency after its original initiators. Charnes, Cooper, and Rhodes (1978) explored the use of the DEA Model in a business context. Later publication by Cooper (2014) also



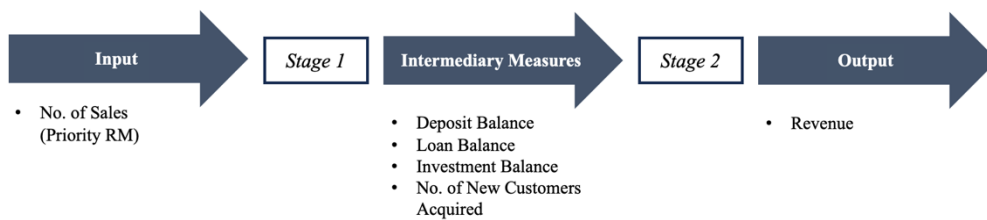
mentioned that the term Decision Units (DMUs) was coined to highlight the objective of DEA, as the term might be more useful and relatable for organizational managers and policymakers related to measuring efficiency between business functions.

In the case study of banks, most input and output variables are based on the reference of the activity performed in the branch. Schaffnit et al. (1997) utilized the number of personnel from different functions on the branch level as inputs for variables. Five different inputs, measured by the number of personnel in five different functions, are taken as input variables. The activities required to be completed by the personnel are considered output and classified as six transaction-related activities and three maintenance-related activities. The discussion compared the result between two different approaches; the first one only considered transaction-related activities as the outputs, while the second considered both transaction and maintenance-related activities as outputs. The weight was adjusted based on the time required for each personnel to complete the required activities. This analysis was applied to 291 branches in Ontario (Schaffnit et al., 1997).

Sherman and Ladino (1995) separated the DMU even further based on the different types of branch types. Three different branches (urban, suburban, and shopping malls) are grouped into different categories. The model was only applied to compare branches within the same branch category to ensure fairness of comparison and the validity of best-practice branches as a reference. Both authors also highlighted the advantage of utilizing the DEA Model as the benchmarking approach could determine the most efficient branch or best-practice branch by considering the position against its own peers rather than relying on observation or comparison between other entities that might not be contextual to each organization (Sherman and Ladino, 1995).

As the model is heavily dependent on the assumption used in pre-calculation, Chen and Zhu (2004) postulated an adjustment to the existing DEA model by applying a two-stage process in the calculation. Their idea was to cater to the possibility of an extensive business process in IT-related investment, which required intermediate measures to transform inputs into outputs. The intermediate measures signify an activity or impact when the input is activated, which will eventually result in the making of the output. It is implied that the user of the DEA model needs to understand the sensitivity of the method to certain issues, depending on the variables and relevant business context, that may impact the result of efficiency calculation (Chen and Zhu, 2004).

The choice of the two-stage analysis model refers to the sales process in Bank X. Sales are expected to sell their product in deposit, loan, and investment or to acquire new customers for the bank. These activities yield revenue for the bank through interest or administration fees, indicating that the process of generating revenue for the bank is an indirect result of sales. Wang et al. (1997) suggest that in the presence of indirect activity, intermediary measures should be considered in the DEA model analysis process, hence the two-stage application in this study. The calculation of each stage will be done separately, where Stage 1 will use input and intermediary measures as calculation variables, and Stage 2 will use intermediary measures and output variables. The same input and output will be used to ensure the same treatment is being applied to all DMUs or branches. Further analysis based on the calculation result will try to answer the underlying reason for the difference in efficiency score based on the result produced by the model. The following conceptual framework will be used in the analysis, adapted from Chen and Zhu, 2004:



**Fig. 1 Conceptual Framework of Analysis, adapted from Chen and Zhu (2004)**

### III. RESULTS AND DISCUSSION

#### A) Variables

Using the conceptual framework explained in the earlier chapter as a reference, the following table represents the dataset used to calculate the efficiency score in the two-stage DEA model analysis. Data is collected from sixteen (16) branches of Bank X located in Jakarta.

**Table 1: Data used in the analysis**

Branch Area Office	<i>Input</i>	<i>Intermediary Measures</i>				<i>Output</i>
	No. of Salespeople	Deposit Balance*	Loan Balance*	Investment Balance*	No. of New Customers	Revenue amount*
Jakarta 01	3	410,781	93,412	161,399	3	1,003
Jakarta 02	8	746,414	217,760	328,729	12	3,749
Jakarta 03	4	435,065	124,173	226,849	5	1,324
Jakarta 04	4	579,146	160,394	221,261	3	1,826
Jakarta 05	5	1,095,710	68,352	591,254	4	1,438
Jakarta 06	6	869,552	135,922	293,416	8	2,266
Jakarta 07	6	1,034,898	379,804	384,304	9	1,380
Jakarta 08	5	537,483	121,932	303,217	2	1,762
Jakarta 09	8	931,233	165,060	618,313	9	3,228
Jakarta 10	6	819,021	165,038	419,370	7	2,557
Jakarta 11	4	558,922	68,706	329,227	5	1,667
Jakarta 12	6	944,255	469,506	552,829	8	2,372
Jakarta 13	7	876,293	241,880	478,335	5	2,920
Jakarta 14	5	370,168	194,096	154,291	4	1,954
Jakarta 15	7	1,030,862	260,627	563,977	10	2,775
Jakarta 16	6	1,131,568	224,243	465,741	8	5,723

