ISSN 2409-2665
Journal of Logistics, Informatics and Service Science
Vol. 11 (2024) No. 5, pp. 471-486
DOI:10.33168/JLISS.2024.0527

Navigating the Challenges and Opportunities of IoT Adoption: A Stakeholder Perspective

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Abstract. Islamic boarding schools in Indonesia play a crucial role in providing religious and academic education, but many have yet to fully adopt Internet of Things (IoT) technology. This study aims to analyze the current state of IoT adoption at Daarul Rahman Islamic Boarding School and examine the involvement of stakeholders in the implementation process. A mixed-methods approach was employed, combining a survey of 130 respondents with focus group discussions. The findings reveal that while some IoT applications, such as security cameras and environmental sensors, have been implemented, there is still significant room for improvement. Key challenges include limited human resources and financial constraints. Stakeholder analysis identified the school committee, head of the boarding school, and technology procurement partners as crucial actors in driving IoT adoption. The study concludes with recommendations for overcoming barriers and fostering a more innovative and technologically integrated learning environment in Islamic boarding schools

Keywords: Internet of Things, Islamic Boarding School, Stakeholder mapping, Situational Analysis

1. Introduction

Islamic boarding schools are the oldest Islamic educational institutions that are deeply rooted in the history of the Indonesian nation. Since the 15th century, Islamic boarding schools have existed as a manifestation of the synergistic encounter between universal Islamic teachings and local wisdom in Indonesia. Islamic boarding schools are able to survive across time and generations, because the Islamic boarding school education system prioritizes the formation of spirituality, morality, noble morals and manners in students. Islamic boarding schools are religious institutions as well as educational institutions that are very typical of Indonesia and rich in culture. Education in Islamic boarding schools takes place while the students live in dormitories with kyai, asatidz (educators) and musyrif (guides). In Islamic boarding schools, students learn the meaning of life, learn to live together, learn discipline, learn to live simply, learn to socialize themselves, organize, be independent, respect the clerics, be patient in seeking and mastering knowledge, and so on.

The increasingly developed function of Islamic boarding school education is holistic, integrative, well-governed, as well as competitive and superior. So currently Islamic boarding schools integrating cultural expertise with international systems will determine Islamic boarding school education in the future (Arafah and Danim, 2021). This is shown by the logical, dynamic and competitive relationships in which Islamic boarding schools are faced with developments in science and technology (Mundiri and Nawiro 2019; Poluakan et al. 2019). Apart from that, Islamic boarding schools must maintain their characteristics as a moral-spiritual basis and their role in building a religious society (Ramaditya et al., 2023).

The growth and development of Islamic boarding schools in Indonesia is also increasingly rapid, there are at least around 26,975 Islamic boarding schools spread throughout Indonesia (Ministry of Religion 2022). Islamic boarding schools are also the largest ecosystem that contributes to improvements in terms of the economy. It can be seen that there are 20,765 billion in funds being disbursed which focus on Islamic boarding schools. These uniqueness and characteristics make Islamic boarding schools an educational institution that has an important role in forming individual character and spirituality, which includes not only aspects of knowledge, but also the values and ethics of life. Islamic boarding schools have characteristics that differentiate them from other educational institutions (Setiadi and Muhaemin, 2018). Some of the distinctive characteristics of Islamic boarding schools that differentiate them are the existence of an ecosystem, including the presence of Kyai/owners who are owners and also role models, figures and respected figures in the Islamic boarding school. As caregivers and providing education and teaching to their students, Kyai have a central role in an Islamic Boarding School. Apart from Islamic leaders, another ecosystem in Islamic boarding schools is the existence of santri or students who live in dormitories or boarding schools in Islamic boarding school terms and there are dormitories/residences, there are mosques/places of worship and there is yellow book learning. Apart from the ecosystem within the Islamic boarding school, there are other ecosystems such as business units, alumni, management and teachers.

Of course, Islamic boarding schools must continue to apply various innovations and creativity in responding to the increasingly rapid developments in the modern era, including the digitalization of the IoT-based education system (Ramaditya et al, 2022). Among the skepticism about the use of digitalization in Islamic boarding schools is that it affects the interaction and learning patterns of students. This has an impact on students' loss of politeness towards teachers. An additional factor is that digital media can eliminate the habit of face-to-face learning, or muhadapah. Apart from that, the habit of looking for references through turots books, or istimbat, can be replaced by the habit of googling or staring at the screen (Suyatman, 2017). By encouraging students to be digitally literate, this negative impact can be reduced. Considering that times are changing rapidly, and new innovations occur every few seconds, teachers have this responsibility (Syamsari et al., 2023). Innovative terminology in the Islamic boarding school context refers to the use of creative ideas and new solutions to improve the effectiveness of education, management and services in Islamic boarding schools. Innovation in Islamic

boarding schools can help strengthen religious education, character development and community empowerment in the Islamic boarding school environment, while still maintaining strong traditional values (Syahansyah, 2023).

