CHAPTER ONE
INTRODUCTION

1.1 RESEARCH BACKGROUND.

Pass the building operation pattern in traditional. At this time, many technological changes have evolved to meet the needs of building owners and resident's sustainability. Almost all buildings are moving toward technology with the revolution industry which is moving faster. Refer to international facility management associated defining facilities include a variety of ways to ensure that environmental functions are built on such interventions as technology, processes, and places. According to (Nizam Kamaruzzaman & Marinie Ahmad Zawawi, 2010), Facility management is like an umbrella for a building as it controls the overall building operations. Facility management is also responsible for in-house services including housekeeping, security, and other services. To maintain all the facilities management services need to have technology capable of communicating with all the services provided.

Internet of Things (IoT) creating by Kevin Ashton, MIT Auto-ID centre on 1999, Since then, many devices have changed by adding functionality for example mobile phone not only to receive and make calls but as a replacing camera functions, recording voice and clock. Some organizations use the Internet of Things (IoT) such an important for drafting the strategic in organization. internet of things (IoT) related research has published several terms that reflect different perspectives and the significant today and coming soon such as cyber-physical system, industrial internet, internet of everything, industry, the web of thing, web 3.0, M2M (machine-to-machine), internet of objects an anything (Najmah, 2014)

According to the (Atkin, 2012) Internet of things (IoT) is about to expand by focusing on several technologies such as wireless communication, internet, embedded system, and micro-electron mechanical system (MEMS).

It means the internal systems, wireless sensor networks and automation (smart automation for homes and buildings) and will contribute to the widespread and effective use of the Internet of Things (IoT).

This communication network greatly influenced the growth of the facility management industry in line with the industrial revolution. At present, the world is preparing for a new revolution in the industrial field. Therefore, every sector of the industry should take the first step in facing this revolution. The first industrial revolution was a steam-based industry, the second industrial revolution was an electricity-based industry followed by a third industrial revolution based on technology information. The world is now moving to a new revolution in the field. The industrial revolution is 4.0 where used the Internet of Things (IoT) is the basis of a new industry (Schwab, 2016)

The Internet is an information communication network that connects millions of networks worldwide (Bridges, 1997). The Internet is an information communication network that connects millions of networks worldwide. The Internet has undergone many stages of development that started with connection to computers or devices.

The development of computers parallel with the development of the internet and gadgets such as personal computers, laptops, tablets, and smart phone the internet only connects this device to send, receive, process and store information until recently the internet has connected devices to another through a network known as the Internet of Things (IoT) (Macaulay & Kuckelhaus, 2015).

Thus, Building operations have surpassed the advancements in wireless technology and can connect every appliance in the building. In the era of advanced technological, facilities management was introduced with the Building Management System (BMS), Building Automation System (BAS) and Computerize Maintenance Management System (CMMS). without knowledge facility management of the technology used as the Internet of Things (IoT) that could assist facility management in monitoring building operations just at

the fingertips. Thus, the system facility management industry use is the one technology can give core business smooth for know how the system work based on the system for example, read Celsius and Humidity from the air conditioning unit directly from the control management system.

1.2 PROBLEM STATEMENT

Internet of Things is also synonymous with the internet for everything is the future technology to pay attention. It is a new paradigm in the field of technology through the network between machines and global devices that can interact and communicate with each other. Thus, the Internet of Things (IoT) is considered to have the potential to change the process and business strategy in various industries whether in large or small industries (Lee & Lee, 2015). There are some issues regarding on Internet of Things (IoT).

In 2017, the previous government has tried to implement the Malaysia digital base in line with the direction of this world on the verge of the industrial revolution and the era of the digital economy. The previous government has been provided an allocation of RM245 million for developing industrial revolution 4.0 involving the technology sector (Che Wan Badrul Alias, 2017).

In, year's 2019 budget presentation by the current government has been provided an allocation of RM 210 million to bring technological change in line with the industrial revolution (Nabil Basaruddin, 2018). But, mostly people still lack knowledge about revolution industry 4.0 and how the internet of thing (IoT) apply in industry (Hafiz Marzuki, 2018)

1.3 CENTRAL RESEARCH QUESTION

Use of the Internet of Things (IoT) is an important technology in facility management especially involving management controls for aimed to achieve for user and owner requirement. Based on the problem and issue faced in internet of things (IoT), there are problem that appear for research purpose.

The main question is how to promote internet of things (IoT) on facility management companies?

1.4 RESEARCH AIM

The purpose of the research is to state the intention or aspiration of the research study. It summarizes in one sentence what you hope to achieve by the end of the research project. Goals should be specific and expressed in such a way that it is possible to identify when it has been achieved. Research aim for this study is to promote the Internet of Things (IoT) among the facility management companies.

1.5 SECONDARY RESEARCH QUESTION

Regarding the issues that have been discussed, questions were raised as a basic guide to the overall implementation of the study. This research was undertaken to find the answer to the following question:

I. What is the factor of internet of things (IoT) in facility management company?
II. What is the level of awareness facility management company in internet of things (IoT)?
III. How recommend internet of things (IoT) in facility management company?

1.6 RESEARCH OBJECTIVES

In conjunction with to achieve the research goal and to answer the research objectives, several specific objectives had been identified. The objectives are as follow:

I. To identify the factor influence the among facility management company to impalement internet of thing (IoT).
II. To analyse the level of awareness among facility management company to implement internet of thing (IoT).
III. To propose the improvement in implementation of Internet of Things (IoT) in facility management company.

1.7 SCOPE OF RESEARCH

The scope of this research must focus on private hospital in Kuantan, Pahang and involve staff of the facility management company regarding the Internet of Things (IoT) among the companies involved in this research:

I. Sultan Ahmad Shah Medical Centre
II. Kuantan Medical Centre
III. IIUM Specialist Medical Centre

1.8 SIGNIFICANT OF RESEARCH

This study will be a significant endeavour in promoting the internet of things (IoT) in the facility management company. This study will also be beneficial to the company for knowing the function of internet of things (IoT) in industry and without realizing almost all facility management company in Malaysia used internet of things (IoT) every day. This research will provide a recommendation on how to promote the Internet of Things (IoT) in the facility management company and the advanced technology

Moreover, this study will be helpful to the facility management company knowing more about internet of things (IoT) technology. It will also serve as a future reference for research on the title of Internet of things (IoT) in facility management company and importantly. This research will educate all involved in the facility management company to knowing what is associated with the internet of things (IoT) as the government has recommended three years ago.

1.9 SUMMARY OF THE CHAPTER

This chapter has explained the current issue related to internet of things (IoT), problem statement, objectives and scope of the research. The research focuses on internet of things (IoT) in facility management companies In the next chapter, the research will provide further explanation on literature review about internet of things (IoT) in facility management company.

CHAPTER TWO
LITERETURE REVIEW

2.1 Introduction

As elaborated in chapter one, the introduction for this research is entitled internet of thing in the facility management company, which research has briefly explained.

In today's world, humans are surrounded by many physical electronic devices, automated vehicles, smart devices, and smart buildings. These all physical entities are embedded with software that allows them individually to supply the special services and facilities they're designed for the net has also overcome the geographical boundaries through the use of powerful communication (Gupta & Gupta, 2016). Device-specific functionaries would be provided by the embedded software. Physical devices sensors would sense the presence of other physical entities in the surroundings and will gather the required information. The Internet will act as a communication medium between various diverse types of physical devices and will be responsible for remote management and access control of these devices. The vision of a web of Things built from smart objects raises several important research questions in terms of system architecture, design and development, and human involvement (Kortuem et al., 2010).

A smart building is one technology to control the building using the Internet of Things (IoT). The place that has highly advanced automatic systems for controlling and monitoring lighting and temperature, building appliances, multi-media equipment, and security systems and many other functions (Gubbi et al., 2013) Through Internet of Thing, almost every object of our standard of living during a building will be connected to the- internet of things (IoT) allows monitoring and controlling all of those connected objects no matter time and placement (Kortuem et al., 2010).

The Internet of things (IoT) is changing businesses and can result in a digital disruption and data explosion. the chance that technology presents to alter the way facilities management works is large, but it'll need to be leveraged by skilled and knowledgeable professionals who understand how best to facilitate the convergence of individuals, place, and process for business. The potential technology can transform the FM function and advancements like the internet of Things (IoT), Building Information Modelling is already contributing to improving business performance (IFMA & JLL;, 2018).

Facilities management helps organizations more efficiently manage their land, and it’s extremely important when you're managing historic buildings that house the office. the power management involves maintaining accurate data about the ground plans, space utilization, asset location, and technical plants (D’Urso, 2011). An efficient facilities management information system can better support the primary organization itself, increase the building’s life expectancy and value, optimize appliance maintenance, help schedule routine maintenance activities, and improve the quality of the working environment (Svensson, 1998).

2.2 Industrial Revolution 4.0

2.2.1 Definition Industry Revolution 4.0

Industry 4.0 is related to call the “smart factory” (Schwab, 2018) In smart factories, a virtual copy of the physical world and decentralized decision making can be developed (Buhr, 2017). Also, the physical system can collaborate and communicate with each other and with humans in real-time, all powered by the Internet of Things (IoT) and related services.

There is no fixed definition for industrial revolution 4.0 but it’s the essential transition technology from the digital era to the cyber era. (Tupa et al., 2017). Physical cyber systems are technologies created by the manufacture of smart computer technology.

2.2.2 Industrial Revolution Progress

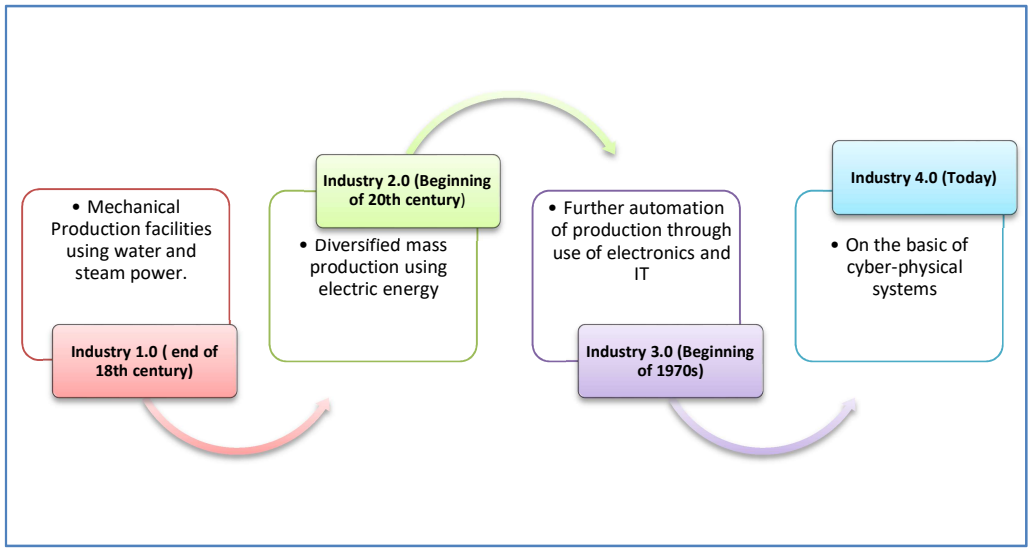


Figure 2.1: Movement process from Industry 1.0 to Industry 4.0
(Sources by Schwab, 2018)

a) Industrial Revolution 1.0

Industrial Revolution 1.0 was introduced around the 18th century where the industry introduced was a steam-based system. At that time, the creation of steam power machines changed the way humans work from the human workforce to the energy machine. The use of steam power machines and also more focused on sector activities (Lukac, 2016).

b) Industrial Revolution 2.0

The Industrial Revolution 2.0 began around the 19th century. That time, technological developments had change technology to electricity systems. At that time, the new technology was created such as the telephone; lamps, oils and gasoline engines were invented as well as Electric Power produced mass production and changed the process of assembly of electrical components (Marius et al, 2016).

c) Industrial Revolution 3.0

According from (Erboz, 2018) Industrial Revolution 3.0 began around the 1960s where the revolution was based on information technology and the internet and computers were the main pillars. The revolution has also seen a combination of the-use of information technology and electricity to produce automation technologies.

d) Industrial Revolution 4.0

The Industrial Revolution 4.0 introduced by Klaus Schwab said he saw the revolution as a technological marvel of digital technology that could connect billions of people through devices. The revolution also saw the discovery of new technologies such as artificial intelligence, the Internet of Things (IoT), robotics, autonomous vehicles, 3D printing, nanotechnology, and quantum computing. At the same time, the Internet of Things (IoT) is at the heart of this revolution (Schwab, 2018). According to Schwab, there were nine key pillars in the Industrial Revolution 4.0. Here are the nine cores:

1. Internet of Things (IoT)

   Internet of Things (IoT) is a network created network capable of controlling, programming and detecting via devices that allow devices can communicate automatically without human assistance.

2. Autonomous Robot

   Autonomous Robot is a workforce that is fully used by energy machines. Whereas, a robot equipped with sensors enables to receive the command and reactions it provides. It helps robots perform complex tasks and can improve the quality of their products effectively and productively.

3. Big Data

   Big data is a large scale data obtained from various sources of technological devices used today such as computers, smart phones, and sensors (Portela et al., 2016) The advent of the Industrial Revolution 4.0 triggered a lot of data that required efficient management to save the data sources.

4. Cloud Computing

   Cloud Computing has become an excellent platform for the development of computing solutions for various fields of knowledge. This new computation approach has many advantages but also requires some challenges. Cloud Computing is a response to current scenarios where tasks such as sharing, obtaining and-handling large amounts of information are realized. (Carlos et al., 2017).

5. Augmented Reality

   Augmented Reality is a form of experience in which the world is enhanced by computer content associated with a specific location and/or activity. In simple terms, augmented reality enables digital content to flow seamlessly with our perception of the real world. In addition to highly anticipated 2D and 3D objects, digital assets such as audio and video files. (Yuen et al., 2011)

6. Simulation

   Simulation is a 3-dimensional animated image displayed shows a real picture of an object in the real world (Tatic & Tesic., 2017).

7. Additive Manufacture

Additive manufacture (AM) enables prototype production and artefacts to function fully although very different in solution, principle, and embodiment the function similar. Artificial intelligence is the process of unifying materials to create objects from 3-dimensional data models with layers. For example, artificial intelligence is 3D printing technology. (Jiménez et al., 2019).

8. Cyber Security

Cyber security is a board used term, its definition is highly variable, often subjective, and sometimes unreasonable. The lack of a clear and comprehensive definition that captures a wide variety of cyber security impedes technology and scientific advances strength by cyber-security perspectives, especially separating disciplines that need to act consistently to solve complex cyber security challenges. (Craigen et al., 2014) Cyber Security is information and user privacy that includes organizational assets such as intellectual property, customer data, and company information.

9. System integration

Information system integration aims at facilitating exchange and information sharing within an organization. (Mohamed et al., n.d.) The system enables various computers to connect via software that makes it easy to communicate and transmit information for example, involve a server that helps users to get information just one click.

2.3 Internet Background

Definition internet refers to international digital communications systems, which arise from the agglomeration of thousands are networks that interact through some common protocols around the world. The foundations of the internet are shaped by the global connection between hundreds thousands of other computers, communications entities and information systems. (Bridges, 1997) The internet is very important to ask a new technology, and no wonder that it is getting a lot of attention from entrepreneurs, executives, investors, and business watchers. In the spirit of the general public, many have assumed that net change is everything making rules about companies and using by people (Porter, 2001).

2.4 World History of Internet Development

The history of the internet begins with the development of electronics in the 1950s and the concept of computer networks has comes laboratories located in the United States, France, and the United Kingdom. The computer network is used to store laboratory data. The research comes to continue the computer function and also about internet usage studies for the use of laboratory researchers (Kim, 2005) the real history of the internet was to the purpose of United States military and defence forces. The internet was developed to facilitate communication between the United States Department of Defence with research in the public universities assisting in the development of this technology (Hussein et al., 2000).