\*Numbers displayed in IDR million (\*000,000)

With a two-stage DEA analysis, each stage is calculated separately. A score between zero (0) and one (1) is appointed to measure the efficiency of the DMUs. The calculation in Stage 1 used input (number of Salespeople) and intermediary measures (Deposit Balance, Loan Balance, Investment Balance, and Number of New Customers Acquisition) as data sources. These variables are taken out of the assumption that the main resource of a DMU is their employees and said employees are required to make certain efforts through selling products or engaging with Bank X's retail customers in order to achieve a certain amount of intermediary measures. Stage 2, on the other hand, focuses on how efficiently the intermediary measures could yield output (Revenue) from related quantitative measures of the bank.

### **B) Analysis**

Scores with the highest possible result (1) are described as perfectly efficient, and DMUs (branches) with perfect efficiency in both stages are marked in yellow. Overall, there are five DMUs (Jakarta 03, 07, 10, 13, 16) that can achieve efficiency in both Stage 1 and Stage 2 (31.25%). The DMUs used, for example, in the following analysis, will only refer to the extreme cases and categorize the Branch Area Office into those who achieve 100% efficiency in both stages and those who do not.

**Table 2: DEA Model Calculation Result**

Branch Area Office	Stage 1		Stage 2	
	Efficiency Score	Result	Efficiency Score	Result
Jakarta 01	0.441		0.955	
Jakarta 02	0.929		1.000	Perfect efficiency
Jakarta 03	1.000	Perfect efficiency	1.000	Perfect efficiency
Jakarta 04	1.000	Perfect efficiency	0.807	
Jakarta 05	0.749		0.661	
Jakarta 06	1.000	Perfect efficiency	0.632	
Jakarta 07	1.000	Perfect efficiency	1.000	Perfect efficiency
Jakarta 08	0.776		0.662	
Jakarta 09	0.897		0.783	
Jakarta 10	1.000	Perfect efficiency	1.000	Perfect efficiency
Jakarta 11	1.000	Perfect efficiency	0.570	
Jakarta 12	1.000	Perfect efficiency	0.552	
Jakarta 13	1.000	Perfect efficiency	1.000	Perfect efficiency
Jakarta 14	0.463		1.000	Perfect efficiency
Jakarta 15	1.000	Perfect efficiency	0.675	
Jakarta 16	1.000	Perfect efficiency	1.000	Perfect efficiency

Referring to Chen and Zhu (2004), the efficiency score of each DMU in different stages may be affected by different reasons. A lower score in Stage 1 indicated a lack of efficiency in activities related to generating deposit, loan, and investment balance and acquiring new customers—while a lower score in Stage 2 indicated a lack of efficiency in revenue-generating activities. An improvement in human capital efficiency may have contributed to improving the bank’s overall efficiency. This includes putting attention on human capital development to accelerate more skillful and high-performing employees within a business (Le et al., 2022). Herjanto and Franklin (2019) summarized key drivers of salespersons across multiple papers over 30 years, covering personal factors, organizational factors, co-worker factors, buyer factors, and situational factors. Some of the perspectives that were discussed within this scope include demographics (Frino and Desiderio, 2013), competency, personality and personal value (Herjanto and Franklin, 2019). Three dimensions of demography are used as a comparison: gender, age group, and education level. The numbers are presented in percentages in proportion to the total salespeople in each efficiency category to adjust to a different distribution of personnel in each Branch Area Office. However, there is no distinction between the two groups—females and university graduates mostly populate both two categories. The slight difference between age groups is visible as the two most populated age groups (35 – 39 and 30 – 34) in groups with perfect efficiency in Stages 1 and 2 (Group A) made up more than 70% of the population. This slight difference may not be notable and by no means should be considered a significant contributing factor for the reason of the efficiency score.