The Internet of Things (IoT) program has the ability to transmit data over a network without human or computer assistance (Pangestu et al. 2020). Currently, the Internet of Things (IoT) is experiencing many advances as a result of the widespread use of technological advances (Mujianto et al. 2022). The Internet of Things (IoT) infrastructure consists of existing global networks and the future internet, which connect physical and virtual objects through data capture and communications technologies. It offers object identification, sensor identification and connection capabilities that are the basis for the development of independently established cooperative services and applications, also characterized by a high level of autonomy of data capture, event transfer, connectivity on the network (Syamsari et al., 2023). The Internet of Things (IoT) is a global infrastructure that connects physical and virtual objects through technological developments such as electronic hardware, software, sensors, and connectivity (Stallings 2015). These physical devices interoperate in an infrastructure network such as the internet (Ulum and Munim, 2019).

The concept of the Internet of Things emerges, when the structure of society is connected in an internet network, this is in accordance with the goal of IoT, namely improving communication between humans and between machines (Syakroni et al., 2019). So, concrete steps are needed in the form of an IoT-based adaptation model to improve the service performance of Islamic boarding schools in the future. As previously mentioned, managers of educational institutions in general must also innovate in Islamic boarding schools so that education can truly meet the needs of society. Technological advances in Islamic boarding schools have not been fully utilized, especially in Islamic boarding schools with traditional education systems (Vilppola et al., 2022). The existence of the Internet of Things (IoT) can offer comprehensive security solutions for students and educators. In Islamic boarding school education, there are several uses of IoT technology that are applied during Islamic boarding school activities, namely e-learning, digital libraries, video conferencing and digital payments (Tang et al., 2019). Based on the implementation of IoT technology, it proves that IoT has had an impact on Islamic boarding schools.

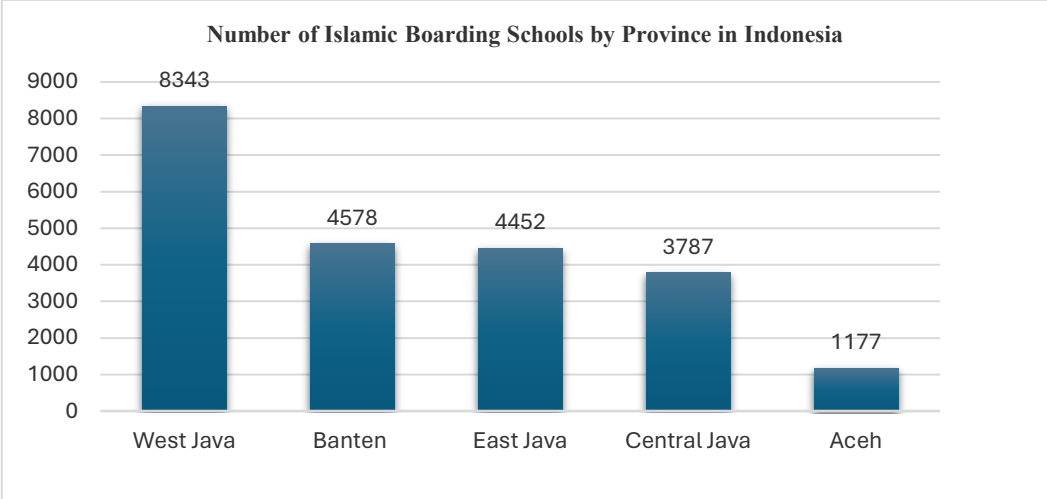

Fig.1: Islamic boarding School in Indonesia

Based on Figure 2. According to the Ministry of Religion, there are 26,973 Islamic boarding schools in all provinces of Indonesia. West Java has the most Islamic boarding schools, with 8,343. Banten, East Java and Central Java each have 3 to 4 thousand Islamic boarding schools. To date, statistically, the Ministry of Religion has recorded around 36,600 Islamic boarding schools throughout Indonesia,

with 3.4 million active students and 370 thousand teachers. The growth in the number of Islamic boarding schools is concentrated in provinces as rural areas such as West Java, Banten, Central Java, East Java and Aceh. And West Java is the region with the largest distribution of Islamic boarding schools. Abdul and Zakaria (2010), explained that the educational tradition in Islamic boarding schools in Indonesia and in the Malay world has a long history and is part of the history of the growth and spread of Muslims in the region. The Daarul Rahman Islamic Boarding School, which is located in Depok City, is an Islamic boarding school that combines religious, character and academic education so that it requires a strong organization that continues to develop according to the times and also continues to grow with the current era of digitalization (Wang et al., 2022). One aspect of device development that has the ability to connect various devices to each other, or the term "Internet of Things" (IoT) (Syamsari et al., 2023). By using objects connected to the internet, data will be collected and processed into "big data". Government agencies, related companies, and other organizations can use it for their respective benefits (Setiadi and Muhaemin 2018).

According to Putra et al., (2023), a progressive & future-oriented Islamic boarding school must have several criteria such as being based on a modern Islamic education system, having advanced modern infrastructure and facilities, having belief in religious principles, attitudes, social insight, nationality, universal humanity and has good governance, neat, modern and open administration. Referred to as a "technological revolution", the era of technological disruption is a stage where the way humans carry out activities experiences changes, differences, limitations and changes from before. Currently Islamic boarding schools have not utilized the Internet of Things (IoT) in running their organizations, so they tend to remain conventional (Wiengarten et al., 2013). Even though there are important things to disrupt IoT, such as optimizing facility management, where IoT allows efficient monitoring and management of facilities. This study has objective to analyze conditions (e.g., infrastructure, staff readiness, student perceptions) related to the application of the Internet of Things (IoT) in innovative Islamic boarding school services in the Daarul Rahman.

