RELIABILITY AND USER BEHAVIOR TOWARDS IOT SYSTEM AFFECTING ORGANIZATIONS' SUPPLY CHAIN PERFORMANCE

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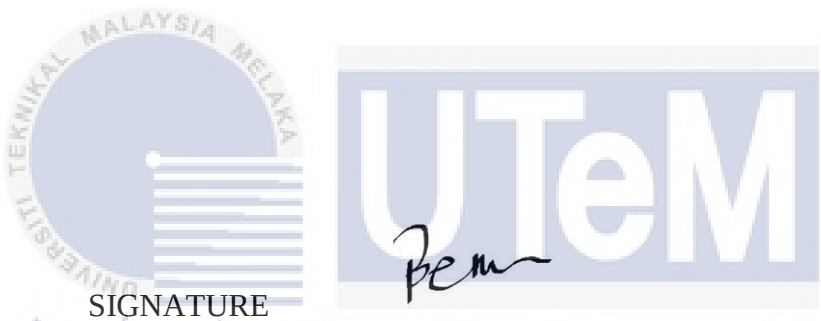
DECLARATION OF ORIGINAL WORK

I hereby declare that all the work of this thesis entitled reliability and user behaviour towards IoT system affecting on organizations' supply chain performance is originally done by myself and no portion of the work encompassed in this research project proposal has been submitted in support of any application for any other degree or qualification of this or any other institute or university of learning.



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DEDICATION

I would like to appreciate the dedication to my beloved family members who educated me and motivate me to pursue my studies until degree level. And also, I express a deep sense of gratitude to my lecturer whom also my supervisor for my final year project, DR. Nusaibah binti Mansor and my fellow friends (Aqilah, Anissa, Izyan & Fatini). They have provided me full support and advice throughout this research. Without their blessing and encouragement, this research is impossible to complete within this short period of time.

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ABSTRACT

This research is about the reliability of IoT system and user behaviour towards IoT system that affecting organizations' supply chain performance. IoT is what connect individual identified products, machines and human to provide optimized solutions, through sensor devices, data storage and analysis equipment as well as decision-making tools. It is utilized in the organizations to enable efficient management and applied in the supply chain industry for efficient process. Due to Covid, organizations' explore IoT in which they include it in their supply chain on deeper level in order to counter demand and supply. This research aim to study the organizations supply chain performance after utilizing the IoT frequently in their operation. IoT application are widely used, not only in Malaysia, but in European countries it is a critical high-end solution that ensure efficiency throughout their supply chain processes and managerial activity.

ABSTRAK

Kaji selidik ini adalah mengenai kebolehpercayaan sistem IoT dan tingkah laku pengguna terhadap sistem IoT yang mempengaruhi prestasi rantaian bekalan organisasi. IoT ialah perkara yang menghubungkan produk, mesin dan manusia yang dikenal pasti individu untuk memberikan penyelesaian yang optimum, melalui peranti sensor, penyimpanan data dan peralatan analisis serta alat membuat keputusan. Ia digunakan dalam organisasi untuk membolehkan pengurusan yang cekap dan digunakan dalam industri rantaian bekalan untuk proses yang cekap. Disebabkan Covid, organisasi meneroka IoT di mana menerapkan IoT ke dalam rantaian bekalan mereka pada tahap yang lebih mendalam untuk mengatasi permintaan dan bekalan. Penyelidikan ini bertujuan untuk mengkaji prestasi rantaian bekalan organisasi selepas menerapkan IoT dalam operasi mereka. Aplikasi IoT digunakan secara meluas, bukan sahaja di Malaysia, tetapi di negara-negara Eropah di mana IoT merupakan penyelesaian yang kritikal yang memastikan kecekapan sepanjang proses rantaian bekalan dan aktiviti pengurusan mereka.

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ABBREVIATION	MEANING
IoT	Internet of Things
RFID	Radio Frequency Identification
WSN	Wireless Sensor Networks

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CHAPTER 1 INTRODUCTION

1.1 Introduction

Organizational supply chain are key to an organization performances. It is one of significant aspect that define the competence of an organization. Reliable supply chain system will enable organization to remain competent and upkeep with the rapid development. The purpose of this research is to study the relationship between the reliability and user behavior of IoT system and how it will affect organization's supply chain. This chapter focuses on the background of study, problem statement, objectives and hypotheses of this research, significance of study, limitation of study and operational definition of terms.

