NEW TECHNOLOGY ADOPTION: ADVANCED METERING INFRASTRUCTURE STRATEGIC IMPLEMENTATION PLANNING USING FANP

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Overview

Technology advancement and innovation lead to improvement in a variety of areas, including the electric power system. PLN as the biggest electricity provider in Indonesia continuously improved and adapted to technological developments in facing business challenges and met the requirements of stakeholders. As a first step, PLN decided to start implementing the smart grid system by implementing the Advanced Metering Infrastructure (AMI)[1]. This system provides accurate, dependable energy transaction measurement results, as well as automatic-meter-reading features, remote connect/disconnect, tampering or malfunction detection, and other features and specifications, as well as demand management and other data management functions based on utility requirements [2]. Advanced Metering Infrastructure is a complex system, therefore integrating this AMI technology into the power system will require a massive investment. According to the company's 2020 annual report, PT PLN (Persero) serves 79 million customers throughout Indonesia's archipelago [3]. With a large number of customers, PLN must prioritise strategy considering the risks, costs, and benefits of implementing the Advanced Metering Infrastructure system to achieve optimal results. This study aims to analyze and propose a set of alternative strategies for implementing Advanced Metering Infrastructure using FANP that has been widely used in decision making but the study using FANP in this scope remain limited. The analysis will consider a set of criteria and sub-criteria that influence the migration process so the strategy can lead to an effective and efficient process.

Methods

In this study, the weighting of a set of criteria that influence the decision upon this strategic plan for the implementation of Advanced Metering Infrastructure will be carried out using the Fuzzy Analytical Network Process method approach, which will later become a parameter in the evaluation based on risks, costs, and benefits for the company. Fuzzy Analytical Network Process (FANP) was one of the multi-criteria measurement methods used to derive the relative priority scale from absolute numbers, which are individual ratings normalized to relative forms, which are also included in the fundamental scale of absolute numbers [4]. This Analytical Network Process (ANP) method is a development of the AHP method by correcting AHP deficiencies in which AHP dependencies between criteria are not taken into account, even though one criterion with another frequently has a relationship with one another [5] and fuzzy sets that used in this study aims to overcome the problem of uncertainty, incomplete or non-specific data in assisting decision making [4].

The network model was constructed with Super Decision Software, which was developed by The Creative Decision Foundation and is a decision support software that implements the Analytical Network Process (ANP) as shown in Figure 1.

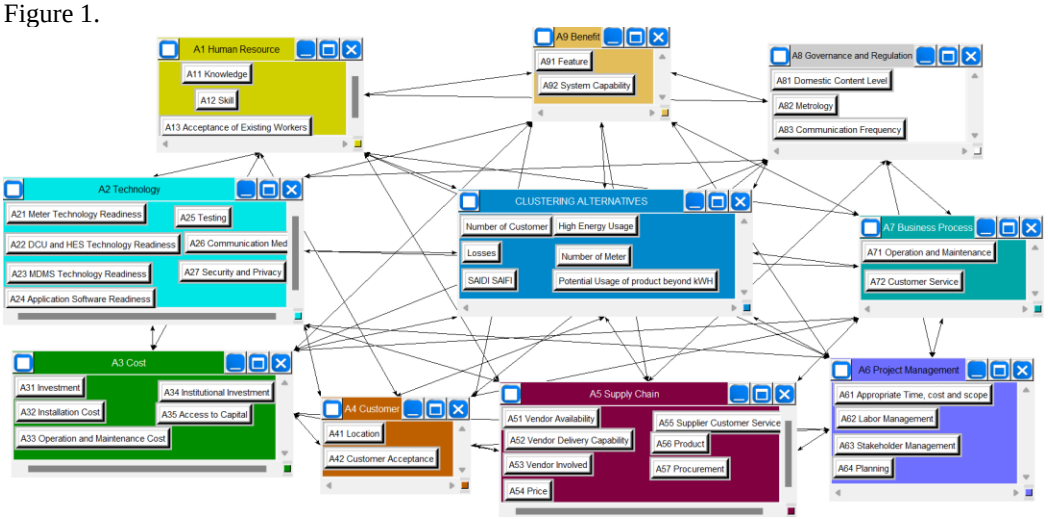

Figure 1. AMI Implementation Strategy Network Model

Some criteria and alternatives were required for the ANP model, which were then prioritized. The criteria and alternatives used in this study were determined based on a review of the literature on technology adoption and Advanced Metering Infrastructure (AMI), as well as the PLN Smart Grid Roadmap 2021-2025, and were followed by an in-depth interview with AMI experts in Indonesia who are responsible for developing AMI systems for PT PLN (Persero)[1]. The relationship between all sets of criteria and alternatives was measured by individual ratings from questionnaires submitted to panel experts, which were then analyzed using the FANP method to obtain weight from each criteria and alternative that takes into account their priority in AMI Implementation Strategy decision-making.

Results

Based on the early analysis result, the decision of AMI implementation strategy must first consider the cost with the weight factor was 20,59% and continue with the Governance and regulation consideration (17,11%), supply chain (15,15%), Business process (14,81%), Project Management (9,00%), the benefit of the system (6,70%), customer (5,94%), Human Resource (5,21%) and Technology (5,17%). And for the location prioritisation, it is highly recommended to consider the location with the highest number of SAIDI and SAIFI Ratio (18,16%), continue with the location with the highest losses (17,82%), the next consideration is the location with the highest number of meter that must be replaced due to lifetime and metrology aspect (16,63%). Location with the highest power usage and high potential to use beyond kWh product becomes the next priority (15,73%) and (15,28%).

Conclusions

Initial findings from the early analysis indicate that the cost factor is the most important factor in strategic decision-making for implementing the AMI system throughout Indonesia, given a large number of customers and the area targeted for implementation. Prioritization is required to achieve optimal results while avoiding interference with existing business conditions. Based on the analysis, the location with a high ratio of SAIDI and SAIFI becomes the priority for implementation, followed by locations with large losses. This is consistent with the goal of implementing AMI, which is to create a lean, efficient electric power management business process and increase company revenue by minimizing interruptions and losses in the system.

References

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