In the 1965s, Robert with the help of Thomas Merrill applies theory by Leonard Kleinrock at Massachusetts Institute of Technology (MIT) to the theory of packet switching that was a major step towards computer networks. As a result of this collaboration, they were able to connect the TX-2 computers in Mass with the Q-32 computers in California; United States using the low-cost networks is making it the first widely used computer network. (Marill & Roberts, 1966)

In the 1967s, The Advanced Research Project Agency Network (ARPANET) was introduced for the Department of Defence, the United States with researchers at public universities (Hussein et al., 2000) As a result of the collaboration between the proposed universities, four universities are successful in pursuing computer technology research through the relationship of four nodes (Roberts etc al., 1967) Network Control Protocol (NCP) is designed through Network Control Protocol (NCP), applications such as transmission and data transfer can be handled through connections between these networks to other computers.

As a result of the development of Network Control Protocol (NCP), Ray Tomlinson has suggested to The Advanced Research Project Agency Network (ARPANET) to create an email network to easy communication between them. Ray Tomlinson has suggested a standard for internet email addresses by using the "@" symbol to distinguish a username from users host. Later, in the 1974s Network Control Protocol (NCP) was replaced with Transmission Control Protocol (TCP) / Internet Protocol (IP) because of several weaknesses identified with Network Control Protocol (NCP) (Lynch etc al., 2009) This is because the Network Control Protocol (NCP) cannot handle the network remotely and don't provide security controls if any packet protocol is lost) (Sigg, 2012).

The 1990s were the culmination of internet usage where Tim Berners developed the basic Internet key using code with Hypertext Mark-up Language (HTML), Hypertext Transfer Protocol (HTTP) and World Wide Web (WWW) codes (Sigg, 2012) by the year 2000, the internet was gaining popularity around the world and technology service providers like Amazon, Microsoft and Google seized the opportunity to develop and provide public services to consumers (Sigg, 2012).

2.5 Internet development in Malaysia

The history of internet development in Malaysia is not the same as the world internet development. This is because the history of the world internet development aims to carry out military activities while in Malaysia expanding the internet due to research and communication purposes (Hussein et al., 2000).

The Internet in Malaysia beginning in 1987 when the Malaysia Institute of Microelectronic (MIMOS), Malaysia Computer Network (RangKom) (Hussein et al., 2000). Later, Malaysia Institute of Microelectronic (MIMOS) launched Joint Advanced Research Integrated Networking (JARING), the only Internet Services Provider (ISP) of Malaysia in 1990, providing internet facilities to job research for institutional and private research (Swee et al., 1997). To facilitate Malaysian consumers with global internet access, in 1992 Malaysia launched a satellite connecting Malaysia with the United States.

The following year, the number of internet hosts was increased from October to November 1995 the survey conducted by Malaysia Institute of Microelectronic (MIMOS) found that one in every thousand Malaysia had access to the internet. In 1998, the number of internet users increased to 2.6% of the population and the number of computer units sold, up from 467,000 that year to 701,000 in 2000, showed a marked increase in 2005, National Public Policy Workshop (NPPW) proposed a strategy for increasing consumption Information and Communication Technology (ICT) and the Internet. Among the results of the National Public Policy Workshop (NPPW) is the High-Speed Broadband Initiative launched in 2010. As of July 2012, Internet users in Malaysia reached 25.3 million. Of these, there are 5 million broadband users, 2.5 million wireless and 10 million 3G subscribers (Salman et al., 2013).

2.6 Evolution

The evolution of the internet is the evolution web changing the world is the World Wide Web (WWW) from Web 1.0 to Web 3.0. The internet created by Vinton Cerf in 1973 and the web created by Tim Berners are two different terms where Vinton Cerf's creation of the internet is a network and Tim Berners creation is a web linking information search application (Zhou, 2013) Nevertheless, the internet is an important part of triggering the evolution of the web (Aghaei et al., 2012).

2.6.1 Web 1.0

Web 1.0 was introduced by Tim Burners-Lee in 1989. The current state of the web is based on the concept of reading (web read-only), meaning the web is a static form of information to the users only read through the web. the current websites are not interactive where users can only visit websites without any trace or contribution (Aghaei et al., 2012) the network-accessible information would be referred to by a single Universal Document Identifier (UDI). (Berners-Lee, 1998).

Web 1.0 is a static providing catalogue or brochure to present their products on the web and users can read and contact the business owner/website. Catalogues and brochures, as well as advertisements in newspapers and magazines, have ecommerce websites that use a variety of applications. The main goal of the site is to publish information to anyone at any time and to create an online presence (Suphakorntanakit, 2008)

2.6.2 Web 2.0

Web 2.0 was introduced by Dale Dougherty in 2004. Definition for web 2.0 is a one revolution the internet basic platform for creating the applications that leveraged networks to reach more users. In contrast to Web 1.0, Web 2.0 is based on read-write web. The web provides more free interaction with

users online. Web 2.0 enables users to gather information, exchange ideas and share information with other users online. (Aghaei et al., 2012)

One of the attractive features of web 2.0 is that it supports collaboration and helps to bring together the collective intelligence of web 1.0 (Murugesan, 2007). The main technologies and services of web 2.0 are included Blogs, Really Simple Syndication (RSS), Wiki, Mashups, Tags, Folksonomy, and Tag Clouds. Table 1 compares web 1.0 and web 2.0 in some of the features of simplicity

Table 2.1: A Comparison of web 1.0 and Web 2.0
(Sources by Aghaei et al., 2012)

WEB 1.0	**WEB 2.0**
Reading	Reading/Writing
Companies	Communities
Client-Server	Peer to Peer
Hypertext Transfer Protocol (HTML), Portals	Extensible Markup Language (XML), Really Simple Syndication (RSS)
Taxonomy	Tags
Owning	Sharing
Initial Public Offering (IPO)	Trade sales
Netscape	Google
Web forms	Web application
Screen Scraping	Application Programming Interface (API)
Dialup	Broadband
Hardware costs	Bandwidth costs
Lectures	Conversation
Advertising	Word of mouth
Services sold over the web	Web Services
Information Portals	Platforms

2.6.3 Web 3.0

John Markoff introduced the term Web 3.0 as the third generation of the web (Nova, 2011) Web 3.0 is about the concept of smart internet (smart internet experience/intelligent internet experience) where the internet can enable the devices around to analyse data for new information for example improve the data management, support accessibility of mobile internet, simulate creativity and innovation, encourage factor of globalization phenomena, enhance customers satisfaction and help the social web collaboration. (Aghaei et al., 2012)

The core of Web 3.0 is the Semantic Web, which is a web of computer-generated features. Computers are said to be able to think on their own and understand information like humans. It is artificial intelligence where computers can replace human roles in thinking and acting (Aghaei et al., 2012) Examples of Web 3.0 that now feature are the Internet of Things (IoT) currently through any internet network or server. The Internet of Things (IoT) can automatically interact with its own devices without human control.

Table 2.2: A Comparison of web 1.0 and Web 2.0
(Sources by (Aghaei et al., 2012)

WEB 2.0	**WEB 1.0**
Reading/Writing	Portable Personal Web
Communities	Individuals
Sharing Content	Consolidating Dynamic Content
Blogs	Life stream
AJAX	RDF
Wikipedia, Google	Db-pedia, i-Google
Tagging	User engagement

2.6.4 Web 4.0

According from Hemnath, Web 4.0 is also known as symbiotic web. The symbiotic web is the interaction between humans and machines. In simple words, machines would be reading the contents of the web and react in the form of executing and deciding what to execute first to load the websites fast with superior quality and performance.

Web 4.0 will be the read, write, execution and concurrency web. It achieves to manage in online networks that deliver global transparency, governance, distribution, participation, collaboration into key communities such as industry, political, social and other communities the web 4.0 will be parallel to the human brain. Although web 4.0 it's a technology and become the artificial intelligence include internet of things, big data and etc.

2.7 Definition the Internet of Things (IoT)

Internet of Things is that the one technologies under the revolution industry 4.0. The web of Things creates an intelligent, invisible network fabric which can be sensed, controlled and programmed. Internet of Things enabled products to use embedded technology that allows them to talk, directly or indirectly, with one another or the within the website (Tropmann-Frick, 2018). The potential benefits of Internet of Things are almost unlimited and Internet of things applications are changing the way we live and work by saving time and resources and opening new opportunities for growth, innovation and knowledge creation.

The Internet of Things is enables organizations to manage assets, optimize performance and develop new business models. It is an essential tool for connecting devices, for improving energy efficiency and optimizing all types of energy and transportation. It comes with technologies like cloud computer, big data, and 5G. Its success depends on ecosystem development, supported by an appropriate regulatory environment, and climate of trust (Franck, 2010) According to (Dr. Mazlan, 2014), the Ratio of things that

connect to the internet and the human population shows that Internet-connected to "things" surpassed the world's population in 2008 (the world's population is about 6.7 billion). Refer to the statistics by 2020 there will be 50 billion "things" that will be connected to the Internet compared to the human population just 7.6 billion at that time.

The Internet of Things has some security issues, privacy issues, diverse authentication and issues related to information storage management and access control network configuration. Internet of Things data and privacy protection is the application challenges. In Internet of Things, WSNs sensors in the RFID systems distinguish for information technology end, which is likely to defend the integrity and privacy of overall information by using the technology of password encryption. (Zayed Halabi, 2018). There are a lot of ways for encryption of information and data, for example, the hash chain protocol, random hash lock protocol, and Encrypted identifier. The access control and identity authentication can settle on the communication involving both sides and corroborate the true identity of each other, to prevent any sort of attacks to make sure the validity and authenticity of the information. (Qi Jing, 2014).

Internet of Things offers the possibility to understand in real-time what is happening throughout every aspect and component of a building and its operation and can provide valuable contextualized data for analytic. The facilities management is that the attainment of predictive rather than reactive maintenance to scale back downtime of assets and aid efficient labour management, among other benefits. Not only can Internet of Things provide the chance to make sure predictive maintenance of assets but Internet of Things also can be wont to improve space management and gain an improved understanding of how a facility is getting used and interacted with by its occupiers (Mylonadis, 2018). However, Internet of Thing technology in facility management become to be a better performance and efficiency to solve problem with the monitor system for example proactive maintenance schedule, manage assets, preventive maintenance and security (Donaldson, 2018).

2.8 Awareness on Implements the Internet of Things (IoT).

Awareness by utilizing the Internet of Things (IoT), Facilities management companies can implementation the maintenance tasks, manage teams and work. This beneficial and forward thinking technology can optimize operations, position FM companies ahead of competitors and implement fast acting and reliable problem solving procedures (Mikke Jeff, 2019) Implementing Internet of things in facilities management is imminent, so you might as well embrace it and reduce labour cost operation. (Medallion, 2018).The awareness implementation internet of thing in the facility management company can cost reductions, improved well-being, enhanced organizational profile, reduction of risk and enhancement of compliance (IWFM,2018).

2.9 Knowledge Level about the Internet of Things (IoT).

The concept of knowledge level is a useful level of description for the understanding system and also focuses on the representation of knowledge. In addition, Knowledge will be processed to obtain a part of the solution or to guide it in its construction. (Newel, 1981) the knowledge level is one of the important reason for introducing levels of description, specification, verification, design, prediction and explanation (Thomas,1986).

The years of 2014 - 2021 is time the European Union's importance of focused research and testing on the internet of things to support facility management technology. The European Union will invest almost EUR 500 million for the internet of things especially related to knowledge and innovation (Horizon, 2019). Based on The International Facilities Management Associate (IFMA) survey in years 2017, 84% of FM professionals agreed that those who successfully harness the power of the Internet of Things will contribute to the strategic advancement of the FM profession but in that same survey, only 13% of respondents indicated that they were extremely knowledgeable about the Internet of Things today (IFMA, 2017).

Building Management Systems (BMS) are not able to provide real time data that facility managers need to make informed decisions regarding efficiency, security, and comfort. The Internet of Things has given rise to many applications that utilize data gathered from connected devices, and the internet of things can help facility managers make smarter decisions about operations (Telit, 2017).

2.10 The Architecture Layer in Internet of Things (IoT).

Internet of Things (IoT) connected to object with the Internet through information sensing equipment for information-exchange and communication, to achieve intellectualized identifying, positioning, monitoring and managing. Aim is to have all items connected with the Internet for convenient identification and management (Zhai et al., 2019) The logically divided into presentation layer, transport layer and application layer (Azzola, 2018) The presentation layer senses, gathers information, and submits the collected information to the higher application layer for intelligent processing via Internet or other transmitted networks (Y.Ning, 2004)

The Open System Connection System Model (OSI model) is a conceptual model that characterizes and simulates the telecommunications or computing system's communication functions without regard to its internal structure and technology. The goal is the interoperability of multiple communication systems with standard communication protocols. The model divides the communication system into layers of abstraction. The original version of the model has seven layers but the architecture layers using in Internet of Things (IoT) have four type Sensing Layer, Network Layer, Data Processing Layer and Application Layer, (Sharma, 2009).

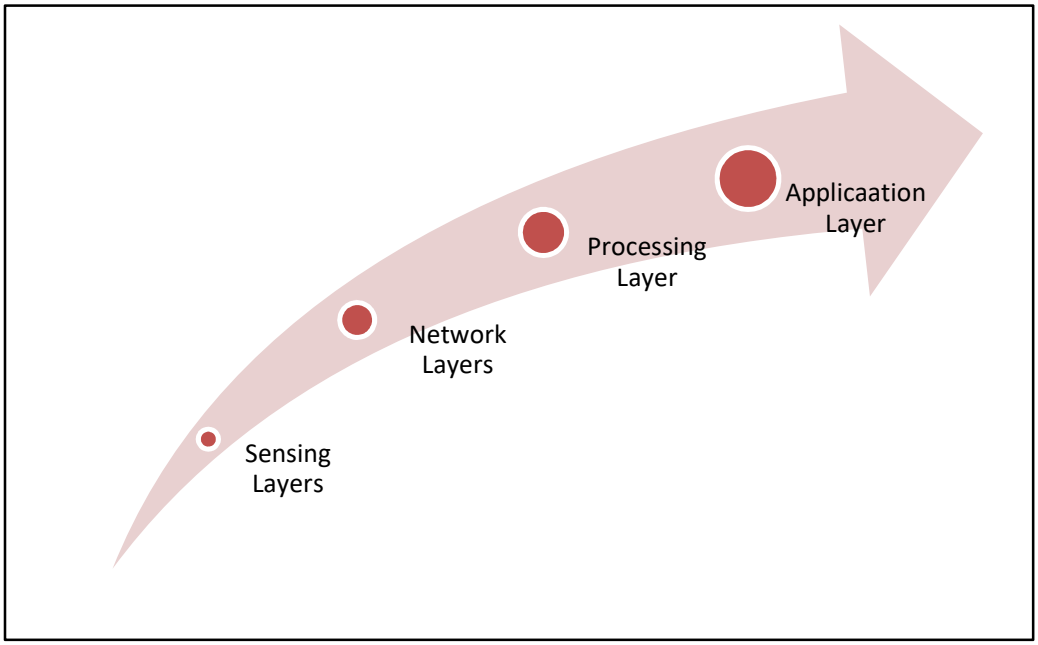


Figure 2.2: The layer of Network (source by Joao Pedro Reis)

2.10.1 Sensing Layer

The main purpose of the sensing layer is to identify phenomena in the device's data from the real world. Sensor using multiple sensors for application is primary feature for the Internet of Thing (IoT) devices (Khan et al., 2012) multiple sensors accumulate and forward the data to the processing unit and the specification name for data flow between sensor and application is inter-Integrated Circuit (I2C) or Serial Peripheral Interface (SPI). The communication channel between application and sensor depends on the Internet of Things (IoT) devices and the sensor in the Internet of Things (IoT) devices can be classified into three broad categories (Sikder et al., 2018)

i) Motion Sensors

The function motion sensor is the measure for change as well as the orientation of the devices. There have two types of motion sensors can observe devices such as (Sikder et al., 2018):

a) Linear motion is the linear displacement of Internet of Thing (IoT) devices.
b) The angular devices are the rotational displacement of the devices.

ii) Environmental Sensors

The sensor used in the environment sensor to change the parameters on the devices. The primary purpose of using is the environmental sensor in the Internet of Things (IoT) to help the devices make autonomous decisions and from the application can giving improve user experiences for example, environmental use in building such as the lighting sensor, Pressure sensor, and temperature. The application by are user is a home automatic system and smart lock (Sikder et al., 2018).

iii) Position Sensors

The position sensor is the Internet of Things (IoT) devices that deal with the physical position and location devices. Most position sensors used in the Internet of Things (IoT) are magnetic sensors are usually as a digital compass and Global Positioning System (GPS) sensors are used for navigation purposes in Internet devices (Sikder et al., 2018).