**Table 3: Demography comparison**

		A. Perfect Efficiency (1.000) in Stage 1 and 2	B. Non-Perfect Efficiency (<1.000) in Stage 1 and 2
		<i>Jakarta 03, 07, 10, 13, 16</i>	<i>Jakarta 01, 05, 08, 09</i>
<b>Gender</b>	Female	75.86%	80.95%
	Male	24.14%	19.05%
<b>Age</b>	24 - 29	10.34%	14.29%
	30 - 34	34.48%	28.57%
	35 - 39	37.93%	23.81%
	40 - 44	10.34%	19.05%
	45 - 49	6.90%	14.29%
<b>Education</b>	Diploma	20.69%	23.81%
	University	79.31%	76.19%

One perspective to approach competency is by considering its attributes and proxy that could be used to provide a clear measurement. A study by Paloniemi (2006) discussed how work experience was highly related to work experience by 46%, in comparison to other attributes such as personal characteristics (29%) and formal training (25%). Work experience was seen as an important metric as it encompasses the practical skills and knowledge required in specific occupations, as well as helping the

salesperson assess ways of working in certain communities. This would also help the salesperson to develop tacit knowledge, which is important in quickly building competency. The table below explored the differences in salesperson’s tenure and their past working experience between Group A and Group B. The tenure is limited to their time as a salesperson in Bank X but not limited to the sales position. The tenure can calculate the time they spent in sales in another department such as telemarketing or even back office. Another perspective of experience is to consider their past working experience in other companies before joining Bank X as sales. Due to the variety of companies the personnel worked before, the distribution is then categorized into four main groups: Multinational Bank, National Bank, Non-Bank, and Not Available.

**Table 4: Work experience comparison**

	A. Perfect Efficiency (1.000) in Stage 1 and 2	B. Non-Perfect Efficiency (<1.000) in Stage 1 and 2
	<i>Jakarta 03, 07, 10, 13, 16</i>	<i>Jakarta 01, 05, 08, 09</i>
<b>Tenure (Years)</b>		
<= 2	34.48%	19.05%
3 - 5	13.79%	14.29%
6 - 8	24.14%	33.33%
9 - 10	10.34%	14.29%
11 - 20	10.34%	14.29%
> 20	6.90%	4.76%
<b>Past Company</b>		
Multinational Bank	10.34%	33.33%
National Bank	51.72%	38.10%
Non-Bank	13.79%	4.76%
Not Available	24.14%	23.81%

The proportion of personnel with less than 2 years tenure in Bank X is significantly higher in the group with perfect efficiency in both Stages 1 and 2 (Group A) compared to the group with non-perfect efficiency in both stages (Group B). The latter shows a higher number of salespeople within 6-8 years of tenure working as sales in Bank X. Apart from the different majority of tenure population, the group with non-perfect efficiency in both stages shows a higher number of senior salespeople, particularly with 9-10 years of tenure and 11-20 years of tenure.

In terms of past company salespeople, the group with perfect efficiency in both stages (Group A) mostly consisted of salespeople who came with experience from working in the National Bank (51.72%). When being compared to the group with non-perfect efficiency in both stages (Group B), the latter has a less concentrated salesperson with working experience in the National Bank. Apart from salespeople with Non-Bank working experience, their distribution is rather equal, while Group A have a clear separation between the majority group and the rest. This may indicate that although both groups are supported by salespersons with prior working experience in other companies, Group A, with the majority being ex-employees of National Bank, may have better efficiency due to the difference in competency. They may have a better competency in Bank X and perform with higher efficiency as they have a better understanding of specific knowledge required for business operations in Bank X, a National Bank.

As the last contributor to sales performance, personality and personal values have long been of interest to researchers and business practitioners. The relationship between personality, personal value, and performance could work in three ways, where personal value may be the mediating factor between personality and performance. However, personality data is not available to be analyzed. Future research may consider this approach to understand the reasons for the different performance efficiency of salespeople in Bank X.

**IV. CONCLUSION**

Referring to earlier studies, three factors may affect the efficiency score from the DEA Model: demography, competency, and personality. In terms of demography (gender, age, last education degree), there is no significant difference between the groups with perfect efficiency in both stages compared to the others. Competency, on the other hand, showed more promising results. Using tenure and past company as a measure of competency, the majority of salespeople from the perfect efficiency branches came from a National Bank background. In short, the people recruited to work in branches with perfect efficiency are those who previously were experienced in working for a national bank before joining Bank X. As Bank X is also a national bank, the salespeople who previously worked for the national bank may have better experience in navigating the company culture and providing services, hence the higher efficiency and performance compared to the others.

Going forward, this study could be used to address the gap in sales efficiency in performing their activities. Existing efficiency score results can be utilized as the basis of the best-practicing branch in Bank X. Additional assessment should be conducted to map salespeople’s personalities and personal values as these two attributes may provide further explanation of the difference in efficiency score between DMUs. With more comprehensive knowledge, Bank X would be able to improve its

human capital quality to support its business process.

### Interest Conflicts

The authors declare that there is no conflict of interest concerning the publishing of this paper,” authors should write if there is not one.

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