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PERFORMANCE EFFICIENCY OF WATER SUPPLY
SYSTEMS IN MALAYSIA USING
DATA ENVELOPMENT ANALYSIS MODELS

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ABSTRACT

This paper evaluates the performance of water supply systems of 14 states in Malaysia using Data Envelopment Analysis (DEA) models. The aim of the study is to compare the efficiency score between the states while suggesting the best water supply system and providing a solution to improve the current efficiency. The first phase is the argument of choosing the best performance efficiency between two models, the Charnes Cooper Rhodes (CCR) and Banker Charnes Cooper (BCC) models to determine the efficiency score. The value of equal to one is considered efficient while anything less than one will be regarded as inefficient in which one out of those two models will be chosen based on the highest number of efficient DMUs. Then, the DMUs with an efficiency score of one was then applied with Super-Efficiency model to identify the ranks according to the highest value. Afterward, DMUs that failed to achieve the efficiency score of one were applied with SBM model to clarify the lowest score value in which could be improved. According to the results of the first phase of the study, the BBC input-oriented model was chosen over the CCR input-oriented model because it has the highest number of efficient DMUs, with BBC models having eight efficient water supply systems compared to CCR models having only seven efficient DMUs. Next, the results of the second phase reveal that Labuan has the greatest efficiency value, followed by Perlis, Johor, Terengganu, Pahang, Kelantan, Sabah, and Sarawak. Finally, during phase three, Pulau Pinang was identified as the most inefficient water supply system. Hence, the state of Labuan had the greatest efficient value score of 3.307692, while Pulau Pinang had the lowest inefficient DMU score of 0.5060130. In conclusion, the water supply systems in Malaysia will gain an extraordinary revolution where water companies will be able to meet consumer demand while providing the best quality of water supply. This study emphasizes the efficiency score value of determining an efficient or inefficient water supply systems in which the lacking area could be improved while the best is set to be an example for a better cause for the future.

1 INTRODUCTION

A water supply system or also known as a water supply network is a system of engineered hydrologic and hydraulic elements that provides water supply. Generally, the type of water services includes water supply services that supply potable and non-potable water, sewerage services which include collection, treatment and disposal of sewage, irrigation service that is the provision of water for irrigation in agriculture or pasture and drainage services which is the management of storm water, groundwater, surface water or soil salinity which include managing the quality of water (Wikipedia, 2021). The National Water Services Commission (SPAN) (*Annual Report*, 2018) stated that Malaysia depends on the water supply from reservoirs which are from rivers and storage dams that contribute 81.3% and 17.4% of the total water used in Malaysia respectively.

Nowadays, the weather patterns have changed a lot as well as a drastic increase in population growth in Malaysia that makes it more difficult to meet the demand for treated water supply. Due to increased population growth, urbanization, industrialization, and agricultural development, requests for water supply have rapidly increased. The Malaysian water industry has encountered drastic changes with development in water supply over a few decades ago. Therefore, Malaysia's water industry suffers from operational inefficiency, poor management and supervision, a limited budget, and terrible environmental performance (Kim, 2012).

On 8th April of 2021, SPAN acknowledged an issue with the water supply in Kedah's rural area. Some villagers are forced to rely on alternative sources to get sufficient water supply to meet their daily needs. A spokesman from SPAN, explained that the water supply is under control except for areas in Baling which are located at the end of the pipes. The worst that could possibly happen when the dry season arrives, there will be an increase in water disruption in certain areas. On the contrary, SPAN already took action on a long-term project to upgrade the Sungai Limau water treatment plant to ease the villager's troubles with the help of Wakaf Air