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Implementation and Adoption Decisions in Technology Adoption Initiatives

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Abstract:

Technology has already been recognized to play a very significant and advantageous role on how human beings can live more conveniently. However, there are still areas in the community that need more evident and effective technology adoption and implementation decisions and these include the utilization of smart grid technology. This study aims to analyze how technology adoption and implementation decisions have been missing or lacking especially in utilizing smart grid technology in every country, including in the U.S. and in India. Through gathering the most relevant and credible studies, the current study was able to critically analyze how technology adoption and implementation decisions have been very challenging in this particular field. The findings showed how utilizing smart grid technology has been really challenging due to several factors such as policy and regulations, insufficient fund, and lack of awareness of the consumers. That being said, this study also provided proposed research questions that can be used in the future studies to be conducted.

Keywords: *Decisions making, Smart Grid, adaptation technology.*

I. INTRODUCTION

The resolution of introducing new technology to an industry is to improve its performance. Ever since technology existed, its aim has been to enhance the way some operations are done and how it can lighten the load of every workload of individuals. In specific, new technologies were able to establish noteworthy opportunities for electric-grid modernization that have resulted to improved communications between distribution and transmission operators and customers. Electric grids known to have been used around the world are in the middle of a transformation that include improvements to their transmission, generation, and distribution systems, mainly in the arrangement of communication and monitoring technologies that agree for more defined information regarding the system's state at any point in time. This study aims to analyze how technology adoption and implementation decisions have been conducted in improving smart grid technology in organizations.

II. Analysis

The electric grid is identified as the structure and equipment that carries the electricity from power-generating plants to consumers, such as transformers, wires, switches, and substations (Oliver & Sovacool 2017). The smart grid is known to be a type of electric grid that applies various modern computer technology to the grid to allow the two-way flow of electricity as well as information (Oliver & Sovacool 2017; Guo et al. 2015). Smart grid technologies are applied through various power systems such as transmission, services and consumption, distribution, and generation (Asian Development Bank 2017). It is a general label for a class of technologies that utilizes computer-based remote control and computerization and is established on the physical infrastructure to allow a more reliable, efficient, and sustainable power supply (Massachusetts Institute of Technology 2016). Smart grid has been a notion established of a more improved electricity delivery infrastructure.

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The implementation of this type of technology-oriented function has been recognized to increase the quality, quantity, as well as the use of information accessible from advanced computing, sensing, and communications software and hardware. Some examples of effective use of smart grid technologies involves how it can help utilities in allowing distributed generation; enhanced grid utilization; enhanced grid security and efficiency, and others (Kumar 2019; Dedrick & Zheng 2011).

With its effective and prevalent development, countries have been called to expect better reliability on energy or power systems, high-quality electric power service, and quality of smart grid service. However, this is not always the fact for every country because of various factors involved. For instance, Zheng (2017) highlighted how the electric utility industry in the United States is recently facing several challenges, such as the increasing customer demand, aging infrastructure, increased susceptibility to outages and overloads, and CO2 emissions. For this reason, utilities are perceived to be under great pressure in providing more efficient and reliable power supply to their consumers and how they can be more successful in reducing its carbon footprint at the same time.

In this study, Zheng (2017) aimed to improve the understanding of IT knowledge challenges specifically in adopting smart grid. In this qualitative study, the researcher indicated four broad areas of knowledge requirements, which includes "smart grid technology and vendor selection; smart grid deployment and integration; big data; and customer management". The findings showed how there are numerous knowledge gaps faced by utilities in the identified four areas, and thereby confirmed that utilities differ in the level of knowledge gaps, which rests on a mix of factors that include IT sophistication, past experience, size, ownership form, service territory characteristics, support from external organizations and regulatory support (Zheng 2017).

Zheng (2017) was able to discover that while much of the technical stresses on the installation and maintenance of grid systems and devices needed for smart grid adoption has not changed noticeably, the work has been perceived to be more multifaceted and challenging compared to prior upgrade projects in technology due to the multi-layer and holistic integration in smart grid. Moreover, while outmoded technical requirements are significant in adopting and implementing of technology decisions such as utilizing smart grid, it has also been observed to involve high demand in integration between communication platforms, physical devices, and software and hardware systems (Zheng 2017). Thus, it is evident how it is challenging to implement and adopt technology decisions wherein smart grid is involved or is to be applied.

In another study, Kaushal (2011) was able to study how implementing smart grids in India also shows technology implementation and adoption decisions that vary due to several factors. Some of the barriers in making technology adoption and implementation decisions, such as using smart grid, specifically in India are its policy and regulation. Accordingly, the recent policy and regulatory structures were usually designed to deal with the recent utilities and networks. To some degree, the standing model has been observed to have encouraged competition in supply and production of power but is incapable of promoting clean energy supplies (Kaushal 2011). Although India is known to be a country that is already knowledgeable about high technology, the adoption and implementation decisions with regards to technology has not been possible because of the level of lack of awareness of the consumers, specifically on how consumers understand how power is delivered to their homes. Funds are also viewed as one of the major barriers in adopting and implementing technology decisions such as smart grid.