2.10.2 The Network Layer

The role of the networking layer is to connect all things and allow things to share information with other connected things. Besides, the networking layer is capable of aggregating information from existing IT infrastructures, for example, business systems, transportation systems, power grids, health care systems, ICT systems (Xu et al., 2014). In the Internet of Things devices, the network layer also implemented by communication technologies, for example,

Cellular network, Wi-Fi, Zigbee, Lora, etc. to allow data flow between other devices with the same network (Sikder et al., 2018).

a) Data Processing Layer

The data processing layer consists of the main data processing unit of Internet of things devices. The data processing layer takes data collected in the sensing layer and analyses the data to make decisions based on the result. Some the Internet of things devices used in smart watch, smart home hub, etc., the data processing layer also save the result to previous analysis for improve the user experience. This layer may share the result of data processing with other connected devices via the network layer (Sikder et al., 2018).

b) The Application Layer

The layer that contains, protocols and interfaces that devices use to communicate with each other (IFMA & JLL;, 2018) This layer also processes all service-oriented issues, including information exchange and storage, data management, search engines, and communication (Xu et al., 2014).

2.11 Movement the Internet of Things (IoT)

There are several components of the Internet of Things (IoT) that are the basic key to its implementation. Here are three components.

2.11.1 Sensor

Generally, sensors are devices can detect the environment changes by it. Sensors are useless but when we use them in electronic systems, the sensor can play a key role. Sensors can measure physical phenomena (such as temperature, pressure, etc.) and turn them into electrical signals. Three features should be at the base of a good sensor as it should be sensitive to

the phenomenon it likes, it should not be sensitive to other physical phenomena and it cannot change the phenomena measured during the measurement process (Azzola, 2018).

Devices have two types of are categorized into inactive objects that require support to make the smart devices require to support sensors. Sensors can change to electrical currents that can be connected between Machine to Machine to Machine (M2M), Radio-Frequency Identification (RFID) or **Supervisory Control and Data Acquisition (**SCADA) that can respond to surrounding conditions for act according to a predefined program. The sensor reacts to the physical stimulus and converts the stimulus to a signal readable by the device. Sensors are capable of responding to all kinds of stimuli and conditions such as heat, temperature, location, pressure, movement, and five human senses and make them the key catalyst for internet of Things (IoT) (Zhai et al., 2019)

Figure 2.3: Internet of things connects to equipment by sensor.
(Source by Liu Xuyang)

2.11.2 Connection

Approximately there are around 7.62 billion humans on our planet, but to surprise, by the year 2021 with an increasing graph of Internet of Things (IoT) devices, there may be around 20 billion Internet of Things (IoT) smart devices up and running with an increase in the demand of 5G network (Vijay, 2019). The networks are the second server of the application Internet of Things (IoT) and are dedicated to devices for realizing the Internet of Things (IoT) functionality. The networks enable devices Internet of Things (IoT) to communicate and interact with each other (Gupta & Gupta, 2016).

Communication between the devices becomes in two ways: through wireless networks and wired networks. Wireless networks are made up of short-range networks such as Radio-Frequency Identification (RFID), Wireless Fidelity (WiFi), Bluetooth, Worldwide Interoperability for Microwave Access (WiMAX) and long-range networks such as Global System for Mobile Communications (GSM), Code Division Multiple Access (CDMA), Wideband Code Division Multiple Access (WCDMA), which are usually in smartphones. The wired networks are networks to connected in the same building, for example, homes, and offices where these devices communicate with each other through nearby wires (Zhou,2013).

The technologies used in these devices are low energy wireless such as ZigBee, WiFi, Bluetooth, BLE, WiMax, and Z-Wave (Davidovic & Labus, 2016), most IoT technologies applications that are aimed at providing an identity-related service make use of RFID technology (Gao et., all 2007).

2.11.3 High Speed Internet

The high speed internet is the most important for helping internet of thing to running the devices and gibe respond to each other's. The launch of 5G networks is expected to significantly accelerate consumer and enterprise adoption of IoT products and services (Michael Hoffmann, 2019) especially involved services in facility management for example, giving some signal to

software such as Building Information System (BIS), Building Management System (BMS), and etc.

The Internet of Things (IoT) which seeks the most energy-efficient connection for countless devices. 5G can facilitate all of these different requirements by dividing a network up into many virtual networks. 5G is considered indispensable for industry building operation, intelligent traffic control systems or factory equipment. (Star, 2019)

2.11.4 Users

Users are the last mover in the Internet of Things (IoT) where users are individuals who take advantage of this internet of things (IoT) application. Consumers comprise various sectors such as industrial construction, logistics, manufacturing, management and so on. Consumers will leverage these interconnected Internet (IoT) applications for their benefit and will create a larger interconnected Internet (IoT) market depending on their usage rate.

2.12 FACILITY MANAGEMENT COMPANY

The definition of the term “Facility Management” from the International Facility Management Association (IFMA) is the practice of coordinating the workplace with people and work of the organization (IFMA,2002) to a profession that encompasses multiple disciplines to ensure functions of the built environment bye people, place, process and also the technology (IFMA,2004). This terminology is reinforced by adding that the facility management discipline covers an extremely wide range of activities, which include physical issues of the built environment, human and business aspects of facility performance and use, fi-financial issues of property investment, environmental health issues, management of structures, and management of construction (Atkin and Brooks 2000, BIFM 2004, Hinks and McNay 1999 and Nutt 1999).

Facility management is responsible for coordinating all efforts related to planning, design and management buildings and their systems, their equipment and their furniture, to improve the organization's ability to compete successfully in an environment rapidly changing (Becker, 2009). The typicality concept concerns the processes involved in the facility management such as services to building for example building maintenance operation and maintenance facilities (air conditioning, electrical, lift and hydraulic system), services space liked management of work safety, internal and external logistics, planning and also setup of workspace and last one, facility management concept is services to people, for example, cleaning services, food services, waste management, document management, supervision, information desk, laundry, and postal services. (Guido Guizzi, 2010). The FM should be entirely capable of integrating facilities to achieve a standard level of performance quality and time management to cost minimization (Sinopoli, 2010)

2.13 Benefit Internet of Thing in Facilities Management

The benefits of the Internet of Things technology can influence several aspects that help make sure the operation of a function facility is well. Access the technology will have a greater impact on the Internet of Things a technology with applications of the Internet of Things is seen in various domains and this reflects the importance of the Internet of Things. However, the actual fact remains that there are many challenges and issues associated with the utilization of the Internet of Things and that they can't be ignored (RedAlkemi, 2018)

2.13.1 Safety and Security Control

The freedom to innovate naturally includes the Responsibility to safeguard the legitimate interests of consumers and the integrity of the connected ecosystem. This premise holds true especially because the Internet proliferates into physical spaces and because the enabling of next-generation protocols and computing continues to grow. (Cerf et al., 2016).

While the Internet of Things guaranteed the security and privacy of the users and their data (Albermany & Alwan, 2017).

Firstly, digital safety is the protection is to protect the user in the environment, with technical mechanisms and policies that protect the users from being harmed by improper operation from the device. Second, online security, is the protection of the physical network, operating systems, and content from exposure, modification or functional damage, utilizing a combination of software and hardware mechanisms. (Cerf et al., 2016)

In, facilities management the technologies such as video analytic, sensors, and alarms can be linked to provide early warning of potential issues, for example, fire and life safety devices can be monitored centrally and programmed to initiate messaging and controlled responses. Besides, personnel management can allow or limit access to areas within the building. (GIlmer, 2018)

a) Monitoring and work equipment

Monitoring and work equipment is applications offered by the Internet of Things (IoT). According from Union Pacific, The Internet of Things (IoT) is used as a device that can detect any equipment failure that could cause any disruption. Through the application, acoustic and visual sensors are installed on the track to monitor train wheel uniformity. (Macaulay, 2017)

In, facilities management the monitoring technology has grown at a rate of the explosion in recent years (Mann et al., 1995) This technology involves tools and techniques for detecting and recording the state of the building system (Davies, 1995; Edward et al., 1998). Using the monitoring for the performance of buildings and systems, technology can initiate and record maintenance operations and to evaluate their effectiveness years (Wood,2005) One of the reasons why

maintenance based on conditions is good is recognized as a rapid improvement in monitoring technology (Peng Au-Yong et al., 2014).

b)] Smart security

The Internet of Things (IoT) has introduced one of the tools to increase consumer security. A device operating over a Wi-Fi network was created called August Smart Lock. The device can detect movement, trigger an alarm when the sensor detects a threat and provides information if the location has a problem. Besides that, even users far from the location allow control at the fingertips. This capability has made the Internet of Things (IoT) connected to a security system that enables users to control their assets even with remote monitoring (Macaulay, 2017)

2.13.2 Maintenance Management

The internet of things will lead to more efficient power and energy management at manufacturing facilities and plants by adjusting environment control systems automatically based on the data received from internet of things devices to reduce energy consumption. The Internet of things can also enhance maintenance management processes through automation and analysis based on real-time data and improve maintenance management processes. (Segzdaite, 2020)

a. Predictive Maintenance

The main use of the internet of things is to be able to manage assets through maintenance by performing calendar checking. Predictive maintenance can monitor equipment and predict failures. For example, the temperature in the boiler has reached. Sensors implemented in equipment can check the conditions set and trigger work orders when certain limits are

broken. predictive maintenance strategy, maintenance work is only done when needed which leads to cost reduction (Parpala & Iacob, 2017)

b. Data analysis in real time

The data is having access to all data from machinery in one network gives manufacturers the ability to accumulate and analyse the data and transform it into better predictive maintenance. Instead of waiting for a failure, manufacturers can accurately predict breakdown because IoT devices report when operating conditions are out of specification. By identifying failure patterns and quickly recognizing issues, manufacturers can improve their production and significantly reduce downtime. That leads to increased customer satisfaction and fewer warranty claims. (Segzdaite, 2020)

c. Remote Asset

The Internet of Things enabled devices can make it easier and more efficient to maintain assets in remote locations. As it was mentioned before, Internet of Things reduces unnecessary visits to remote locations where you need to inspect assets through predictive maintenance. For example, connecting assets through internet of things like pumps would make assets generate work orders based on their condition and from Control Maintenance Management System (CMMS). Technicians would get the exact location of the object that needs maintenance, described problem, and list of spare parts needed to fix the asset. That would extremely reduce the time and costs associated with emergency repairs in asset Intensive Industries. (Segzdaite, 2020)

2.13.3 Reducing Risks

Using the internet of things to give the physical security of a building is improved and augmented. The systems in place can stop intrusions, notify the authorities and assist the occupants in evacuating. The building user must be safe based on the internet of thing devices. Paired with technologies like drones and robotics, security can be further improved and risks lowered. (Mylonadis, 2018)

2.14 SUMMARY OF THE CHAPTER

The Internet of things (IoT) is more effective to use in technology in the facility management industry. However, the Internet of Things (IoT) important implement in building especially for help the services provider to handle the big system, reducing the risks and also the costing, for example, Building Management system (BMS) this system can read the water temperature in the cooling tower, chiller, and system using by the internet of things (IoT) or sensor.

Research methodology used in completing this dissertation will be the environment as explained in chapter three, research methodology. The chapter includes the research design, goals, conceptual framework, research philosophy, and approach, research question, instrument, and validity

CHAPTER THREE
RESEARCH METHOLDOGY

3.1 INTRODUCTION

As elaborated in the previous chapter, literature review explains about the details about internet of thing in facility management company while the following the chapter will determine the research methodology used in this dissertation.

The choice of which method to employ is dependent upon the nature of the research problem (Morgan, 1980) argue that the actual suitability of a research method derives from the nature of the social phenomena to be explored (Morgan, 1980). Research in general terms refers to knowledge and also can define research as a scientific and systematic search for important information on a particular topic. In fact, research is an art of scientific investigation (Kothari, 2004) Methodology is the systematic, theoretical analysis of the method applied to a field of the research.

Methodology describes how to carry out in stages. The research methodology is a theory of how research should be conducted. For the research design, the researchers used the research design model by Maxwell (2013). The research method is meant to give the research the needed mechanism to carry out an effective investigation for the study. There are having three main types of approaches in addressing the research problems, which are qualitative, quantitative and mixed-method.

3.2 RESEARCH PHILOSOPHY AND STUDY APPROACH

The term philosophical research refers to beliefs and assumptions about knowledge development. While this may sound profound, it is the right thing to do when starting research: developing knowledge in a particular field. The knowledge of development are working on may not be as dramatic as the new theory of human motivation, but it will also the specific issues within a particular organization. Whether you are consciously aware or not, every stage in research you will make a number of types of speculation (Burrell and Morgan 1979).

Besides that, research philosophy is a belief about how data about a phenomenon should be gathered, analyses and used. The term epistemology is meaning what is known to be true, as opposed to doxology mean what is believed to be true and encompasses the various philosophies of the research approach. The purpose is the process of transforming things believed in things known in the philosophy that have four major research philosophies that have been identified such as positivism, realism, interpretivesm, and pragmatism.

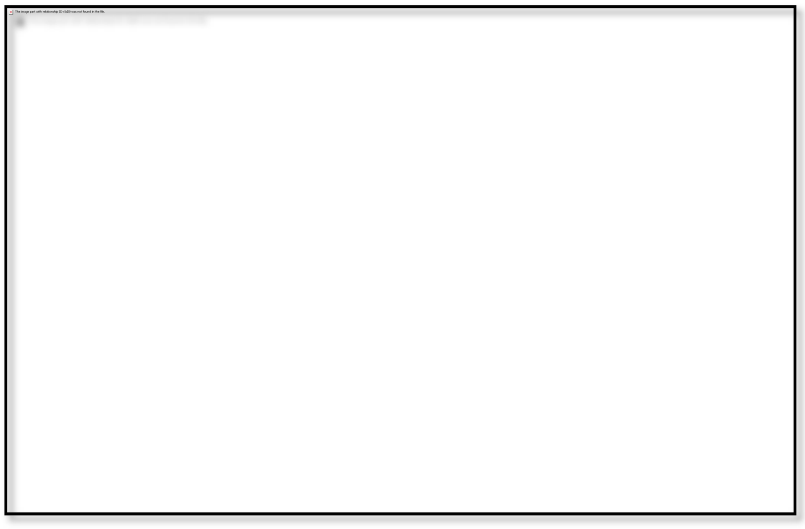


Figure 3.1: The ‘Research Onion' design (Source by Mark Saunders, Philip Lewis and Adrian Thornhill, 2008)

In the dissertation, the researcher used pragmatism a realistic research. The importance of the study is finding realistic outcomes. Pragmatism is the continuum decided via study quires which direct methodological picks in obtaining advantage information from the research supply. However, this does not imply that pragmatist record series are achieved, pragmatism considers that no single viewpoint can and that includes perhaps multiple realities. Therefore, the researcher always used a couple of technique and analysis procedures. Pragmatics combines both positivism and interpretivism in single research is consistent with the research question.