Participating in the Internet of Things (IoT) has become an important component in Islamic boarding school activities with its students (Harris 2023). Human life is not disrupted by technology; on the contrary, technology helps society become better. Islamic boarding schools can maintain Islamic boarding school culture by adhering to good old traditions but must still accept changes that are more profitable (Ulum and Mun'im 2019). In this way, more insight will be gained to help Islamic boarding schools advance and develop. Nowadays, Islamic boarding schools are also starting to build or provide formal education, although they still follow the old education system such as bandungan, sorogan, and wetonan (Krisdiyanto et al. 2019). Currently Islamic boarding schools have not utilized the Internet of Things (IoT) in running their organizations so they tend to remain conventional. Even though there are important things to disrupt IoT, such as optimizing facility management, where IoT enables efficient monitoring and management of facilities. For example, smart sensors can help monitor energy consumption, manage room temperature, and optimize resource use. Apart from that, Islamic boarding schools also improve educational experience services where IoT can improve the learning experience of students by providing access to more interactive and customized educational content. Smart devices can also be used to facilitate distance learning and collaboration between students. Apart from that, the use of an IoT-based administrative management system can increase efficiency in the administrative management of Islamic boarding schools, such as inventory management, finances and reports.

In addition, it is important to involve all relevant parties, including Islamic boarding school staff, students and local communities, in the process of implementing and developing this service. Implementing IoT in Islamic boarding schools can open up great innovative opportunities to improve the quality of life, security and overall management efficiency of Islamic boarding schools. However, along with these benefits, it is also necessary to pay attention to data security and privacy aspects to protect sensitive user information. The application of the Internet of Things (IoT) in Islamic boarding schools can create various innovative conditions that can improve efficiency, comfort and experience

for students and Islamic boarding school managers. The research question is what the current state of adoption at Daarul Rahman Islamic Boarding School is. This study aims to analyze the current state of IoT adoption at Daarul Rahman Islamic Boarding School and examine the involvement of stakeholders in the implementation process.

2. Literature Review

The Resource Based View used paradigm in competitive advantage, including technology and digital transformation, manufacturing strategy, and environmental sustainability goals (Putra et al., 2023) In this context, the term "resources" refers to two types of resources available to a company. Tangible resources include physical assets, such as land, equipment, buildings, machinery, and capital; and intangible resources include non-physical assets, such as brand reputation, trademarks, intellectual property, systems, and processes (Mais et al. 2022). The success of an organization is basically under resource management which is called Resource Based View. For a company, internal resources are the most important component among external factors that can help it become stronger and gain a competitive advantage to improve performance (Barney 1991). Proponents of the resource-based perspective argue that internal resources are the key to organizational success. These resources are divided into three categories. The three main categories of resources consist of physical resources (tangible), human resources (intangible), and organizational resources. Physical resources consist of all plants, equipment, locations, technology, raw materials, and machinery; employees, training, experience, intelligence, intellect, and abilities (tangible); and organizational resources consist of organizational structure, strategy formation process, and information systems (Syamsari et al., 2022). Based on Barney (1991) the Technology Organization framework is based on the concept which states that technology and organization are factors that must be considered by companies when deciding to adopt innovation. Furthermore, Grover and Goslar (1993) found 5 factors that influence a company to adopt or use telecommunications technology in its business or organization, namely a stable competitive environment, company scale, the extent to which the company has gone global, the level of work flow consisting of standardization, documentation and computerization. as well as the ease of telecommunications technology to carry out operational flows for its users.

Technology-based organizations is a general framework that identifies various factors that influence organizational technology adoption (Ramaditya et al., 2023). According to Abbas et al., (2020), this is the only theoretical framework that includes all the drivers that can influence information technology adoption initiatives. The antecedents of adopting Green information technology can be broadly categorized into three contexts: technological, organizational and environmental. The Resource-Based View theory emphasizes the antecedents of technological and organizational context. Specifically, this theory provides a framework for explaining the contribution of a firm's specific technological/organizational resources and capabilities to influence Information Technology initiatives (Ramaditya et al., 2022).

According to Buralnge and Misallkalr (2015), the Internet of Things (IOT) has a structure in the form of objects, people are provided with exclusive identities and the ability to transfer data through the network requires a dual network-to-machine interface, i.e. source to destination and computer-to-computer interface. The Internet of Things is a scientific development that is taking place continuously to optimize life based on intelligent sensors in smartphones that work directly through internet networks (Keoh et al. 2014).

The Internet of Things has become a technological revolution that has fundamentally transformed computers into communications, where digital development depends on dynamic technological innovations in many fields, from wireless sensors to digital technology. This technology is designed to connect various types of objects in each signal device to a network in a large digital network. The problems of the Internet of Things have also been made easier by the developments that have occurred in telecommunication technology such as the introduction of wider capital, the new version of the IP

V6 internet protocol, the integration of digital technology into many of the products in life's equipment. The idea of connecting various objects in the device to a network of digital devices managed via the web and enabling interaction with the software is in line with the evolution of educational technology which moves from e-learning (electronic learning), m-learning (mobile learning), to u- learn (learn everywhere). The main characteristics of u-learning include increasing access to learning content (learning content) in a collaborative learning environment supported by computers, in digital settings too.