1.2 Background of Study

Supply chain performance is significant for organizations' competitive advantage and utilising IoT system revolutionize many aspects of supply chain from manufacturing to endpoint (Locke, 2020). Previously, supply chain are fragmented into warehousing, forecasting, production and many more and now with the integration of IoT, supply chain are heading and evolving into automation (Rodrigue, 2020). Using IoT, uncertainties are eliminated and allow seamless integration across the supply chain (Locke, 2020). RFID systems, barcodes, and intelligent sensors are some of the technologies that have been deployed in supply chain management in recent decades (Tharaka de Vass, 2018). Implementation of IoT into supply chain allow additional capabilities by IoT technologies to sense supply chain processes, improving visibility, accuracy, traceability, interoperability and collaborative decision (Tharaka de Vass, 2018).

In Malaysia, IoT is still at infancy stage in terms of automating, which puts Malaysia in the back end of line manufacturing although Malaysia has 40 years in the semiconductor segment (Amarthalingam, 2017). The reasons for IoT still being at infancy stage also due to manufacturers refuse to invest in fully automated system as expenditure could cost up to several millions. Currently, it had been predicted that by 2030 and beyond, trillions of sensors and related device in the IoT projected to exist (Sibin Mohan, 2018). Thus, emerging amount of IoT devices and applications will result in emerging variances of vulnerabilities. As other disruptive technologies, reliability of the devices or system will be questioned.

Furthermore, employee or individuals utilization of IoT system in supply chain are impacting the efficiency of IoT system to work with IoT technologies, solutions, device to network and then on its application (Samuel J. Moore, 2020). Reliability and user behaviour towards IoT system which affect organizations' supply chain performance are studied in this research to find out about their relationship. Integration of IoT into an organizations' supply chain will affect organizations' supply chain performance since it has transform conventional supply chain into smart supply chain (Bahar, 2022).

1.3 Problem Statement

IoT system are implemented into supply chain to improve its traceability and visibility which can enhance supply chain performance (Faghihi-Nezhad, 2022). The system generate huge amount of data thus security issues often arises which result into questioning the reliability and of IoT system. Commonly, as any new technology that enters the market, the question about its reliability will surely follow suit (Sibin Mohan, 2018). In addition, the authentication of connected and embedded device within each other and the web services still remain a great challenges (Sibin Mohan, 2018). On top of that, user behavior of IoT system are associated with how employees and organization as a whole interact with the system in order to achieve certain goals set by the companies.

Globalization in supply chain depended heavily on data exchange across its associated organizations despite located geographically apart (Global-Supply Chain Management-Drivers and Activities of Global Supply Chain, n.d.). One of the main aspect that enable supply chain to function efficiently regardless of how broad it is, is visibility within the supply chain (Global-Supply Chain Management-Drivers and Activities of Global Supply Chain, n.d.). An effective supply chain collaboration will allow exchange of information that is accurate and timely which display required information at different point in the supply chain (Global-Supply Chain Management-Drivers and Activities of Global Supply Chain, n.d.). Thus, issues such as inaccurate evaluations, misjudgments and poor decision could affect badly on an organizations and the entire supply chain processes.

Previously, there is also huge case that made the headline, Mirai botnet that infect thousands of IoT devices and then evolving conducting full large-scale attacks (The Mirai Botnet-Threats and Mitigations, n.d.). Mirai botnet which focus on infecting as many device as possible was further encouraged by lack of security embedded into the IoT devices (The

Mirai Botnet-Threats and Mitigations, n.d.). This further result in the gap of security of IoT system with organization adoption of IoT system into supply chain processes which directly impact organizations' supply chain performance.

Moreover, the user behavior of IoT devices also result in vulnerabilities within the devices.It was believed that lack of knowledge, carelessness or malice on employee's part could lead tocyber-attack (Cyber Security Awareness: 7 Ways Your Employees Make Your Business Vulnerable to Cyber Attacks, 2022). This illustrates that user behavior towards IoT system and its reliability result in significant impact on organizations' supply chain performance.