Pragmatism is one of the philosophies used in research, for the study approach will explain more detail on three main points on approach such as deduction, induction and abduction

Table 3.1: Reason to research (Source by from Mark Saunders, Philip Lewis and Adrian Thornhill, 2019)

	Deduction	**Induction**	**Abduction**
Logic	In a deductive inference, when the premises are true, the conclusion must also be true	In an inductive inference, known premises are used to generate untested conclusions	In an abductive inference, known premises are used to generate testable conclusions
Generalizability	Generalising from the general to the specific	Generalising from the specific to the general	Generalising from the interactions between the specific and the general
Use of data	Data collection is used to evaluate propositions or hypotheses related to an existing theory	Data collection is used to explore a phenomenon, identify themes and patterns and create a conceptual framework	Data collection is used to explore a phenomenon, identify themes and patterns, locate these in a conceptual framework and test this through subsequent data collection and so forth
Theory	Theory falsification or verification	Theory generation and building	Theory generation or modification; incorporating existing theory where appropriate, to build new theory or modify existing theory

a) Deduction

Deduction is what would think of a scientific research. It involved the development of a theory that is then subjected to test through a series of proposition. According to blaikie, 2010 have six deductive approach will progress

1. Put the tentative idea, premise or hypothesis is a detestable proposition about two relationships, more concept or variable.
2. Existing literature review, by specifying the condition under which the theory is expected to hold. Deduction a testable proposition or number of propositions
3. Examine the logic of the argument that produced them, comparing.
4. Test the idea by collecting appropriate data to measure the concepts and analysis them.
5. If the results of the analysis are not consistent with the premises. The theory is false and must either be rejected or modified.
6. If the results of the analysis are consistent with the premises and the theory is corroborated.

a) Induction

The induction will also criticize the deduction for its tendency to develop a methodology that does not allow for alternative explanations of what's going on. In that sense, there is an end to the choice of theory and definition of the hypothesis. Alternative theory may be suggested by deduction. However, these would be within the limits set by the highly structured research design and significant characteristic

b) Abductive

Instead of moving from deduction or induction, abductive approach move back and forth. Effect combining the deduction and induction (Suddaby,2016). According from Van Maanen et al on 2017, the theories can account for what is note that some reasonable theories can explain what is absorbed better than others and these theories will help to uncover more 'surprise the fact'. The abductive approach is sometimes called 'retroduction'. In fact, reproduction is believed to be the original label for what is known as abduction through corruption misunderstanding for older philosophical texts (Peirce, 1896).

Therefore, the abductive is the selection for using in this research because related to qualitative. The research based used the framework and also using the abductive can help to achieve a research goal.

3.3 RESEARCH DESIGN

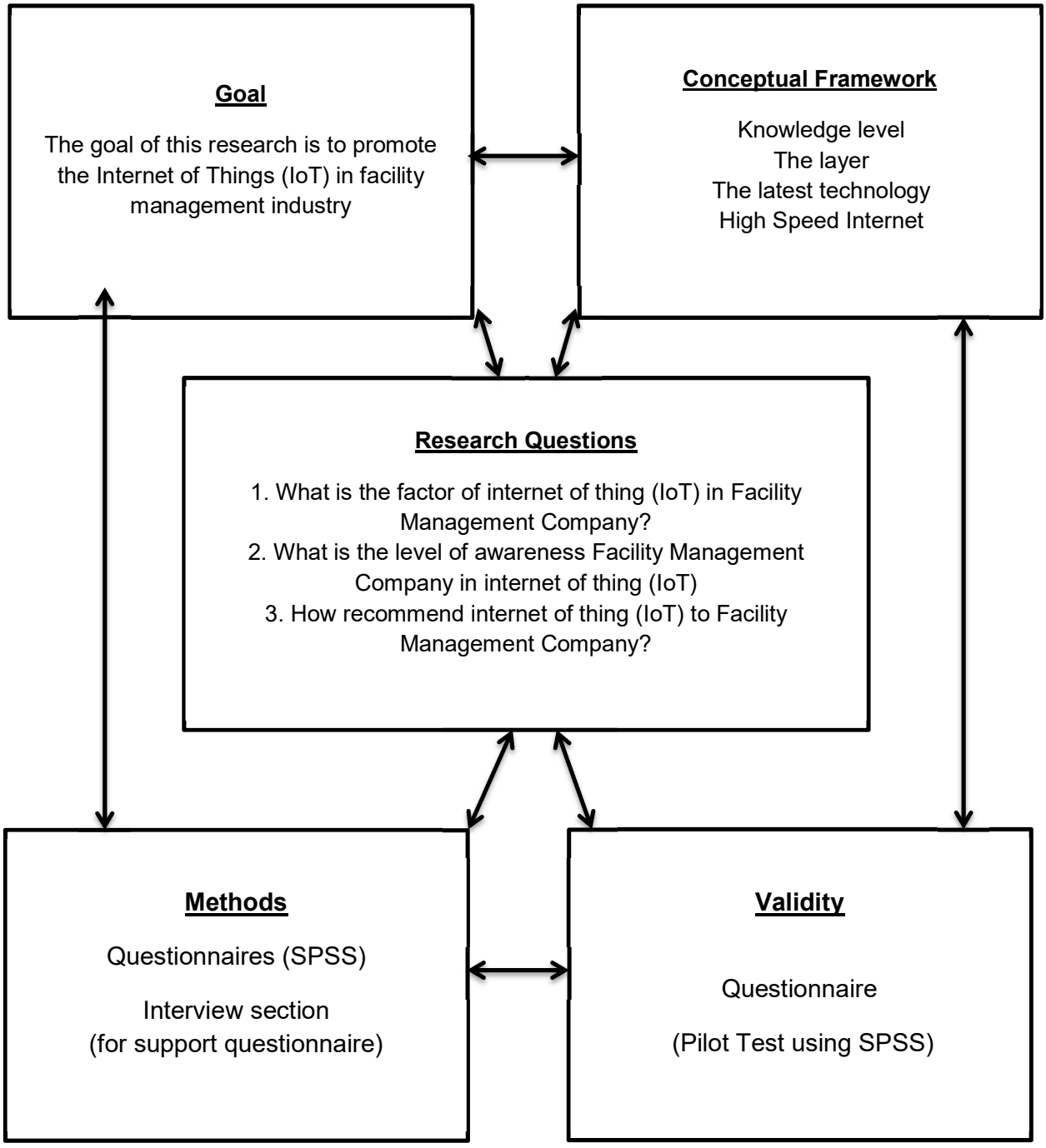


Figure 3.2: Research Design (Source by Maxwell, 2013)

Refer to figure 3.2 Research Design by Maxwell, 2013 shows the relationship between all five components which are goals, conceptual framework, research questions, methods, and validity. The model has no starting point. However, the research question was granted as the central point. The design describes the research design based on generic research components and how all components interact with each other.

3.3.1 Goal

The goal component is the main goal of helping the researcher to stay in the right direction and also to help the researcher know what to expect during the research. Besides, goals help in achieving the desired result. Based on the discussion in chapter 1, the goal of this research is to promote the Internet of Things (IoT) in facility management companies. This research has three goals to help achieve the desired research goals such as what is the factor of internet of thing (IoT) in facility management companies, what is the level of awareness facility management in internet of thing (IoT) and how recommend internet of thing (IoT) to facility management companies

3.3.2 Conceptual Framework

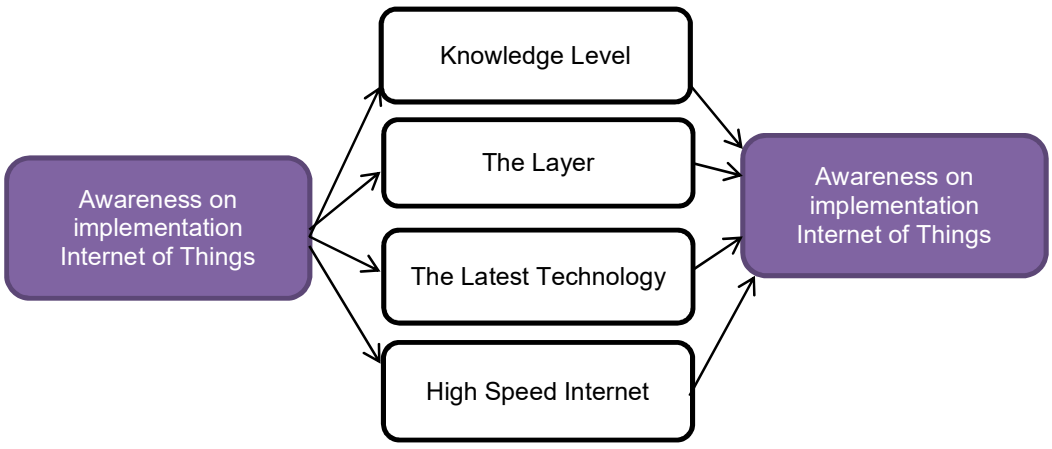


Figure 3.3: Conceptual Framework

3.3.3 Research Question

Research question are the fundamental core of a research project, study or review literature. Research question focus on the study, determines the methodology, and guide all stages of inquiry, analysis and report. Research question are reviewed and revised through the whole research duration. The central research question directly interacts with the goal of the research while the secondary research question interacts with the research objectives.

Apart from issues that have been discussed, questions are raised a basic guide to the overall implementation of this research. This study was undertaken to find the answer to the following question:

1. What is the factor of internet of thing (IoT) in Facility Management Company?
2. What is the level of awareness Facility Management Company in internet of thing (IoT)
3. How recommend internet of thing (IoT) to Facility Management Company?

3.3.4 Method

The Instrument technique used in this study was to use a quantitative that involved to questionnaires and addition, the data must be collect from interview from support the questionnaire and to get strong objective.

3.3.4.1 Questionnaire

Questionnaire is a form of inquiry report, which contain scientific assemble and well-organized collection of question that intend to attain facts. According to Sauders & Tosey, 2012, a questionnaire is a form that includes a difficult and quick question about a subject or organization with subjects designed to answer to the degree of which respondents assume or emote

without being impacted by means of the researcher or third party. The questionnaires are distributed to the facility management including a group of workers. This approach was employed to decide the extent of consciousness and significance of the implementation. The questionnaires given include the usage of a numerical kind in which respondents are given the answers to choose the suitable solution.

3.3.5.2 Interviews

An interview in qualitative research is a conversation in which questions are asked for information. Interviewers are usually professional or paid researchers, sometimes trained, who ask questions to interviewers and in a series of frequently asked questions and answers.

They can be different by a focus group in which an interviewer interrogates a group of people and observes the resulting conversation between the interviewers. In phenomenological or ethnographic research, interviews are used to expose the meaning of key themes in the world of the subject's life from their own point of view. There are three types of interviews used in research such as structure interview, semi-structure interview and unstructured interview.

For this research, questionnaires option to collect research data but section interviews also created to support the objectives of the research and also help to get strengthen this research. the type of section interviews is unstructured interviews cause the section interview needed to know about opinion from top management especially awareness part, skill, etc.

3.3.6 Validity

Validity refers to how well the instrument is measured in terms of what it intends to measure. Establishing validity would require establishing both reliability and accuracy.

Figure 3.4: Validity Process

3.5 SUMMARY OF THE CHAPTER

It could be reemphasized here that researchers are not restricted only to different methods of data collection instruments and their classification as presented in this paper. However, the choice of which method to apply depends on the researcher as well the nature or problem to be investigated and prevailing circumstances at the time of carrying out the research. Thus, researchers are free to use any method they deem fit for their research.

CHAPTER FOUR
DATA COLLECTION

4.1 INTRODUCTION

As elaborated in the previous chapter, the research methodology explains what data collection method can use from the research methodology and also to help the researchers to collect the data from the research issue and objective while the following chapter will determine the data collection used in this dissertation.

Data collection are defined as the process of data collecting and measuring information about variables of interest, established the systematic enable to answer, state research questions, test hypotheses, and evaluate results (Jovancic, 2019) and from this research, the collection of data that has been created is to support the research issue and also to achieve the objectives of the research. The use of data collection is following the method that has been selected. So, for this data collection is more detail about the sampling and other methods

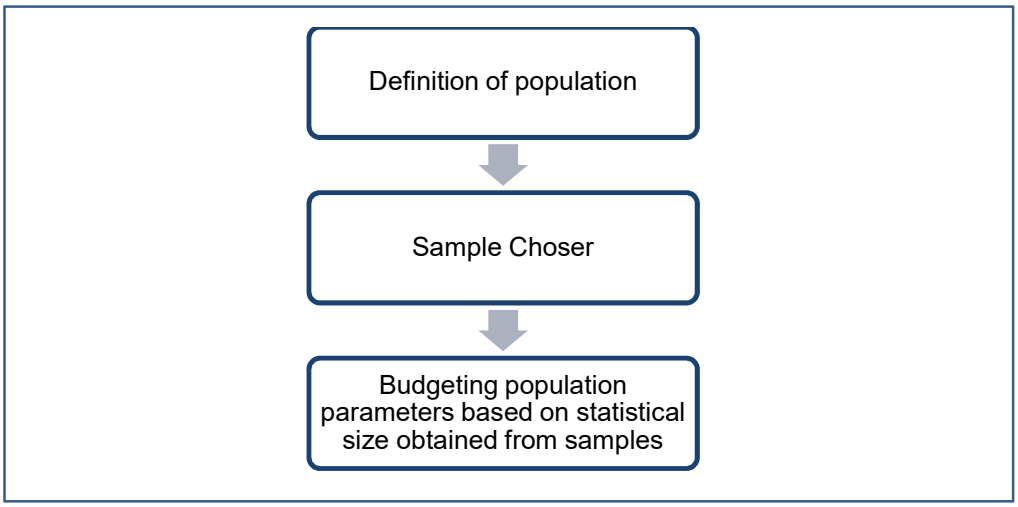


Figure 4.1: Definition of Sampling (Source by Mohd Osman Dani, 2011)

4.2 SAMPLING

Samples are the number of individuals or elements of a population (large group) required in a research that is the basic for making estimates. A population is a group or individual to attract the interest of researchers having the characteristics, where the results of the study findings allow generalizations are made.

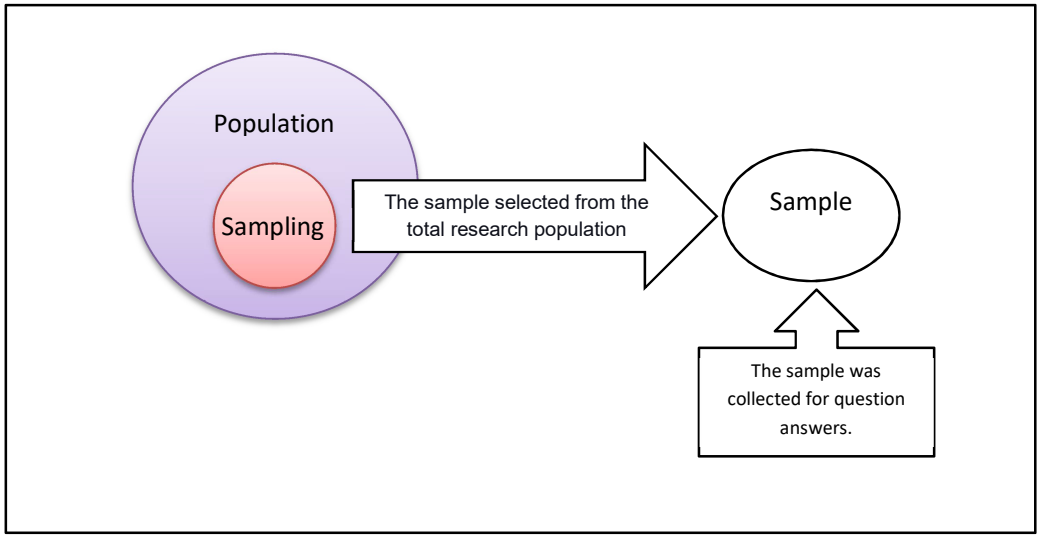


Figure 4.2: Sampling concept (Sources by Salant & Dillman, 1994)

Researchers that require data from wide and diverse population size, rarely do researchers cover the whole population. The normal practice is to draw a sample from the target population (Salant & Dillman, 1994) defined a sample as a group of respondents selected from a larger population for a survey. Generally not necessary to review all possible cases to know the phenomenon under consideration (Ary, Jacobs, & Razavieh, 1996)

The most important thing taken into consideration is that the sample drawn from the population must be representative so that it allowed the researcher to make inferences or generalization from the sample statistics to the population (Maleske, 1995). The sample size is too low, it lacks the precision to provide reliable answers to research questions investigated. If the sample size is just too large, time and resources might be wasted often for minimal gain. Therefore, the facility of a sample survey lied within the ability to

obtain the necessary information from relatively few respondents to describe the characteristics of the entire population.