The evolution of the internet occurred due to the active role of the Internet of Thing (IoT) which has a direct relationship between users and digital processing which is combined with informality which is prohibited in everyday life (Kiryalkoval et al. 2017). IoT is simply a network of connected devices which is useful for supporting the communication process of device equipment. There are several technologies that use IoT such as: sensors, calculators, operational systems, microcontrollers, communications technology, securities, IoT platforms, and allalt alnallitis (Genaldialrto et al. 2017). The working system of IoT technology already processes and transfers digital information obtained from digital sensors such as Radio Frequency Identification (RFID), infrared sensors, and Global Positioning System (GPS). In addition to implementing IoT in business activities, residential physical systems have also been integrated with IoT, this technology is more often known as Smart Grid technology. The need for management in organizational activities is to carry out activities so that a goal is achieved effectively and efficiently. In the scope of the management of social media trends, researchers divide into two areas, namely: (1) Management of social media trends which are physical in nature, and (2) Management of social media trends which are non-physical in nature.

Implementing IoT in Islamic boarding schools can open up great innovative opportunities to improve service quality, security and overall management efficiency of Islamic boarding schools. However, along with these advantages, it is also necessary to pay attention to data security and privacy aspects to protect sensitive user information. The application of the Internet of Things (IoT) in Islamic boarding schools can create various innovative conditions that can improve efficiency, comfort and experience for students and Islamic boarding school managers. The following are some of the innovative phenomena that occur Monitoring the Health of Santri. IoT Wearables: Use of IoT-based devices such as smartwatches or health sensors that can monitor students' health parameters, such as heart rate, body temperature and physical activity levels. This data can be accessed by Islamic boarding school managers and medical personnel for real-time health monitoring. Furthermore, security and Environmental Monitoring. Smart Security Systems: Implementation of smart security systems connected to an IoT network, including smart security cameras, motion sensors, and facial recognition systems to ensure Islamic boarding school security.

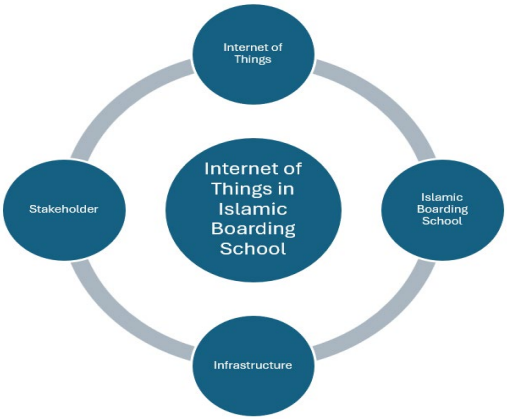

Fig.1: Conceptual Framework Adoption IoT in Islamic Boarding School

3. Method

A quantitative approach is research with descriptive characteristics and uses more in-depth analysis to fulfill the full explanation by concluding from several phenomena that occur (Mais et al., 2022) Additionally, an analysis of stakeholder involvement in Islamic boarding schools was carried out using individual interest matrix analysis. Following a systematic analysis of the findings, they are then identified and formulated. This research begins with descriptive research, that is, research that aims to describe and then combine real phenomena, which are both natural and even potentially malicious. This type of descriptive research in this research aims to collect specimens, describe them, identify them, classify them, and make an overall inventory of all possible discoveries in ideas. Furthermore, this research uses the individual stakeholder analysis method to determine stakeholder actors to encourage innovative Islamic boarding schools. The sample is get from purposive sampling that stakeholder of the Islamic boarding school which already have experience working 5 years.

Primary data collection is carried out through filling out questionnaires in public surveys representing stakeholders with the aim of more precise and objective justification. The source in this research is an individual who has special knowledge, understanding, and methods that are used to solve existing problems in the organization. The respondent is occupied is 130 people consist by principal, teachers, curriculum staff, administration staff. The questionnaire is adapted from administration staff. The questionnaire is adapted from previous studies (Parasuraman 2015, Aisyah et al 2014). Stakeholder analysis aims to map the interests of key actors in policy advocacy. With this identification, program managers become sensitive to stakeholder interests; and in the long term can create strategies to ask for support from certain stakeholders. Stakeholder analysis can be carried out using the Analysis Individual Interest Matrix (AIIM). Reliability refers to the consistency of a measure (whether the results can be reproduced under the same conditions), we used to check the reliable of data itself. Validity refers to the accuracy of a measure by using face validity and content validation with other expert to check whether the questionnaire already acceptable.The data statistical tests or software used is SPSS version 22 and using descriptive analysis. Some of AIIM's steps are identification of all stakeholders in the policy process; Identify the level of interest and alignment of stakeholders in the policy; Identify stakeholders who have the power/power to intervene in policies in Daarul Rahman Islamic Boarding School. The questionnaire used Likert scale as follow:

Table 1. Indicator of Variables

No	Variable	Indicator	Reference
1	Optimsm	Ease of controlling things	Parasuraman 2015
		Convenience using the latest technology	
		Efficient	
2	Inovativeness	Productivity	Parasuraman 2015
		Ability to provide explanations related to technology	
		Mastery of the use of technology	
		Independent use of technology	
		keep up with technological developments	
3	Discomfort	Doubt when facing problems with technology	Aisyah et al 2014
		Doubts about technical support for using technology	
		Confidence in the use of technology	

4	Insecurity	Dependence on technology	Hallikainen & Laukkanen, 2016
		Perception of the dangers of using technology	
		Perception of direct interaction	
		Confidence in using online technology	
5	Perceive usefulness	Speed of work	Edrogmus & Esen, 2011
		Job performance	
		Increased productivity	
		Job effectiveness	
		Job ease	
		Benefit assessment	

4. Findings and Discussion

Based on the findings on table 1, total 130 respondent from the Islamic boarding school was appointed to be respondent to further analysis regarding the current situation analysis. The respondent majority is from teacher with age 17-29 and total 1-5 years with degree. Most respondents knew quite a bit about the Internet of Things and feel that the Daarul Rahman Islamic school management does not support the implementation of the Internet of Things in Islamic boarding schools. Currently there was no special department or team in your place tasked with transforming Daarul Rahman Islamic Boarding School towards the Internet of Things. Most of respondent, felt that currently there is already implemented digitalization but not yet optimal results towards the Internet of Things. The majority of respondents also did not know the amount of investment that had been spent by the Daarul Rahman Islamic Boarding School for IoT transformation.

Table 2. Demographic Respondent

No	Type of work	Age	Length of Work	Education
1	Teacher: 122 Person	17-29 Years: 79 Person	1-5 Years: 54 Person	Degree: 112 Person
2	Curriculum Staff: 3 person	30-39 Years old: 32 Person	6-10 Years: 37 Person	Magister: 18 Person
3	Principal: 1 Orang	40-55 years old: 19 Person	11-25 Years: 39 Person	
4	Administration Staff: 4 Person			
	Total	130 Respondents		

The result also found that chose Learning process and finance as a field that has implemented the Internet of Things. In general employees at Daarul Rahman Islamic Boarding School were flexible towards change and were accustomed to continuous improvement. The teacher and administration staff also felt that all employees were very open to technological changes, they were ready to support it by continuing to learn with new technology. Employees in Daarul Rahman also think that there had been no training, workshop, education, certification related to the Internet of Things at the Daarul Rahman

Islamic boarding school. The majority of respondents felt that the IoT information data available at the Daarul Rahman Islamic Boarding School was generally used to improve the quality of service to all Islamic boarding school families. Daarul Rahman Islamic Boarding School provides services that are integrated with technology in the field of security and monitoring, for example, smart door and window sensors, security cameras, or motion sensors can help monitor and protect assets as well as the safety of boarding school residents. Moreover, Daarul Rahman Islamic Boarding School created services that were integrated with technology in the field of environmental monitoring, such as environmental sensors connected to IoT that could help monitor environmental conditions around Islamic boarding schools.

Currently, the findings also considered that there was minimum or less machine-to-machine connectivity (communication between machines) via the internet/intranet in the Daarul Rahman Islamic Boarding School infrastructure. The respondent also considered that the technology need by the Daarul Rahman Islamic Boarding School was connectivity. IoT networks must support slow as well as fast sensors. For example, a fast sensor from a CCTV camera analyzes it in real time. Besides that, the technology used by the Daarul Rahman Islamic Boarding School was Sensor. An important component in IoT. The amount of data created by sensors will be very large and IoT equipment will communicate via communication channels such as Wi-Fi.

The Daarul Rahman Islamic Boarding School was only a few fields that had used IoT and stores data on the servers of each department. Meanwhile. The respondent also views that the main obstacle in implementing IoT at the Daarul Rahman Islamic Boarding School was human resources (HR), such as the readiness, ability and willingness of human resources (HR). Furthermore, the problem incur was cost, as implementing the Internet of Things (IOT) required quite a lot of money for invesment. Furthermore, the urgency of implementing Internet of Things-based services at Daarul Rahman Islamic Boarding School is for security and monitoring, such as smart door and window sensors, security cameras, or motion sensors can help monitor and protect assets as well as the safety of boarding school residents. Moreover, the Islamic Boarding School considered that stakeholder needs analysis (evaluating the needs and priorities of Islamic boarding schools, such as security, energy management, health or inventory management) was an important step in planning IoT implementation with support training and outreach (training to staff, residents and related parties regarding the use and benefits of IoT technology) was an important step. Another study by Huda et al. (2020) provides information and the suitability of the application of IoT which is very strong on the success of learning, attitudes and behavior of students as the millennial generation in the Era of the Industrial Revolution 4.0. Apart from that, learning models such as Innovative learning are the most suitable models in the Industrial Revolution Era 4.0, because currently almost all learning is based on the Internet of Things (IoT) as an excellent learning medium. Apart from that, in other research on students at the Nurul Jadid Islamic Boarding School from all levels of education, the research results showed significant changes in students' motivation and learning outcomes after being exposed to learning with the IoT concept (Syakroni, 2019).