In another study, Kappagantu & Daniel (2018) was able to highlight another factors that affect the adoption and implementation of technology decisions in India such as utilizing smart grid. Accordingly, the existing grid network in the said country was insufficient to accommodate the future

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needs of clean energy as well as distributed generation that may throw numerous challenges in operation, erection, design, and maintenance. Moreover, numerous electrical parts in India are unevenly linked to national grid so as to optimally evacuate large solar parks or wind farms that otherwise plea for installation of the whole infrastructure. This then leads to recognizing the significant role of the higher authorities or the government when it comes to recognizing and finally adopting and implementing technology decisions that can significantly helps a country live better.

Several facts serve as the most relevant and essential factors to highly consider technology adoption and implementation decisions. This includes energy efficiency and how it is considered as a way of handling and limiting the development of energy consumption. This is also viewed to be one of the most cost effective and easiest means to fight climate change, reduce the energy costs for consumers, and enhance business competitiveness. In Markovic, Branovic and Popovic's (2014) study, they aimed to describe the effects that new technologies' development, including smart grid, will possibly carry when it comes to reducing carbon emissions. The researchers further discussed the primary features and requirements of smart grids to incorporate energy efficiency, the anticipated benefits, and the enabler technologies that they will carry. They were able to recognize how smart grid can become an essential part of future clean energy solutions, at the same time, nanotechnology has also been recognized to possibly become central for the smart grid to completely evolve in the near future.

Technology adoption and implementation decisions has been highly considered through smart grid because of how it can reduce CO2 emissions. Accordingly, the Pacific Northwest National Laboratory provided a report that evaluated nine instruments by which the smart grid can reduce carbon impacts and energy use linked with electricity delivery and generation. The said reduction in electricity use and CO2 emissions have been perceived to take place or more evident in 2030 (Markovic et al. 2014). Some of the proposed ways of technology adoption and implementation decisions involves communications layers that covers the formation and implementation of communication hardware and protocols that will offer the capability to control and monitor the utilization and flow of electricity across the grid (Markovic et al. 2014).

The actions that were linked on technology adoption and implementation have affected how smart grid implementation and utilization can be successful and beneficial for a community. In view of this, it is evident that there is a great opportunity for future researchers to consider recognizing the best possible solution in the highlighted dilemma, aiming to improve how technology adoption and implementation decisions can even be more prioritized and therefore provide more effective and beneficial services and effects through more seen and applied technology adoption initiatives.

III. Possible Research Questions for Future Research

From analyzing a particular area where technology adoption and implementation decisions has been weak, this study provides three possible research questions that can be used if this would progress as part of my post-graduate studies. The research questions highlight the issue on how technology adoption and implementation decisions can be improved especially in recognizing the advantages of utilizing smart grid.

1. What does it mean to adopt and implement technology decisions on energy industry?
2. How would electrical engineers respond and provide their service if technology adoption and implementation decisions were combined more evenly with the government laws?
3. What is/are the positive effect of technology adoption and implementation decisions in providing cleaner and safer energy usage?

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IV. Conclusions

Smart grid innovation allows a group of capabilities that had been non-existent in the past, such as how the missing functions of two-way communication between customers and utilities, outage management, demand-side management and load control, electric vehicles and so on. Even though the rate of smart grid adoption and implementation differs throughout U.S. states, it has gained extensive attention and more utilities are designing and implementing smart grid at the present time. However, smart grid technologies are still viewed to present noteworthy challenges in knowledge for electric utilities. This has also been recognized in other countries such as in India. Although these countries have been known to have utilized technology in a more advanced way, they still experience challenges and therefore is linked with technology adoption and implementation decisions. This study was able to highlight how smart grid utilization has been one of the substantial advantages that countries would have been able to make use of, but this has not been the case because of the several factors involved.

The way that even developed countries have faced challenges, such as the increasing customer demand, aging infrastructure, increased susceptibility to outages and overloads, and CO2 emissions, reveals how technology adoption and implementation decisions is needed especially in utilizing smart grid technology. One of the factors that affect how technology adoption and implementation decisions are not considered is because of the lacking participation of the government. This situation has also been linked to the lacking education or awareness of the public of the capability and advantage of technology when it comes to recognizing the role of smart grid technology. This has been primarily witnessed in both U.S. and India.

Technology adoption and implementation decisions associated to applying smart grid technology has also been recognized to be not that applicable yet because of the funds for these countries. The funds are one of the major barriers in implementing this specific type of technology and thereby recognizing a greater issue on how technology adoption and implementation decisions can be done. The other factors also involved the current situation that national grids are in in a particular nation, such as in India. The electrical parts in the said county are unevenly linked to national grid, which was intended to optimally evacuate large solar parks or wind farms that otherwise plea for installation of the whole infrastructure. The desire to adopt and implement technology decisions would not be easily possible and/or applicable because of some factors such as this.

There were also some positive implications highlighted in this study when it comes to recognizing the technology adoption and implementation decisions made through utilizing smart grid technology. However, it is still evident how there is a greater need for future research and influence in encouraging the public with effective technology adoption and implementation decisions, especially when it comes to helping a country live with cleaner energy and better lifestyle through utilizing smart grid technology. In view of this, the current study provided proposed research questions that can be used in the future studies for providing more effective and efficient adoption and implementation of technology decisions, specifically the implementation of smart grid technology.

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