4.2.1 Sampling Design

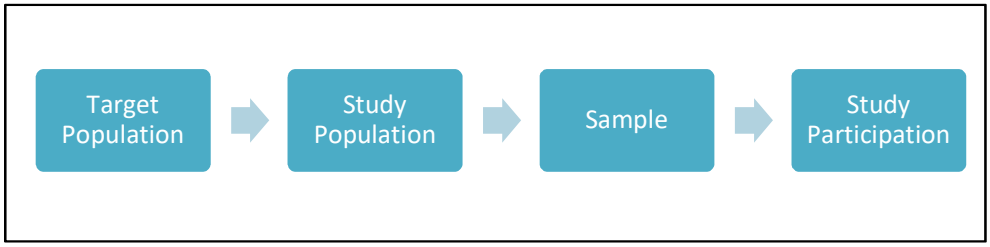


Figure 4.3: Step in sampling design (sources by Dr Asir John Samuel. 2012)

Using the sample design for help to determine the research purpose, cost, time provides, and sample size for this research. Sampling is more important in research since sampling error can lead to results with specific biases or only relevant to a specific for the subgroup. The research used sampling further gives space for researches to gain deeper information about the population.

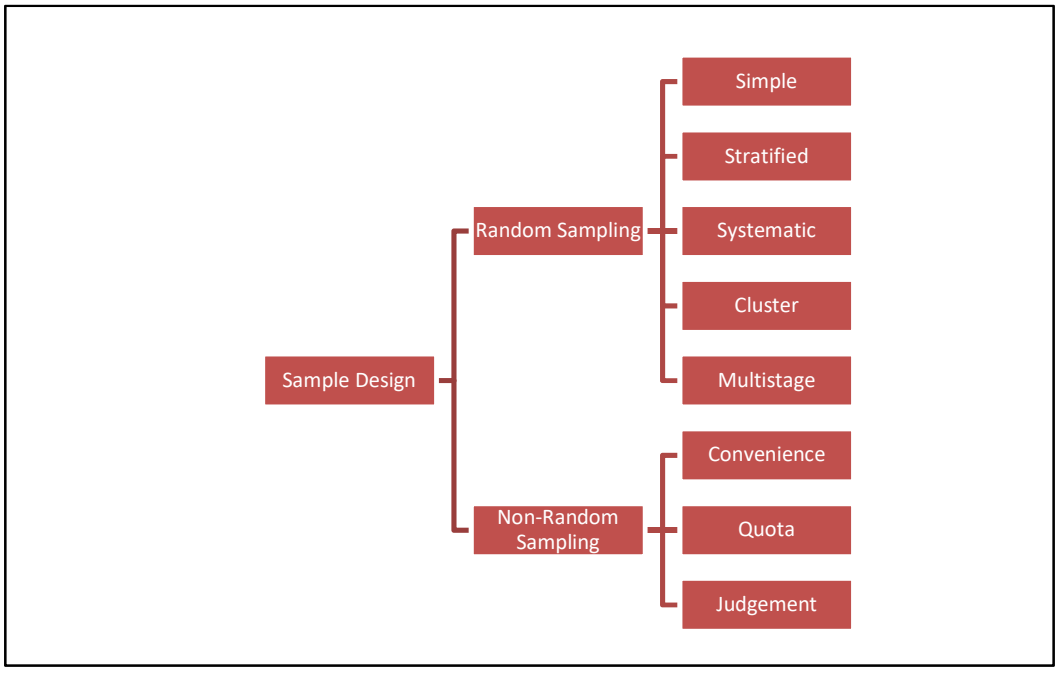


Figure 4.4: Type of Sample Design (sources: Dr Asir John Samuel. 2012)

The type of sampling design has two types. First is probability or random sampling. The selection of subject is according to any predicted chance of random. Random has 4 sampling methods which simple random sampling, systematic sampling, cluster sampling, and stratified sampling for second type is Non-probability or Non-random sampling does not depend on any chance of pre-decided probability. Non-probability has 4 sampling method: convenience sampling, judgment sampling, referral sampling, and quota sampling.

4.2.2 Purposive sampling design (Judgement Sampling)

Purposive sampling can also be referred to as judgment sampling or authoritative sampling is a non-random sampling. The technique where this sample researcher used based on existing knowledge or professional judgment (Ben, 2018) this sampling is most effective when only a limited number of individuals the trait that a researcher is interested. Using judgment sampling can conduct interview and hand-on data collection technique. Therefore, using judgement sampling can get the target population interest by individual fit particular criteria.

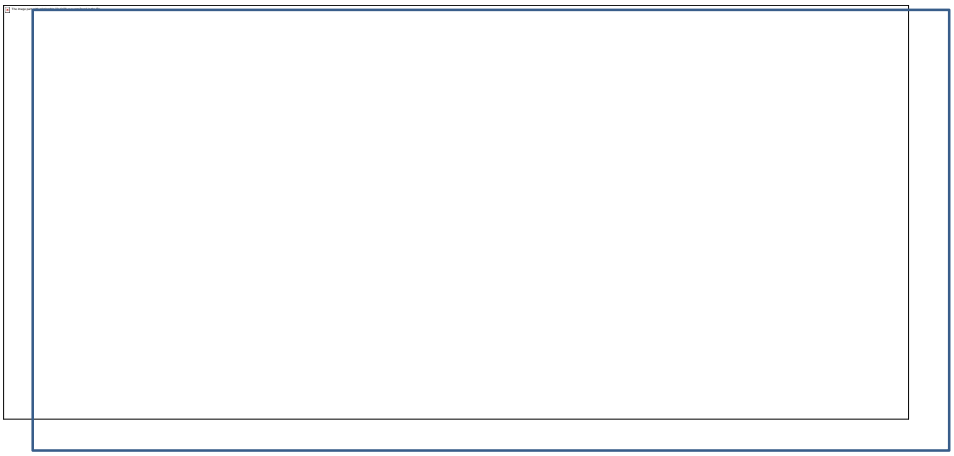


Figure 4.5: Purposive Sampling (Source: John dudovskiy)

Judgment sampling in this research is to collect data collection and interviews from the facilities management company in Kuantan, Pahang. Collected judgment sampling based on respondents' experiences and knowledge. For the research to be conducted as efficiently as possible, researchers should strive to use the sample that's most relevant to their population of interest as possible form the opinion in data collection can help this research to achieve the objective.

4.2.3 Sample Size (N)

4.2.3.1 Population

If the population is homogeneous, the research does not require a large sample size. However, if the population research is heterogeneous, the sample size should be large so that the research acquires characteristics that represent the population.

The population of this research is to focus on employees working in facilities management companies (FM) for this research three companies have been selected for the study. Each company has been categorized as a facility management companies that have long been in the facility management industry. The selection of these companies refers to the technology that has been used and also the company experience in the industry. The order selected is random by the researcher and does not follow the sequence or resolution.

4.2.3.2 Sample Size

The sample size using generalisation because of the feedback from the respondent's is not confirming the total respondent’s. Sample size was determined using by Krejcie and Morgan (1970) table. The table is used in order to decide the sample size for the research. The research population of this study focused on the facility management staff at three private hospitals in Kuantan, Pahang.

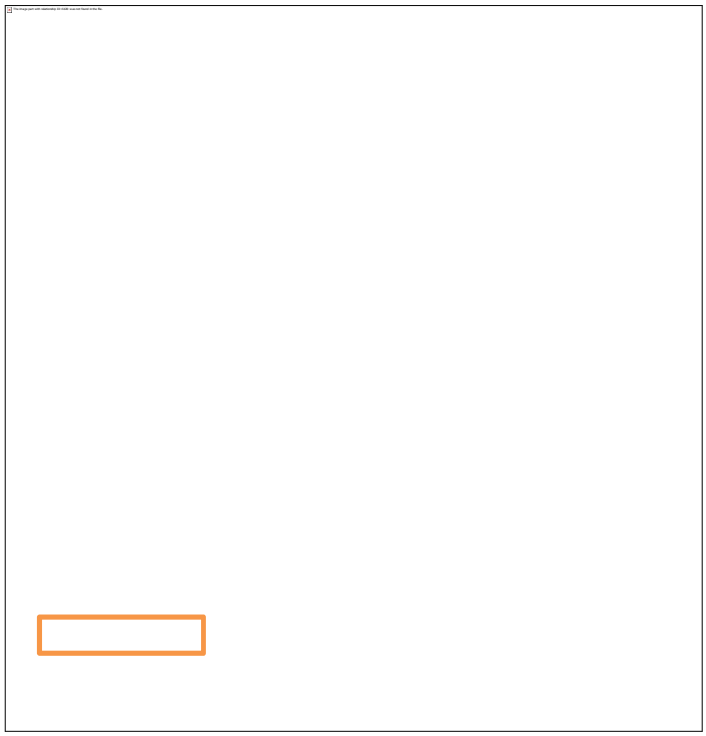
Table 4.1: List of Sample Size

No	Location	Population Size	Sample Size
1	Sultan Azlan Shah Medical Centre	43	92
2	IIUM Specialist Medical Centre	36	
3	Kuantan Medical Centre	40	

Krejcie and Morgan's table was used in this research since the whole population was identified to gain the data about the awareness using the Internet of Thing (IoT) in the facility management company from the data collection is to identify are several private hospitals that have

The total response from the questionnaire is 104 people respondent. First private hospital is Sultan Azlan Shah Medical Centre. The total respondents are 38 staff. Second, IIUM Specialist Medical Centre is 30 staff, and the last Kuantan Medical centre the respondents are 36 staff. According to Krejcie and Morgan's table, the sample size (S) needed to collect 92 respondents because of the population size (N) are 120 respondents.

Table 4.2: “Determining Sample Size for Research Activities”, Educational and Psychological measurement by Krejcie and Morgan (1970)



4.3 DATA COLLECTION INSTRUMENTS

For this dissertation, the researchers used two method of instrument for data collection which is questionnaire and unstructured interview.

4.3.1 Questionnaire

The questionnaire were designed using two approaches type first scale and subjective. The scale ranges from number 1 to 5 of “Strongly Disagree”, Disagree”, “Not Sure”, “Agree” and “Strongly Agree” respectively. The Researcher scale using by 1 to 5 according to Lozano (2008) Items were built to represent the concept that the researcher intended to measure. The questionnaire consists of 4 sections. Section A focuses on the demographic means more to focus on the background respondents. Section B aims to the factor influence and implement respondent knowledge about the Internet of Thing (IoT) in Facility Management. Section C is meant the level of

awareness the respondent to implement Internet of Thing (IoT) in the workplace and the last section is Section D, this section includes how to improve and recommend the Internet of Thing (IoT) in facility management company.

Table 4.3: Likert scaling for section B, C, and D

Title	Scale
Strongly Disagree	1
Disagree	2
Not Sure	3
Agree	4
Strongly Agree	5

To get reliability statistics for generated and provided the actual value need to refer SPSS System before questionnaire distributed to respondents. The pilot test needs to be performed to ensure validity and the actual value for Cronbach's Alpha is 0.805 and 15 respondents from the pilot test.

Table 4.4: Reliability statistics for pilot test

Reliability Statistics	
Cronbach's Alpha	N of Items
0.805	30

Section A contains the respondent's personal information and background such as academic, designation, work experience, workplace, respondents using media social or not, and company using the internet or not. A total on this section is 6 items and respondents need answer

Table 4.5: Section A - Respondents Demographic

Section A	Items
Demographic	6

Section B includes the respondent's knowledge about the system in building especially maintenance tools and equipment, While Section C is to get the respondent's level of awareness on the Internet of Thing (IoT) in the tools, software, network, etc. and the last Section is represented their opinion about recommendation the Internet of Thing (IoT) for implement Internet of Things (IoT) in the facility management company. All sections are regarding the Internet of Things (IoT) in the facility management company

Table 4.6: Question in survey form

Section	Title	Item
Section A: Demographic	Academic	4
	Designation	7
	Experiences	4
	Workplace	3
	Respondents using media social or not	2
	Company using internet or not	2
Section B: The factor	Using internet at workplace	5
	Function Devices	2
Section C: The level of awareness	Sensor	3
	Server	4
	Awareness Internet of Thing (IoT)	4
	High Speed Internet	2
Section D: The recommendation	Improvement	1
	Update technology	1
	Apply Internet of thing (IoT) technology	1
	Providing training	1
	Apply Internet of Thing (IoT) technology in building	1

Table 4.7: Questionnaire link for online method

No	Companies name	Link	
		Short Link	Full Link
1	Facility Management Companies	https://forms.gle/1yUTcqRFYUBQtCLWA	https://docs.google.com/forms/d/e/1FAIpQLSd6eMNKwWCDMfzQHdiaaScYqCqceV0Q6UL6p1fCRFmbUQ/viewform?usp=sf_link

4.3.2 Interview

Qualitative data involves the interview section. This research interview using just to support the questionnaire to get a stronger answer and interview section target to top management on the facility management company. These instruments were used to help the researcher to understand more about the research being conducted.

Respondents to provide any extra information they consider to be relevant, as well as their impressions of the interview (McNamara, 1999) Therefore it needs to be done to reinforce the view on the Internet of Things (IoT) on the facility management company. The interview using unstructured format so for the question interview based on the questionnaire and question additional depend on the questionnaire and their knowledge about Internet of Thing (IoT)

4.4 SUMMARY OF THE CHAPTER

The conclusion of chapter 4, the compilation of data, involves the sampling and the instruments applied. Sampling split into two, which were the probability and non-probability table used by Krejcie & Morgan (1970) to determine the sample size questionnaire for instruments used to collect data and results.

Questionnaire divides into four sections, and is distributed to the respondents selected. Chapter five, cover the analysis and discussion of data, and all collection data on the study must be clarified in the article. Chapter five includes the review and discussion of all section questionnaires.

CHAPTER FIVE
DATA ANALYSIS AND DISCUSSION

5.1 INTRODUCTION

Chapter four has already explained how data collection elaborated to involve the questionnaire and unstructured interview. Chapter five will focus on data analysis and discussion about this dissertation. Research data analyses are process employed by the researchers for reducing data and interpreting it to derive insights. The data analysis process helps in reducing an outsized of knowledge into smaller fragments, which is sensible (LeCompte & Schensul, 1999).

Three essential things happen to info the analysis process which is first, the data organization is to Summarization and categorize together contribute to becoming the second known method used for data reduction. It helps to find patterns and themes in the data for easy identification. Last, the data analysis does it in both things above.