In terms of infrastructure, Daarul Rahman Islamic Boarding School does not yet optimal have IoT-based equipment or infrastructure such as sensors, smart devices or other tools, but has started bringing in consultants/experts to provide input. Daarul Rahman Islamic Boarding School also need data security and privacy management related to the use of IoT technology and concern about data security and privacy related to the use of IoT technology. IoT technology really supports the life of the Daarul Rahman Islamic Boarding School. In Technology Readiness Index The majority of respondents, agreed that products and services that use IoT technology are much more comfortable to use. Also by using IoT agreed that they liked the idea of doing business via IoT because it was not limited to normal working hours. Previous research by Amali et al. (2022) tried to design an IoT-based solar energy system at the Assyifa Islamic Boarding School Laboratory, Subang Regency as an active contribution in overcoming air pollution as well as a renewable energy solution and handling air pollution as well as

a solution to the current depletion of energy. The system is planned with solar panels, inverter and electric current controller, which has built-in WiFi connectivity.

The majority of respondents, also chose neutral that they liked using the most advanced IoT technology available and customize things to suit your own needs. The IoT technology makes employees more efficient at work. In The Daarul Rahman Islamic Boarding School agreed that you find new IoT technology to be mentally stimulating and IoT technology gives employee more freedom of movement. Used of IoT was easier to handle than people performing the same service and agreed the majority of respondents were neutral that humans can solve problems more effectively than IoT. The majority of respondents, agreed that people often become too dependent on IoT technology to do things for them. IoT technology designed to make life easier usually and employees want to see the benefits of IoT technology demonstrated before.

The majority of respondents, are neutral that other people come to you for advice about IoT technology and are neutral that other people come to you for advice about IoT technology. The respondent that you enjoy the challenge of finding out about high-tech gadgets and have fewer problems than other people in creating IoT technology. The majority of respondents agreed that you have fewer problems than other people in creating IoT technology. The employees also feels embarrassing when they have problems with IoT technology gadgets when people are watching and feel that new IoT technology makes it too easy for governments and companies to spy on people. The main focus of this research is to investigate the extent to which Internet of Things (IOT) technology can be applied in this school environment, by gathering views and potential contributions from various parties involved in it. Stakeholders who are research subjects include local government (Pemda), city government (Pemkot), education services, associations, parents' associations, IT practitioners, teachers and vendors. All of these parties have an important role in the development and application of this technology in the Islamic boarding school environment. In the context of the Daarul Rahman Islamic Boarding School, IoT implementation can include various aspects, such as the use of eye sensors to detect the location of students, the use of CCTV to monitor security, the application of a fingerprint system for access to facilities, automatic tap sensors for ablution facilities, emergency call systems, central online learning for students to prepare material before class, as well as the use of headband-shaped sensors to monitor students' concentration levels.

In the FGD (Focus Group Discussion) discussion, participants will discuss the roles and contributions of ten relevant stakeholders, including external parties, in designing and implementing adequate IoT solutions to improve the efficiency and quality of education at Islamic Junior High School integrated Daarul Rahman. From the mapping results, there are three main actors most frequently chosen by FGD participants, namely the School Committee (teachers, parents and employees); BSI Bank (Indonesian Sharia Bank); and Goods and Technology Procurement Partners (material shops and IT personnel). In the process of determining stakeholder priorities for developing innovation, we adopted a structured approach using a priority scale of 1 to 4. This scale is used to determine which stakeholders need to be given the highest priority in developing innovation, especially in the context of implementing the Internet of Things (IoT). The following are the criteria used in priority assessment:

1. High Power, Highly Interested People (Manage Closely): You must fully engage these people, and make the greatest efforts to satisfy them.
2. High Power, Less Interested People (Keep Satisfied) Put enough work in with these people to keep them satisfied, but not so much that they become bored with your message.
3. Low Power, Highly Interested People (Keep Informed). Adequately inform these people, and talk to them to ensure that no major issues are arising. People in this category can often be very helpful with the detail of your project.
4. Low Power, Less Interested People (Monitor). Again, monitor these people, but don’t bore them with excessive communication.

By using this scale, we can carry out a more systematic and objective assessment of the stakeholders involved in the innovation development process, thereby ensuring that resources and attention can be allocated effectively according to the level of importance of each stakeholder.