1.4 Research Objectives

1.4.1 General Objective

The research objective of this paper is to determine the relationship between reliability and user behaviour of IoT system and how it will affects the organization's supply chain performance.

1.4.2 Specific Objectives

The specific objectives are:

a. To identify factors of reliability and user behaviour towards IoT system that is affecting an organization supply chain performance.

b. To analyse the factors of reliability and user behaviour towards IoT system that is affecting an organization supply chain performance.

c. To determine the most significant contributing factor of reliability and user behaviour towards IoT system that affect an organization supply chain performance.

1.5 Research Question

a. What factors of reliability and user behaviour towards IoT system affecting organizations' supply chain performance?

b. What are the effects of reliability and user behaviour towards IoT system affecting organization's supply chain performance?

c. What is the most significant contributing factor of reliability and user behaviour towards IoT system that affect an organization's supply chain performance?

1.6 Scope and Limitations of Study

This research study about the reliability and user behavior of IoT system that is affecting organizations' supply chain performance. The scope of the study are focused on utilization of IoT system in Malaysia that will affect supply chain performance of that organizations. This study measures how the reliability aspect of IoT system in organizations and from how the user behavior towards the system affecting organization's supply chain performance. The research are conducted on selected organizations in Ayer Keroh, Malacca, Malaysia where IoT system are utilized in supply chain operations.

The limitation of the study is inaccurate data from the respondents due to some employees does not have a deep and adequate knowledge about IoT system. The researcher also does not focus on every single state in Malaysia and only focuses in three organizations in Melaka that utilized IoT system to manage their supply chain. In addition, researcher also faces time limitation in conducting the study due to study need to be completed in a short amount of time which is in 10 months.

1.7 Significant of study

This study may contribute useful information for other parties as well as for researchers. The findings of the study may contribute to the existing literature today. Through this study, determining the relationship between reliability and user behaviour of IoT system and organization's supply chain performance may enable an extension of current research factors. The findings of the study will benefit organizations who want to improve IoT application within their organization. This will make aware of organizations understand the impact that reliability and user behaviour of IoT system on their supply chain performance. Besides, employees within the IT department can understand and develop more alternatives and solution to build a better IoT system.

1.8 Definition of Terms

In this section, the operational definition of the terms in the research will be explained.

1.8.1 Reliability

Operational: Reliability is the measure of how consistent the system or device respond after certain period of time.

1.8.2 User Behaviour

Operational: User behaviour is defined as how individual act when using the system. The steps and procedure of interacting with the system in order to achieve goal or complete the tasks.

1.8.3 Internet of Things (IoT)

Operational definition: Internet of things consist of smart devices, RFID, sensors, actuators that capture and transmit data that real-time data.

1.8.4 Supply Chain Performance

Operational: Supply chain performance refers to more than just performing the supply chain activities. It is about ensuring the performance delivered comes with good quality and of good service level. For an example, delivery within the time pre-determined time frame, but faster delivery will result in better supply chain improvement.

1.8.5 Security

Operational: Security in the context of reliability refers to the capability of the system to withstand attack of botnets and hackers to prevent leak of data to unauthorized party.

1.8.6 Sensitivity

Operational: Sensitivity under the context of reliability refers to the frequency of the system to produce and transmit accurate data even under non-favourable conditions

1.8.7 Expertise

Operational: Expertise discussed under the context of user behaviour towards IoT system refers to the knowledge and technical skills that employees possess to use IoT system functionality to an optimum level.

1.8.8 Engagement

Operational: Engagement from user behaviour perspective refers to level of involvement of customer in utilizing IoT system in their day to day operations.

1.9 Summary

In conclusion, this chapter discussed about the overview of the study. The discussion in this chapter includes the background of the study, problem statement, research questions and objectives, scope and limitations of the study, significance of the study and the operational definition of terms. In the coming chapter, literature review of this study are discussed and information will be broader and more understandable.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

This chapter review literature on reliability, user behaviour and organizations' supply chain performance. The concepts obtained from this literature were used to generate the conceptual framework and the hypotheses for this research. This chapter are segmented into four sections. The first section is about concept which describes the concept of IoT, IoT in supply chain, and the supply chain performance. The second section will describe on the factors of reliability, which are security and sensitivity. For the user behaviour part, factors of user behaviour towards IoT system are described which are engagement and expertise.