Table 5.1 Targeted Sample Size by Researchers

Building's Name	No of Population	Percentage (%)	No of Sample
Sultan Ahmad Shah Medical Centre	43	36.13%	32.77% (39)
IIUM Specialist Medical Centre	36	30.25%	25.21% (30)
Kuantan Medical Centre	40	33.61%	30.25% (36)
Total	**119**	**100%**	**88.23% (105)**

Refer to table 5.1 shows the total population, percentage, and number of samples. The data is to know how much responding answers the questionnaire survey. According to Krejcie and Morgan (1970), shows the population and sample size. Based on the table, the population in this research is 145 respondents and the sample size researchers need to get at least 108 respondents.

The results from question need transfer to Excel Microsoft and from Excel Microsoft convert to Statistical Package Social Science (SPSS) to get the specific for support research. The data obtained will be analysed using SPSS and data from SPSS will be explained through charts and tables. Three types of analysis methods will be used in the analysis description among percentage, mean, and frequency.

5.2 DEMOGRAPHIC

Section A identifies respondent demographic or personal information their personal information include academic, designation, work experience, workplace, respondents using media social or not, and company using the internet or not. There are three locations of the questionnaire distributed and from the questionnaires that have been returned to researchers.

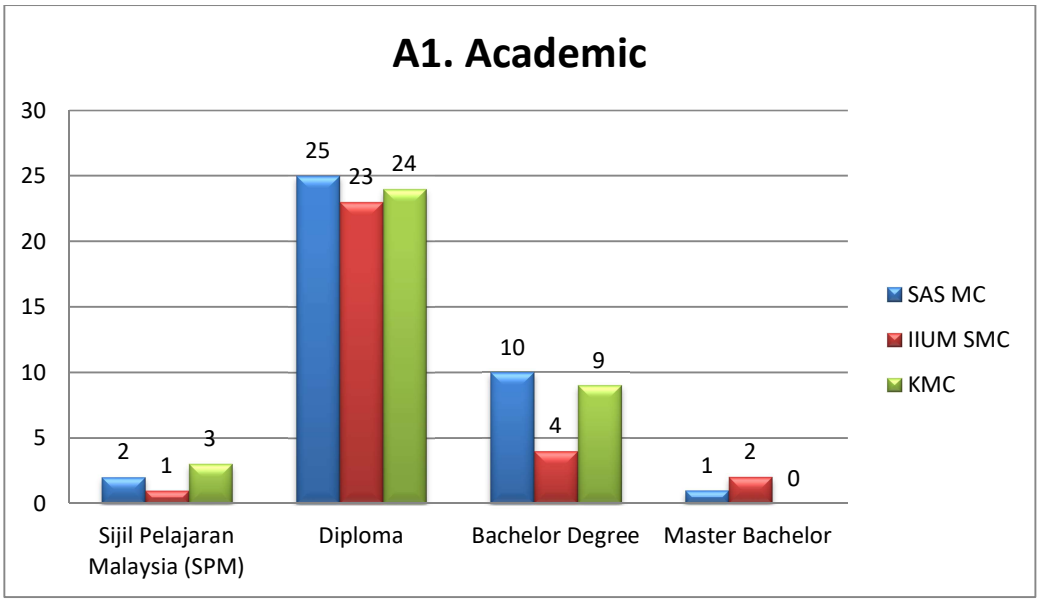


Figure 5.1: Academic Certification Level

As shown in Figure 5.1, four levels of educations have been obtained among the Sijil Pelajaran Malaysia (SPM), Diploma, Bachelor Degree, and Master Degree. Refer to the graph above; the level of Diploma education got the first highest choice. Where Sultan Ahmad Shah Medical Centre (SAS MC) obtained feedback frequency is 25 respondents of 65.80%, followed by Kuantan Medical Centre (KMC) the respondent's feedback is 24 people of 66.70% and Lastly, IIUM Specialist Medical Centre (IIUM SMC) had 23 respondents of 76.70%.

The second-highest result is a bachelor's degree with an overall average frequency of 23 respondents. Where Sultan Ahmad Shah Medical Centre got the feedback respondents are 10 responds, for Kuantan Medical Centre got 9 respondents and last, from IIUM Specialist Medical Centre, got the feedback respondents are 4.

The third highest is Sijil Pelajaran Malaysia (SPM), which shows are total of respondents is 6. Where the percentage from Sultan Ahmad Shah Medical Centre is 5.30% and got 2 responses, 8.30% of 3 respondents from the Kuantan Medical Centre, and the last, 3.30% percentage then the frequency respondents are one from IIUM Specialist Medical Centre. Lastly is the master bachelor where the total number is 3 people, from Sultan Ahmad Shah Medical Centre there is one respondent in the master and IIUM Specialist Medical Centre there are two people who have qualifications in master bachelor.

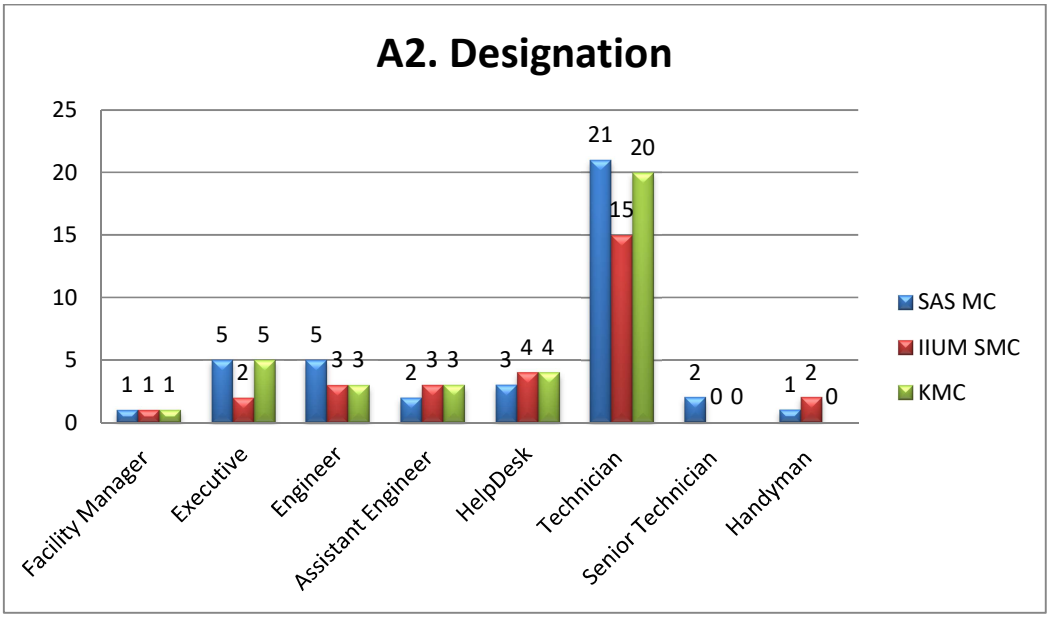


Figure 5.2: The respondent's designation.

Question A2 to identify the respondent designation which is inside Facility Management Company and there have 8 positions that have been filled by respondents. Refer to the figure 5.2, the feedback obtained found that the position of the technician got the first highest answering by the respondents from the research questions. Distributed with a total response of 56 people where Sultan Ahmad Shah Medical Centre got 21 respondents of 57.90%, IIUM Specialist Medical Centre is 15 respondents of 50.00%, and Kuantan Medical Centre is 20 responds of 55.60%. The position of technicians gets the highest respondents because each facility management company has a large number of technicians compared to other positions.

The executive got second with total respondents is 12. Sultan Ahmad Shah Medical Centre got the percentage of respondents is 13.20% of 5 respondents, IIUM Specialist Medical Centre got 2 respondents of 6.70% and Kuantan Medical Centre got the respondent's feedback is 5 responds of 13.90%.

Next, the total respondents between engineer and helpdesk are the same average frequency where the respondents are 11 peoples. Then, the

assistant engineer position is 8. Where Sultan Ahmad Shah Medical centre got 2 respondents of 5.30%, IIUM Specialist Medical Centre is 3 respondents of 10.00% and Kuantan Medical Centre got 3 respondents of 8.30%. The position of facility manager and handyman got the total respondents is 3 responds. Where the position of facility manager has each hospital and the handyman shows that Sultan Ahmad Shah Medical Centre has one respondent of 2.60% and IIUM Specialist Medical Centre has 2 respondents of 6.70%. Lastly, the senior technician's position has a total of 2 respondents of 5.30% which is obtained from Sultan Ahmad Shah Medical Centre.

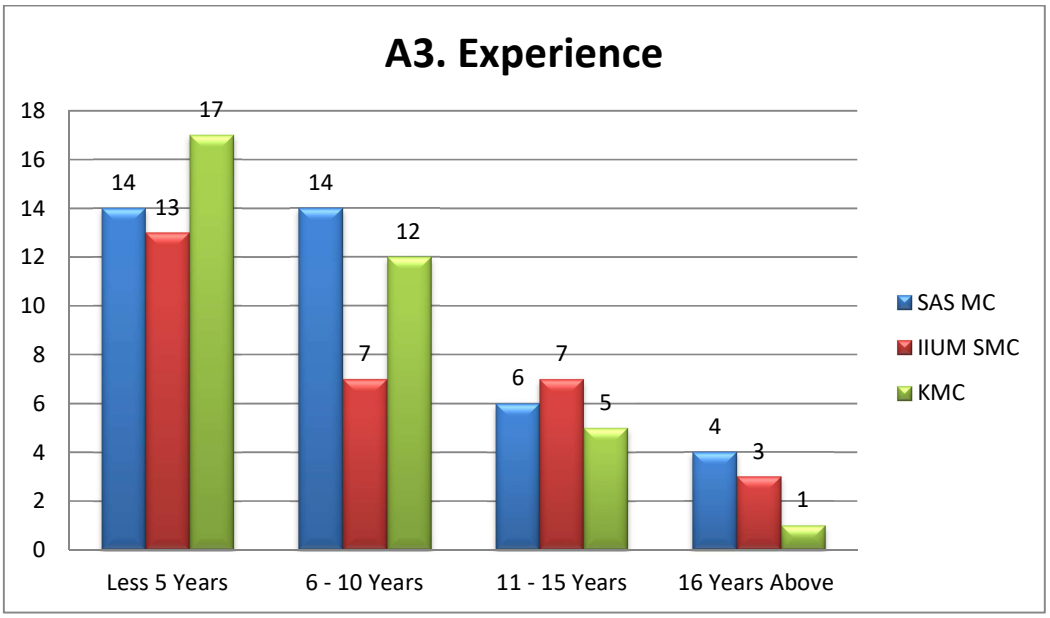


Figure 5.3: Experience respondents.

Experience involving respondents has 4 categories which less than 5 years, 6-10 years, 11-15 years and 16 years and above. Refer to Figure 5.3 most respondents have less than 5 years of work experience in the facility management company. Feedback respondents have less than 5 years of experience of 44 respondents where 14 respondents of 36.80% from Sultan Ahmad Shah Medical Centre, 13 respondent of 43.30% percentages from IIUM Specialist Medical Centre, and 17 respondents of 47.20% from Kuantan Medical Centre.

Experience for a period of 6 to 10 years is also a total of 33 respondents where Sultan Ahmad Shah Medical Centre is 14 respondents of 36.80%, followed by Kuantan Medical Centre is 12 respondents of 33.30% and IIUM Specialist Medical Centre is 7 respondents of 23.30%. Next, for the experiences from 11 to 15 years, got 18 feedbacks respondents where Sultan Ahmad Shah Medical Centre got 6 respondents of 15.80%, IIUM Specialist Medical Centre is 7 respondents of 23.30% and Kuantan Medical Centre is 5 respondents of 13.90%. Lastly, the total respondents on experiences between 16 years above got 8 responses. Where Sultan Ahmad Shah Medical Centre is 4 respondents of 10.50%, followed by IIUM Specialist Medical Centre got are 3 responds of 10.10%, and the lastly Kuantan Medical Centre with a total of one respondent of 5.60% the percentage.

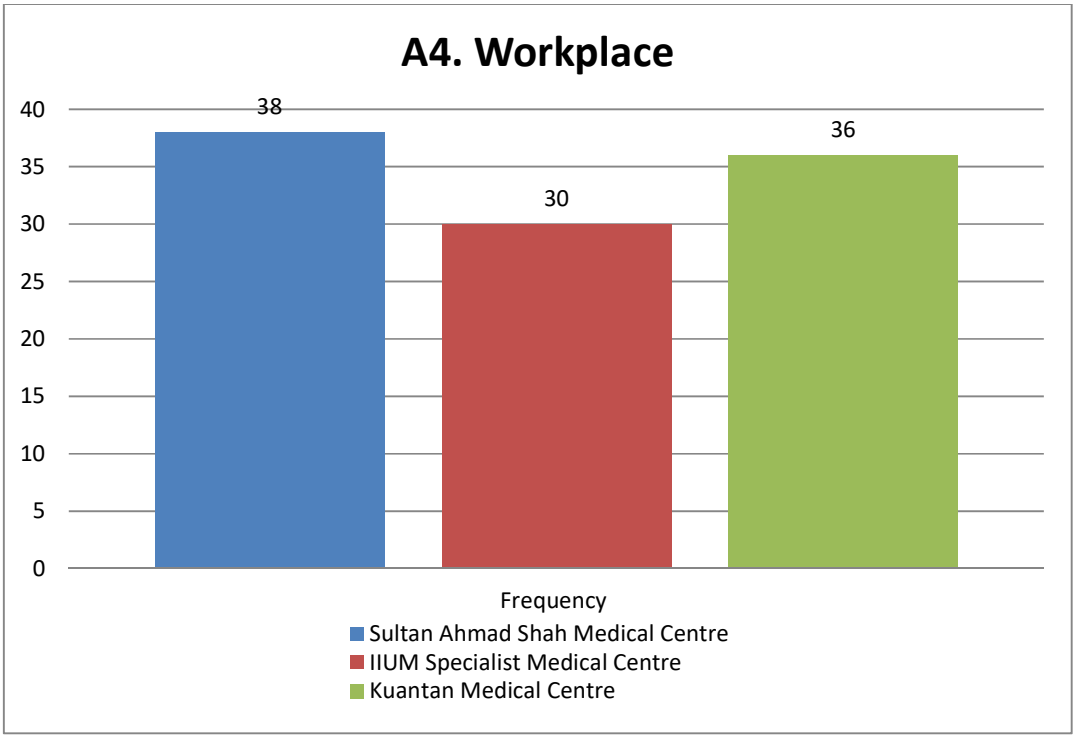


Figure 5.4: Workplace respondents.

Refer on Figure 5.4, it shown the respondents workplace. Questionnaire was distributed among three facility management companies in Kuantan, which were Sultan Ahmad Shah Medical Centre, IIUM Specialist Medical Centre and Kuantan Medical Centre. Based on the pie chart at

above, Sultan Azlan Shah Medical Centre it was show the high percentage is 37.14% and the total respondents are 38 people, Second, Kuantan Medical Centre are 30 respondents of 34.29% and the last 36 respondents of 28.57% is IIUM Specialist Medical Centre. Workplaces was chosen since these places are healthcare buildings and suitable with the research scope and goals.

BIL	Sultan Ahmad Shah Medical Centre		IIUM Specialist Medical Centre		Kuantan Medical Centre	
	Yes	No	Yes	No	Yes	No
Do you used Media social (Whatsapp, Telegram and Facebook Messenger) as a medium for discussion and to giving information to teams?	38	-	30	-	36	-
Does your company use the internet?	38	-	30	-	36	-

Table 5.2: Question A5 and Question A6 result.

Referring to the table above represents the number of demographic Question A5 and Question A6 where the overall result is that all respondents agree to use social media as a medium for discussion and provide information to teams and companies using the internet. Refer on the table 5.2, total feedback of respondents getting Sultan Ahmad Shah Medical Centre got 38 respondents, IIUM Specialist Medical Centre is 30 respondents and Kuantan Medical Centre is a total of 36 respondents.