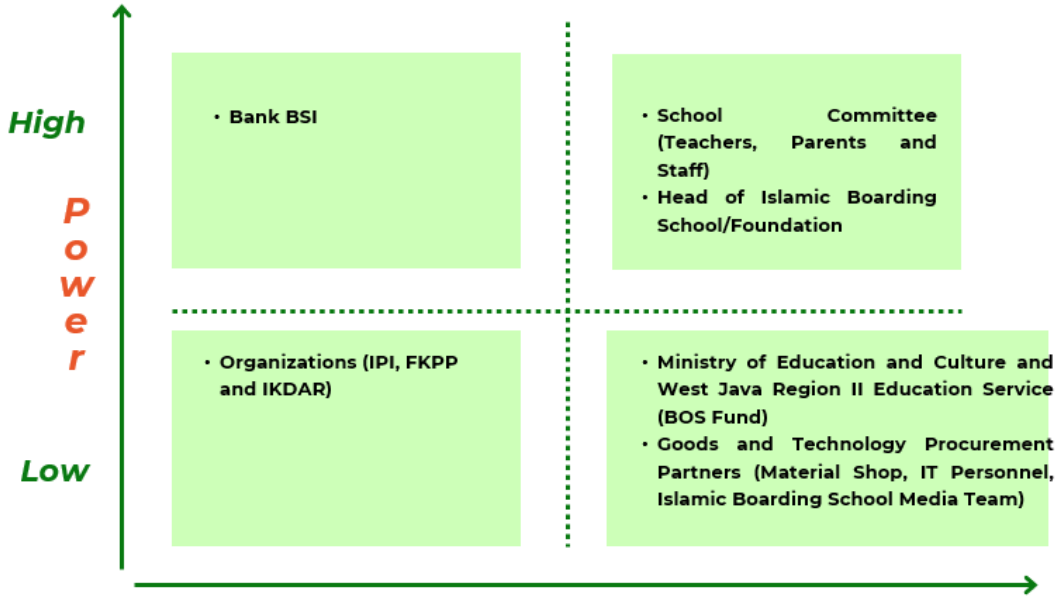

Fig.2: Important stakeholders in business operations in implementing IOT

In The Figure 2. The majority of respondents, consider the school committee (including teachers, parents and school employees) and head Islamic boarding School and foundation to be very important stakeholders (scale 4) in business operations at the Daarul Rahman Islamic Boarding School. Meanwhile, other respondents agreed that the Ministry of Education, Research and Technology (Kemendikbukristek) and the West Java Region II Education Office were important (scale 3) in business operations. This is because it has an influence on providing funding for schools in the form of BOS funds.

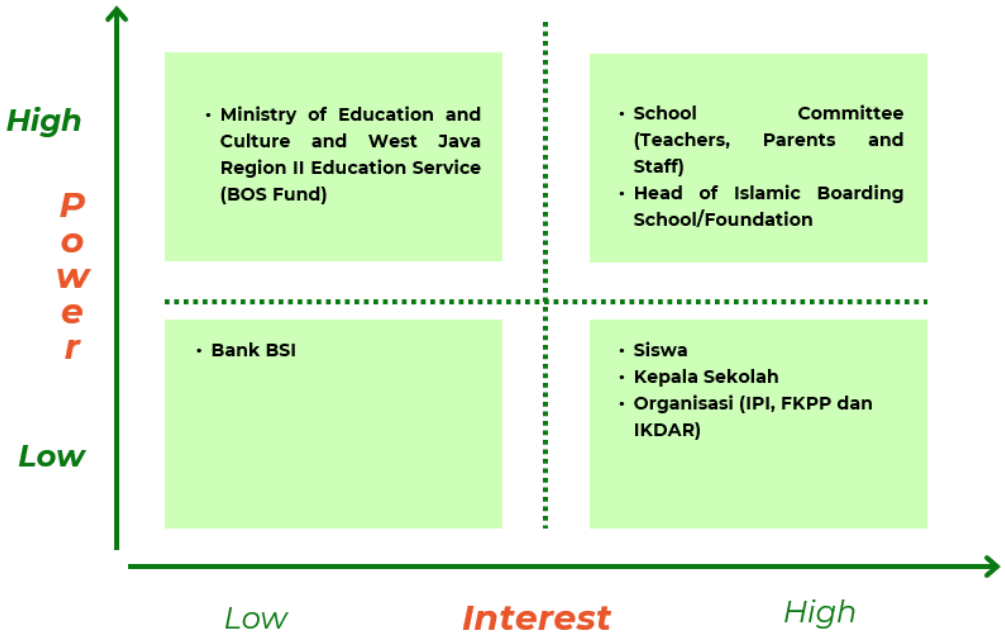

Fig.3: Important stakeholders in influencing policies related to IoT

The majority of respondents, consider the school committee (including teachers, parents and school employees) to be very important stakeholders and head of Islamic boarding school or foundation (scale 4) and consider the same stakeholders to be equally important. In influencing policies related to operations at the Daarul Rahman Islamic Boarding School. The majority of respondents, consider that students are very important stakeholders (scale 4) to build consistent communication with stakeholders at the Daarul Rahman Islamic Boarding School. Meanwhile, other respondents agreed that choosing a school committee (including teachers, parents and school employees) was important (scale 3) to build consistent communication with stakeholders. This is considered because the school committee is a liaison for internal information that needs to monitor the progress of existing innovations.