2.2 What is IoT?

The term IoT has been circling around during the past two decades and it was first introduced by Kevin Ashton in 1999. It describes the IoT as interconnection among computing devices embedded in physical objects to gather and save information without the requirement of human interaction. The central concept of IoT was described as everyday objects can be equipped with processors and capable of identification, sensing, networking and processing, allowing them to communicate with each other, and with other devices and services, over the internet (Atzori, 2010). Among three main systemic characteristics of IoT were described as well in which it is everything that communicates in the context that wireless communication enable the creation of networks of interconnected things or object. Next, IoT is everything that is identified in which connected things or objects are able to receive a unique identification. Lastly, is that IoT is everything that interacts in which it is possible to sense and interact with the environment when this capacity is present (Miorandi, 2012).

Understanding how IoT work is essential as author needed to strengthen its foundational knowledge about IoT before diving in deeper on IoT in supply chain. Thus further definition of IoT are gathered. According to an article written by Alexandes S. Gilis, 'IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware in order to collect, send and act on data that were collected and acquire from their environments' (Gillis, 2022). This definition detail out that IoT consist of various hardware and software that interacts to carry out various operational functions.

On the other hand, author McLellan defined IoT as 'a fast-growing constellation of Internet-connected sensors attached to a wide variety of things' (Maria Tsourela, 2020). Among

varios real word applications of IoT are smart homes (Amazon Alexa), wearable device (smart watch,etc.) smart healthcare (glucose monitoring), smart buildings, smart city, smart farming (CropMetrics), smart appliances and it stretches from consumer IoT and enterprise IoT to manufacturing IoT and industrial IoT (Maria Tsourela, 2020).

Various sectors are adoption IoT into their business process. This is due to the competitive advantage that it gives the companies. IoT importance in businesses can be seen as it enable real-time look into how the company's systems actually works which deliver insights into everything from the performances of machines to supply chain and logistics operations (Gillis, 2022).

Adoption of IoT into business also enable business to 'automate their process and significantly reduce their labour costs' (Gillis, 2022). 'Waste in the business also can be reduced which eliminate additional cost to manage unnecessary waste and improve service delivery that makes it less expensive to manufacture and deliver goods' (Gillis, 2022). The IoT adoption also offer 'transparency into customer transaction which bring business and customer relationship to another level' (Gillis, 2022). Organizations that integrate IoT into its business process could reap benefit such as saving time and money, enhance employee productivity, makes better and well-informed business decisions. It is found as well that IoT is most abundantly applied in manufacturing, transportation and utility organizations with the use of sensors and several other IoT devices (Gillis, 2022).

2.3 IoT in Supply Chain

Shapiro defines a company's supply chain (SC) as "dispersed facilities where raw material, intermediate products, or finished products are acquired, transformed, stored, or sold and transportation links that connect facilities along which products flow" (Abdallah Jamal Dweekat, 2017). Concept of IoT in supply chain first recognized in 1999 due to its relation to the use of radio-frequency identification (RFID) tags to track product along the supply chain (Ashton, 2010). In association with supply chain, IoT is a network of physical objects that are digitally connected to sense, monitor and interact with a company and between the company and its supply chain, enabling agility, visibility, tracking, information sharing to facilitate timely planning, control and coordination of the supply chain processes (Ben-Daya, 2019). RFID technology, the foundational technology that allow microchips to transmit the identification information to a reader through wireless communication (Elham Ali Shammar,

2019). RFID tags were used to read and identify objects and then transmit the information wirelessly through a network (Mohamed Ben-Daya, 2017).