5.3 FINDING THE OBJECTIVE ONE: TO IDENTIFY THE FACTOR INFLUENCE THE AMONG FACILITY MANAGEMENT COMPANY TO IMPELEMENT INTERNET OF THINGS (IOT)

The first objective is to evaluate the factor influencing the implementation of the internet of things among facilities management companies and to finding the impact factor internet of thing on the respondents. Refer to table 5.2, displays the statistics of reliability for assessing the level of the Cronbach Alpha technique. This method has shown that these variables' reliability is 0.879, which means the results for objective one are valid and reliable to proceed for the next objective.

Table 5.3: Reliability Statistics for Section B

Reliability Statistics	
Cronbach's Alpha	N of Items
0.879	6

Refer to table 5.3 below, the variable explained the question by survey and required to achieve the second objective. In population (N) the responding are not missing to answering the question which has been distributed through questionnaire. In the table, section mean was shown the average total mean result by the deferent location. The total average for Sultan Ahmad Shah Medical Centre is 4.79 respondents, IIUM Specialist Medical Centre is 4.74 respondents and Kuantan Medical Centre is 4.54 respondents. The total mode for three location is 5 and the scale was selected using the range from 1 to 5 and where 1 represent is “strongly disagree” and 5 is “strongly agree”.

Table 5.4: Result data from SPSS for Question B

No	Question	N	Sultan Ahmad Shah Medical Centre			IIUM Specialist Medical Centre			Kuantan Medical Centre		
		Valid	Mean	Mode	Range	Mean	Mode	Range	Mean	Mode	Range
B1	Do you agree using the internet as a medium for helping technical teams to do the scope of work?	104	4.87	5	1	4.80	5	1	4.92	5	1
B2	Using the internet is important to ensure the services can be monitored. Example monitoring management work, maintenance, services, communications, and information.	104	4.82	5	2	4.83	5	1	4.89	5	1
B3	The internet helping in keeping the company database or collected the important data.	104	4.82	5	2	4.53	5	2	4.61	5	2
B4	Do you agree email is part of an important network to support services?	104	4.84	5	1	4.80	5	1	4.92	5	1
B5	Do you agree devices can provide information function on equipment? For example, a sensor on a heat detector	104	4.68	5	2	4.73	5	1	4.86	5	1
B6	Do you agree using the internet as a medium for helping technical teams to do the scope of work?	104	4.68	5	2	4.73	5	1	4.86	5	1
Total Average			**4.79**			**4.74**			**4.84**		

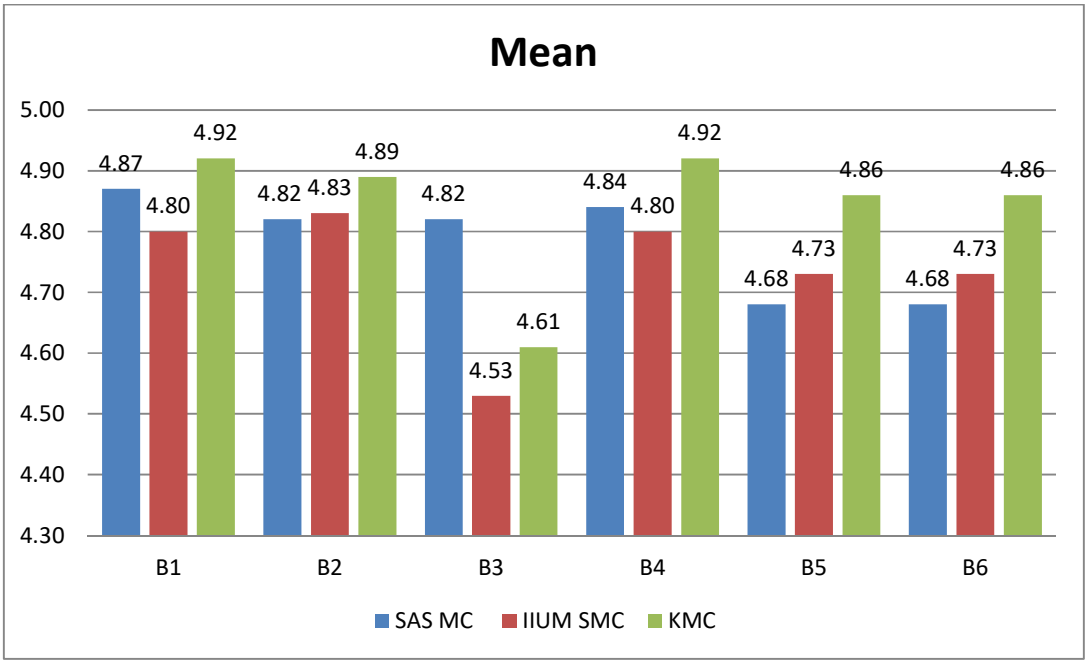


Figure 5.5: Mean bar chart for Question B

Table 5.4 shows the results of the questionnaire that was sent to the respondents. Looking at the table, the percentage result answering by respondents is to choose Likert scaling from 3 to 5 where it represents are not sure, Agree, and strongly agree. Mostly respondent answer strongly agrees.

Referring to the graph picture above shows the total mean for the three locations for each question. First of all, question B1 is the internet as a medium to help the technical team implement the scope of work in the operations and that shows the rank obtained is 1 for all three locations. The total mean for these three hospitals is 4.87 for Sultan Ahmad Shah Medical Centre, 4.80 mean for IIUM Specialist Medical Centre, and lastly Kuantan Medical Centre is 4.92.

Second, question B2 is that using the internet is important to control services. The mean result for Sultan Ahmad Shah Medical Centre is 4.92 and the rank obtained is 2. The result ranking for IIUM Specialist Medical Centre and Kuantan Medical Centre is 1 and the mean obtained is 4.83 for IIUM Specialist Medical Centre and 4.89 for Kuantan Medical Centre.

The third is question B3 the question asks about the internet helps in maintaining the company database. The rank for the three places of this researcher showing 2. The mean reading that has been shown for the three study locations is 4.82 for Sultan Ahmad Shah Medical Centre, Mean 4.53 for IIUM Specialist Medical Centre, and Kuantan Medical Centre is 4.61 mean.

Fourth, question B4 is related to email being part of an important network in supporting services. The rank reading obtained from SPSS is 1 for all three locations and the mean reading shows 4.84 for Sultan Ahmad Shah Medical Centre, 4.80 for IIUM Specialist Medical Centre, and 4.92 for Kuantan Medical Centre.

The fifth shows question B5 related to devices technology assisting in maintenance work. Where the rank reading for Sultan Ahmad Shah Medical Centre is 2 and for IIUM Specialist Medical Centre and Kuantan Medical Centre obtained rank 1. The mean reading obtained is 4.68 for Sultan Ahmad Shah Medical Centre, 4.73 for IIUM Specialist Medical Centre and 4.86 mean reading for Kuantan Medical Centre.

Finally, question B5 asks questions related to the device that can provide information regarding the function of the equipment used. Refer to the table above, shows the rank for Sultan Ahmad Shah Medical Centre is 2 and IIUM Specialist Medical Centre and Kuantan Medical Centre is 1. The mean reading for these three places is 4.68 for Sultan Ahmad Shah Medical Centre, 4.73 for IIUM Specialist Medical Centre and 4.86 for Kuantan Medical Centre

The conclusion of finding from objective 1, found that the total mean for the location shows the highest respondents is Kuantan Medical centre with a total mean of 4.85. The collection for all question shows that the highest respondent is question B2 which states that the internet is important to ensure the services can be monitored operation and most respondents strongly agree with the question and the total number obtained "strongly agree" is 91 people and 86.67% percentages. As stated in literature review the internet are shaped by the global connection between hundreds thousands of other

computers, communications entities and information systems. (Bridges, 1997) The internet is very important to ask a attention from the operation and services is everything making rules about companies and using by people (Porter, 2001).

5.4 FINDING THE OBJECTIVE TWO: TO ANALYSE THE LEVEL OF AWARENESS AMONG FACILITY MANAGEMENT COMPANY TO IMPLEMENT INTERNET OF THINGS (IOT).

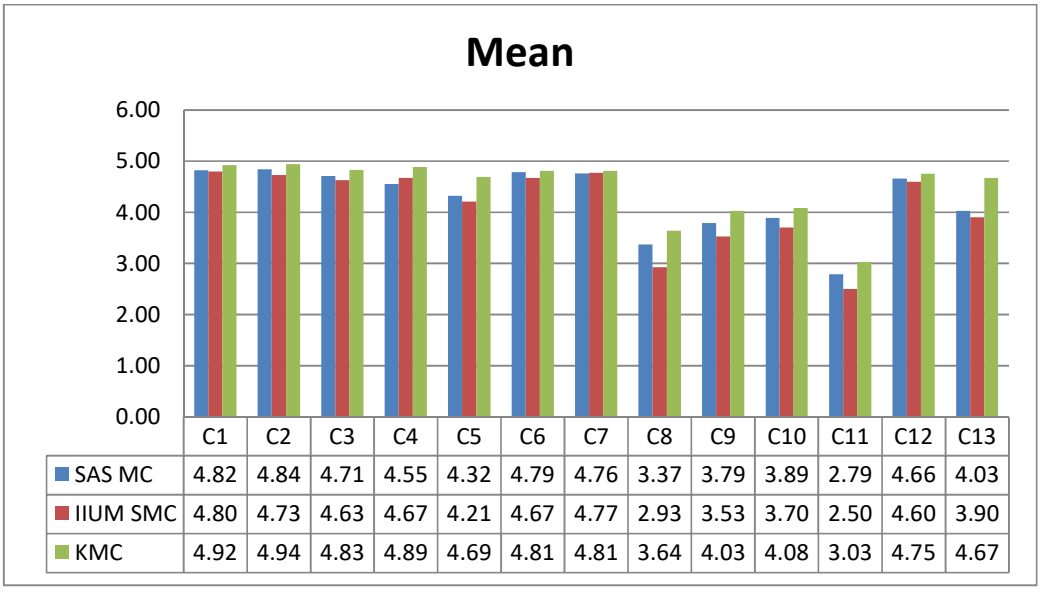
The second objective of this research is to analyse the level of awareness among facility management companies to implement internet of things. The finding of the second objective is to show, how the respondents aware with internet of things technology. As shown to table 5.5, displays the statistics of reliability for assessing the level of the Cronbach Alpha technique. This method has shown that these variables' reliability is 0.869, which means the results for objective two are valid and reliable to proceed for the next objective

Table 5.5: Reliability Statistics for Section C

Reliability Statistics	
Cronbach's Alpha	N of Items
0.869	13

Refer to table 5.6 below, the variable explained the question by survey and required to achieve the third objective. In population (N) the responding are not missing to answering the question which has been distributed through questionnaire. In the table, section mean was shown the average total mean result for three locations. Firstly, the average means for Sultan Ahmad Shah Medical centre is 4.25, second, IIUM Specialist Medical Centre is 4.13 and lastly, Kuantan Medical Centre is 4.44. The scale was selected using the range from 1 to 5 and where 1 represent is “strongly disagree” and 5 is “strongly agree”.

No.	Question	N	Sultan Ahmad Shah Medical Centre			IIUM Specialist Medical Centre			Kuantan Medical Centre		
		Valid	Mean	Mode	Range	Mean	Mode	Range	Mean	Mode	Range
C1	Do you agree the sensors are an effective technology for use in buildings?	104	4.82	5	1	4.80	5	1	4.92	5	1
C2	The used sensors technologies, effective to control the environment (lighting, pressure, and temperature) building.	104	4.84	5	1	4.73	5	1	4.94	5	1
C3	The network (ICT System, Business System or Transportation System) influences the provision of services in facility management	104	4.71	5	2	4.63	5	1	4.83	5	1
C4	Do you agree the data collection process can respond to equipment and applications used?	104	4.55	5	2	4.67	5	1	4.89	5	1
C5	Do you agree with internet application that can help the view data, functions, and equipment through (Building Management System (BMS) application or Air Conditioning application control?	104	4.32	5	2	4.21	5	2	4.69	5	2
C6	Building Management System (BMS) or Computerized Maintenance and Management system (CMMS) is the important software to manage the facility services?	104	4.79	5	2	4.67	5	1	4.81	5	2
C7	Do you aware with the Internet of thing (IoT) devices for example sensor Equipment, Internet, or door security systems?	104	4.76	5	2	4.77	5	1	4.81	5	2
C8	Do you agree the Internet of Things (IoT) can minimize the negative impact of buildings on the operation?	104	3.37	5	4	2.93	2	4	3.64	5	4
C9	The high-speed internet (5G) considered indispensable for facilities management or building operation.	104	3.79	3	2	3.53	3	3	4.03	5	2
C10	Do you agree high-speed internet is the energy-efficient for moving the Internet of Thing (IoT) device?	104	3.89	4	2	3.70	3	3	4.08	5	2
C11	Do you agree the sensors are an effective technology for use in buildings?	104	2.79	1	4	2.50	1	4	3.03	5	4
C12	The used sensors technologies, effective to control the environment (lighting, pressure, and temperature) building.	104	4.66	5	2	4.60	5	4	4.75	5	1
C13	The network (ICT System, Business System or Transportation System) influences the provision of services in facility management	104	4.03	5	2	3.90	3	2	4.67	5	2
Total Average			**4.25**			**4.13**			**4.44**		



	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
SAS MC	4.82	4.84	4.71	4.55	4.32	4.79	4.76	3.37	3.79	3.89	2.79	4.66	4.03
IIUM SMC	4.80	4.73	4.63	4.67	4.21	4.67	4.77	2.93	3.53	3.70	2.50	4.60	3.90
KMC	4.92	4.94	4.83	4.89	4.69	4.81	4.81	3.64	4.03	4.08	3.03	4.75	4.67

Figure 5.6: Mean bar chart for Question C

Referring to the graph above was shows the total mean obtained from SPSS for each location and questions that have been distributed by the researcher. Refer to the three locations found that the results obtained different especially from the total mean, mode, and rank. Objective 2 is regarding analysing the level of awareness of the Internet of Things (IoT) of facility management companies. The questions have given is related to sensors, servers, the Internet of Things awareness, and high-speed internet.

The result shows that the highest mean amount obtained is Question C1, which states that using sensor technology is very effective in buildings. The mean reading for Sultan Ahmad Shah Medical Centre was 4.82, IIUM Specialist Medical Centre showed a total of 4.80, and Kuantan Medical Centre showed a total of 4.92. The result showed most of the respondents answer “Strongly Agree” and the percentage for the response is 81.90% it means most of the respondents agree sensor can help the building to be effective. According (Zhai et al., 2019) ,Sensors are capable of responding to all kinds of conditions such as heat, temperature, location, pressure, movement, and human senses and make the effective for building implement the internet of Things (IoT).

The lowest mean shown in Question C11 was most respondents answering “strongly disagree” and the percentage was shown 30.50%. So, from the result the respondents did not understand the Internet of Things. According from Jeremy, many facilities management teams are poor about technologies opportunities and lack to understanding the transformation technologies. Refer to the table above, the mean result for Question C11 obtained from Sultan Ahmad Shah Medical Centre is 2.79, IIUM Specialist Medical Centre is 2.50 and Kuantan Medical Centre is 3.03.

There have three types of results that have been obtained. First, Sultan Ahmad Shah Medical Centre was shown the average mean is 4.25. The mode reading obtained was showing, Question C10 is mode 1, Question C9 got the total of mode 3, the mode for Question C11 is 4 and the unspecific questions list got mode 5. The rank position obtained for Question C1 and Question C2 is rank 1. Next, for Question C8 and Question 10 show the rank 4 and for other questions obtained rank 2.