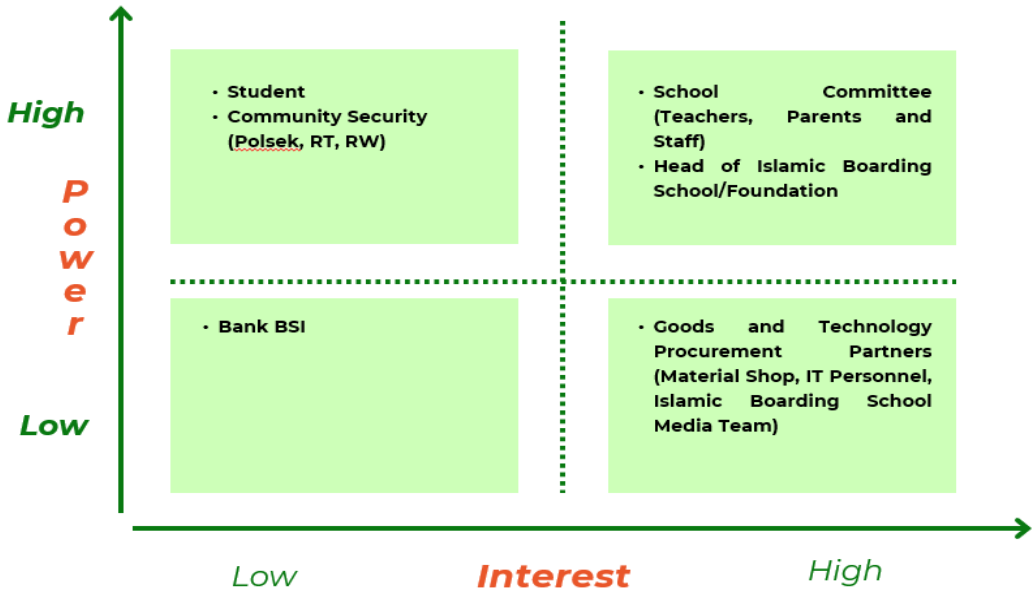

Fig.4: Important stakeholder that need to be consistent communication.

Previous research by Amali et al. (2022) tried to design an IoT-based solar energy system for PLTS at the Assyifa Islamic Boarding School Laboratory, Subang Regency as an active contribution in overcoming air pollution as well as a renewable energy solution and handling air pollution as well as a solution to the current depletion of energy. The system is planned with solar panels, inverter and electric current controller, which has built-in WiFi connectivity. Another study by Huda et al. (2020) provides information and the suitability of the application of IoT which is very strong on the success of learning, attitudes and behavior of students as the millennial generation in the Era of the Industrial Revolution 4.0. Apart from that, learning models such as Innovative learning are the most suitable models in the Industrial Revolution Era 4.0, because currently almost all learning is based on the Internet of Things (IoT) as an excellent learning medium. Apart from that, in other research on students at the Nurul Jadid Islamic Boarding School from all levels of education, the research results showed significant changes in students' motivation and learning outcomes after being exposed to learning with the IoT concept (Syakroni, 2019).

The position of this research is the development of models through organizational services based on the Internet of Things (IoT). Based on previous research, digital technology is already widely used to develop IoT, even if it is offering organizational services, innovation, entrepreneurship but also for the services of a legal company. However, there is not yet much research on Islamic boarding schools as a place to implement IoT in creating innovative organizational service adaptation models. With the educational potential of Islamic boarding schools spread throughout Indonesia and the potential for Islamic boarding schools to become organizations, it is possible to create IoT-based organizational services to achieve innovative Islamic boarding schools in the era of disruption.

5. Managerial Implication

Historically, Islamic boarding schools are an Islamic educational institution that was revived by the Indonesian Muslim community. Regardless of whether the traditional traditions in the system were adopted, it did not influence the unique patterns (khals) that have evolved and lived in the midst of social history. Especially in the field of education, for example, Islamic boarding schools in Daarul Rahman are working together to develop a competitive educational model that is capable of producing students who have competence in the acquisition of knowledge as well as skills so that they become equipped to enter into social life which continues to experience change supported by modernization of salt in technology. Implementing IoT in Islamic boarding schools can open up great innovative opportunities to improve service quality, security and overall management efficiency of Islamic boarding schools. However, along with these benefits, it is also necessary to pay attention to data security and privacy aspects to protect sensitive user information. The application of the Internet of Things (IoT) in Islamic boarding schools can create various innovative conditions that can improve efficiency, comfort and experience for students and Islamic boarding school managers. The following are some of the innovative phenomena that occur such as Monitoring the Health of Student. IoT. Use of IoT-based devices such as smartwatches or health sensors that can monitor students' health parameters, such as heart rate, body temperature and physical activity levels. This data can be accessed by Islamic boarding school managers and medical personnel for real-time health monitoring. Security and Environmental Monitoring with using Smart Security Systems: Implementation of smart security systems connected to an IoT network, including smart security cameras, motion sensors, and facial recognition systems to ensure Islamic boarding school security. Furthermore, environmental Monitoring: IoT sensors to monitor air quality, temperature and humidity around the Islamic boarding school. This can help identify potential health and safety issues. The limitation of the study can be used for future research that can used in different Area.

6. Conclusion

In conclusion, this study provides valuable insights into the current state of IoT adoption at Daarul Rahman Islamic Boarding School and the role of stakeholders in the implementation process. While some progress has been made in areas such as security and environmental monitoring, significant challenges remain, particularly in terms of human resources and financial constraints. The stakeholder analysis reveals that the school committee, head of the boarding school, and technology procurement partners are key actors who can drive the adoption of IoT in Islamic boarding schools. To fully realize the potential benefits of IoT, such as improved efficiency, safety, and learning outcomes, Islamic boarding schools need to develop a comprehensive strategy that addresses the identified barriers and engages all relevant stakeholders. This may involve providing training and support for staff, allocating sufficient financial resources, and collaborating with external partners who have expertise in IoT implementation. By embracing technological innovation while preserving their unique values and traditions, Islamic boarding schools can create a more dynamic and future-oriented learning environment that prepares students for the challenges of the 21st century.

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