Seconds, the average mean for section C for IIUM Specialist Medical Centre is 4.13 and the result of average mode is 1, 2, 3, and 5. Through the result, Question C11 got mode 1. The question was related to the level of respondents understanding the internet of things. Then, for Question C9, Question C11 and Question C13 gets the result mode is 2, and mode for 5 is related to the other question in section C. the result for rank was showing, Question C1, Question C2, Question C3, Question C6, and Question C7 on rank number 1. Then, Question C5 and Question C13 on the second rank for the rank number 3 is Question C8 and Question C10 and lastly, Question C11 is rank number 5.

Lastly, the obtained result for Kuantan Medical Centre related to mean, mode, and rank. The average mean was obtained for Kuantan Medical Centre is 4.44 from the result Kuantan Medical Centre got the highest average mean between to other locations. Refer to the table above, all questions get mode 5 and for the ranking, the result was showing Question C1, Question C2, Question C3, Question C4, and Question C12 got the first rank. The second

rank gets by Question C4 to Question C10, Question C13 and for the fourth `rank gets by Question C8 and C11.

5.5 FINDING THE OBJECTIVE THREE: TO PROPOSE THE IMPROVEMENT IN IMPLEMENTATION OF INTERNET OF THINGS (IOT) IN FACILITY MANAGEMENT COMPANY.

The last objective is to propose the improvement in implementation of internet of thing (IoT) in facility management companies and the finding for this section needed to improving internet of things on knowledge, skills, operation and management. Refer to table 5.8, displays the statistics of reliability for assessing the level of the Cronbach Alpha technique. This method has shown that these variables' reliability is 0.881, which means the results for objective one are valid and reliable.

Table 5.7: Reliability Statistics for Section D

Reliability Statistics	
Cronbach's Alpha	N of Items
0.881	5

Refer to table 5.9 below, the variable explained the question by survey and required to get the result for objective three. In population (N) the responding are not missing to answering the question which has been distributed through questionnaire. In the table, section mean by location was shown the average total for Sultan Ahmad Shah Medical Centre is 4.57. for IIUM Specialist Medical Centre is 4.77 and lastly Kuantan Medical centre is 4.88. the mode is 5 and the scale was selected using the range from 1 to 5 and where 1 represent is “strongly disagree” and 5 is “strongly agree”

Table 5.8: Result data from SPSS for Question D

No	Question	N	Sultan Ahmad Shah Medical Centre			IIUM Specialist Medical Centre			Kuantan Medical Centre		
		Valid	Mean	Mode	Range	Mean	Mode	Range	Mean	Mode	Range
D1	Improvements in the use of technology as one of the suggestions for helping to maintain efficiency in providing facility management services.	104	4.79	5	1	4.80	5	1	4.89	5	1
D2	Updating the latest technologies helping to reduce the risks especially involving security systems (Improvement the security alarms to use more efficiently).	104	4.71	5	2	4.83	5	1	4.89	5	1
D3	Providing training to employees for learning the latest technologies and gained knowledge can assist in supporting the facility management services.	104	4.32	5	2	4.80	5	1	4.86	5	1
D4	The new buildings construction in Malaysia needs to apply the Internet of Things (IoT) technology in the new building to be more effective and facilitate future maintenance work.	104	4.71	5	2	4.57	5	2	4.89	5	1
D5	Improvements in the use of technology as one of the suggestions for helping to maintain efficiency in providing facility management services.	10	4.32	5	2	4.87	5	1	4.89	5	1
Average Mean			**4.57**			**4.77**			**4.88**		

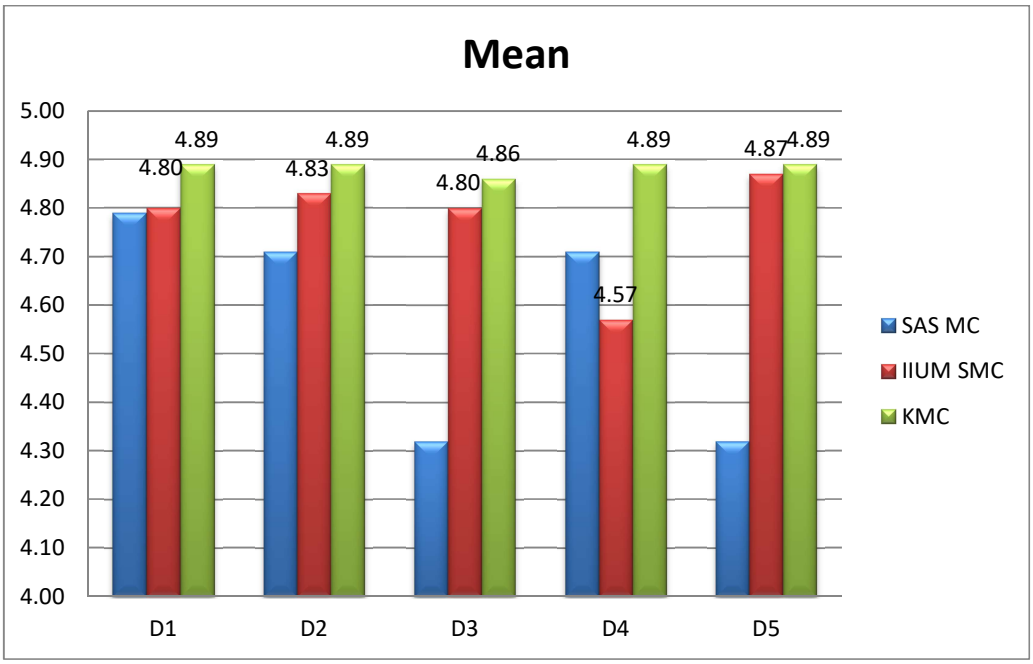


Figure 5.7: Mean bar chart for Question D

Refer to the table above; the average mean for three locations is different for the first location is Sultan Ahmad Shah Medical Centre the average mean result is 4.57, second location, IIUM Specialist Medical Centre got 4.77 and the last location is Kuantan Medical Centre the average mean got 4.88.

Through the first question is Question D1 was obtained mean for Sultan Ahmad Shah Medical Centre is 4.79, IIUM Specialist Medical Centre is 4.80, and Kuantan Medical Centre is 4.89. Second, Question D2 was showing the mean result for Sultan Ahmad Shah Medical Centre is 4.71, IIUM Specialist Medical Centre is 4.80 and Kuantan Medical Centre is 4.89. Third, obtained was showing Sultan Ahmad Shah Medical Centre got 4.32, IIUM Specialist Medical Centre is 4.80 and Kuantan Medical Centre is 4.86. Fourth, was showing Sultan Ahmad Shah medical centre got the mean is 4.71, IIUM Specialist Medical Centre is 4.80 and Kuantan Medical Centre is 4.86 and lastly, the mean result on Sultan Ahmad Shah Medical Centre is 4.32, IIUM Specialist Medical Centre is 4.87 and Kuantan Medical Centre is 4.89.

Refer to the table above; every location gets a different result. So, for Sultan Ahmad Shah Medical Centre got two numbers rank which the first rank for Question D1 and second rank for Question D2 to Question 5. IIUM Specialist Medical Centre was obtained Question D4 got the second rank and other questions got first ranks and lastly, Kuantan Medical Centre was showing all the questions got the first rank.

The conclusion from the overall results obtained find that Question D1 got the highest result where respondents "strongly agree" with the average percentage obtained was 78.10% was showing respondents strongly agree that the latest technology helps in supporting facilities services. According to Davies, latest technology involves tools and techniques for detecting and recording the state of the building system. Using the monitoring for the performance of buildings and systems, technology can initiate and record maintenance operations and to evaluate their effectiveness years (Wood,2005).

5.6 INTERVIEW

The interviews conducted to support the questionnaires that were made to strengthen the research findings. Interviews were conducted on a two respondents where they gave opinions based on their experience and understanding.

I. What your opinion about the internet thing in facility management?

Interviewe 1

The internet of things (IoT) is the good latest technology to using in the building because the IoT can be given a benefit to the user and easy for handling the building operations. So, for the implement the IoT need to see the building condition for example, new buildings need to be started as-built stage because it helps in cost savings and future

planning and old building is not suitable to install because involves a large cost.

Interviewee 2

The internet of things is a technology for helping in work operations and life. The technology involves a lot in the IoT, especially for buildings for example, that can be seen is smart buildings. The internet of things is a technology for helping in work operations and life. The technology involves a lot in the IoT, especially for buildings. For example, smart buildings are among the main areas of applications for the Internet of Things (IoT). Compared to what can often refer to the combination of IoT, advanced analytics, artificial intelligence and machine learning, few autonomous decisions in buildings, edge computing, and so forth.

Interviewee 3

The interviewee 3, still not too familiar with the internet of things but exposure to the internet of things has been. The obtained were through the existing understanding the internet of things is a good technology especially involving building operations and control over the building. Looking at the positive side, using the internet of things technologies can help in maintenance work and helps reduce manpower but the disadvantage is a high cost for the maintenance process if using this technology and also the high cost to install into an old building like this hospital.

II. In your opinion, the internet is an important part of using the Internet of Things?

Interviewee 1

Important because the high speed internet will be supporting the IoT database in the building but for improvement, the latest internet depends on the database in the building if the building uses high coverage high-speed internet should be used to support the database.

Interviewee 2

Improvements to the internet of things technology have many benefits; especially involving buildings that use large systems because they are easy to do work but for technical aspects, work on-site needs to be done to ensure the readings on the system are the same. Yet, for the cost, it is quite expensive because the IoT installed on old buildings will involve high costs.

Interviewee 3

Nowadays, the internet is very important to handle the operations because all information can be shared online. An example that can be seen is, the use of high-speed internet that is being worked on by Telco company's aims to improve internet coverage. Besides, it helps in providing the best signal for users, especially involving important data such as Building Management System (BMS)

III. As a facility manager, is it necessary to give awareness to staff about technology including the internet of things?

Interviewee 1

Awareness of technology is still unknown because acquaintance with technology is still declining so, to provide an approach to technology training can be made but depends on the building technology. Besides, employees need to know the latest technology because they performed at work so as employees, they need to know about the purpose and function of technology it is also included the introduction of IoT in their environment.

Interviewee 2

Implement the training should be done especially related to the latest technology involving terms because most of them still are lack understanding of current technology. for example, most of the technical staff still lack using Building Management System (BMS) and some of the staff do not understand the function of BMS in building and also the criteria system.

Interviewee 3

The level of awareness related to technology is very important because it helps in increasing the level of knowledge of Malaysians on par with foreigners where they generally know the latest technology because their government reveals the latest technology.

In Malaysia, the government has provided allocations but among the companies in Malaysia still have not implemented the latest technology to the public. An example of implying is through training where the company reveals the use of technology in time can increase the level of knowledge of employees regarding technology.

5.7 SUMMARY OF THE CHAPTER

The conclusion, the data collection has been collect to achieve the research objective. This chapter, the method researcher use to collect the data is Google Form Were the researcher shares the link that has been sent to selected hospitals to answer the research questions. Besides that, the use of interviews was to support the distributed questionnaires. The results from data collection and discussion made the desired objectives achievement

CHAPTER 6
CONCLUSION

6.1 INTRODUCTION

In the previous chapter, chapter five is explained about the data analysis and discussion that has been presented and stated the data collected by the researcher. Chapter five includes explanations complete with the figure and tables. As the final chapter of the research, chapter 6 will deliver a general description of the study. All description is based on the data collected during the research. The summary of the research covers the research question, research implication, and research limitation and proposes improving for facility management companies.

6.1 SUMARRY OF RESEARH QUESTION FINDINGS

This study aims to examine the level of understanding concerning the internet of things there is a facility management company. The findings in chapter five have been discussed in-depth to be linked to the objectives to be achieved in this study. This section to explain about the research sub-question such as:-

I. Research question one: What is the factor of internet of things (IoT) in Facility Management Company?

The research has been successfully reviewed the factor of the Internet of Things (IoT). The research found that the factors of the Internet of Things to implement in the Facility Management Company. The internet of Things concept involves such as using the internet as a medium to help technical teams. Internet is important to ensure the services, the Internet can maintain the database and data collection, Email is important to network, Device help for maintenance work, and Devices can provide information. Besides, the objective one obtained

can see the factors that drive the level of understanding of respondents on the use of the internet and technology in line with the era of globalization and the era of the industrial revolution. Average mean for implement the factor gained from the data is 4.77.

II. Research Question Two: What is the level of awareness Facility Management Company in internet of things (IoT)?

The level awareness of the facility company can be seen through objective two where the level of awareness is seen through the use of sensors, network, server, application, building management system, high-speed internet, and internet awareness of things. Referring to objective two found that respondents use a lot of technology under internet of thing (IoT) but they do not know the meaning of internet of thing (IoT)

III. Research Question Three: How recommend internet of things (IoT) in Facility Management Company?

The research summary that has been made on objective three mostly respondents agree the use of the Internet of Things (IoT) that need to be applied to all facility management companies because the technology uses knowledge related to fast-moving technology. Besides, suggestions for improvement need to be made to improve existing systems in buildings, especially involving old technology. The purpose of improvement is to have a good effect on the building as well to help in maintaining efficiency in carrying out the operations.

6.3 RESEARCH IMPLICATION

The research is found the importance of the internet of things (IoT) to buildings and employees in facility management companies because this technology helps in giving an advantage also to companies, among the result that give an advantage to the facility management company are:

1. Reducing Consumption

The Internet of Things (IoT) is equipped with a network of wireless sensors that obtain and collect information from all available assets and can save energy used as a result of faulty equipment or systems. Therefore, the company can reduce the cost of use in the building.

2. Reducing Labour Costs

Reducing the labour on the site is the quickest way to reduce costs of labour by knowing which system is causing the problem you can send the right person the first time, eliminating wasted time and repeat site visits. Furthermore, with enough information about the matter can be ready to monitor the severity of the difficulty and schedule maintenance when someone is already scheduled to be on site.

3. Increasing Operational Efficiencies and Intrinsic Value

Proactive maintenance of equipment can detect early problems before they become big and expensive to fix. Therefore, the use of the Internet of Things (IoT) can detect minor damage through devices that have been installed on system equipment and assist in saving repair costs on equipment.

6.4 RESEARCH LIMITATION

There have some limitations occur when conducting research, especially during the occurrence of Pandemic coronavirus disease (COVID-19) that has invaded the world between the limitations faced are as follows:

1. The data collection need time to complete.

The collection of questionnaire results has taken a long time and ran away from the data collection schedule that has been planned because the pandemic COVID-19. The researcher managed to get the respondents above the sample size that has been in the table krejcie and morgan (1970).

2. Obtaining Data Interview.

The research involved the individuals in the interview session. The researchers can't conduct interviews simultaneously on all these individuals at one time. Furthermore, while the data is being taken the country is facing Pandemic (COVID-19). So, the companies were involved in handling the issue and they need to follow the government instructions. The interview is made after the motion control order (MCO).

6.5 RECOMMENDATION FOR FURTHER RESEARCH

This research believes the Internet of Things (IoT) needs to install in all buildings because the Internet of Things (IoT) devices are important for the equipment system to carry out building operations and also to help the core business then for further research can focus on Internet of Thing (IoT) in the smart building because it can include management and technical which can relate with smart buildings are artificial intelligence or big data, asset digitization, energy efficacy, indoor air quality (IOQ) monitoring, operational technology, workspace management, and horizontal platform.

From the results obtained from the research finding that has been made. Further studies that can be done by studying the cost price to implement the internet of things in the building involving clients and services providers as well as studying the benefits that the client can get if the internet of things is implicated in the building

6.6 RESEARCH SUMMARY

Summary from the study that has been made the use of the Internet of Things (IoT) in line with modernity in Malaysia, but the level of knowledge is still lower related to the Internet of Things (IoT). Therefore, facility management companies need to apply the level of knowledge related to technology. So, the facility management industry becomes one of the industries that know about current technology.

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