IoT enabling technologies were developed which enable the IoT to work systemically. The enabling technologies are segmented into four categories, the identification and network technologies, communication and network technologies, service management technologies and cloud computing. Among the identification and tracking technologies commonly used are RFID system, barcodes, and intelligent sensors in which widely used in the retail, logistics and supply chain management over the last few decades (Abdallah Jamal Dweekat, 2017). The RFID can be integrated with wireless sensor networks (WSNs) to ensure better track and trace things in real time. Then, for communication and network technologies, it is described as technology that assist entities to communicate and exchange information. For an example, WAN, MAN, LAN, and WLAN, VPN, communication protocols and standards such as machine-to-machine (Abdallah Jamal Dweekat, 2017). Also, Internet Protocol version 6 (IPv6) and cross layer protocols for wireless networks such as wireless sensor and actuator network to enable or facilitate a diverse communication and computation capabilities (Abdallah Jamal Dweekat, 2017).

Moving on to service management technologies which refers to implementation and management of quality IoT services that meet the need of users or applications and other technologies such as storage space, security management, billing support, and business process management, which were offered through cloud computing (Abdallah Jamal Dweekat, 2017). Cloud computing is described as a promising IoT- enabling technology in the manufacturing industry, virtual enterprises and in supply chain management (Sepehri, 2012). All these technologies which also known as IoT-enabler work together to enable full optimization of IoT function in supply chain.

IoT relate to supply chain in which it authenticate the location of goods at any time. For an example, IoT devices are attached to moving storage container or to raw material or on the product itself. The IoT devices will transmit the goods location in which it will be sensed by GPS satellites that will be used to track the good's movement. Congestion or problematic movement of goods also can be streamlined through IoT device in which IoT devices used are capable to identify where and when goods are delayed during its transit. This enable companies or organization to construct contingency planning and identify alternative routes to ensure

efficiency in the company's supply chain to which significantly improve the company's supply chain performance.

Supply chain can be affected by IoT in various ways and first and foremost, it can develop SC reliability by ensuring or enabling object visibility and real-time information exchange which is information exchange that is up to date and instantaneous (Abdallah Jamal Dweekat, 2017). Next, it can improve SC responsiveness and reduce SC cost, facilitating realtime optimizations for its functions and business process activities (Abdallah Jamal Dweekat, 2017). In addition, IoT enable a better SC asset management by tracking resources in real-time to ensure there is no leftover or waste from negligence (Abdallah Jamal Dweekat, 2017). Last but not least it enhance SC agility as information flow are speed up within few seconds. Based on the content discussed of IoT in supply chain, it is true that IoT affect supply chain performance significantly and the aspect that affect the organizations' supply chain will be discussed accordingly in this research paper.

2.4 Supply Chain Performance

Supply chain performance was describe by (Warren Hausman, 2004) as extended supply chain's activities in meeting end-customer requirements, including product availability, on-time delivery, and all the necessary inventory and capacity in the supply chain to deliver that performance in a responsive manners. The supply chain performance incorporate more than company boundaries as it includes basic materials, components, subassemblies and finished products, and distribution through various channels and finally to the end customer (Supply Chain Performance Measures, n.d.). In order to stay competent in businesses, organizations need to transform their supply chain by implementing and utilizing new technologies such as IoT, big data analytics and other smart solutions.

Commonly, in order to evaluate the effectiveness of the supply chain activities, performance management model and approaches has been develop such as the balance scorecard (BSC) and supply chain operations reference (SCOR) model (Abdallah Jamal Dweekat, 2017). Supply chain performance are broad and can be segregated into two categories. The quantitative measure which includes aspect such as flexibility, resource utilization, delivery performance (SCM - Performance Measure, n.d.). Then, the qualitative measure are based on customer satisfaction and the quality of the product (SCM - Performance Measure, n.d.).

Using IoT technology, supply chain management performance issues can be addressed. Among the issues are the track-and-trace activity in which the applications result in improvements of service levels towards the customer (Abdallah Jamal Dweekat, 2017). This is due to real-time information exchange which enable the firm to make decision accordingly, which guarantees the product quality and able to observe the shelf life of products, mainly the perishable item in the food supply chain context (Abdallah Jamal Dweekat, 2017).

Moreover, utilization of IoT could enhance supply chain performance as it enable dissemination of accurate, updated information from customers at different levels which lowers the bullwhip effect, which enable activity to be coordinated to fulfill the product and service level agreement with customers (Abdallah Jamal Dweekat, 2017). These result in lower inventory as inventory handling are costly and an improved service level, which not limited to certain companies but improve the whole supply chain. Thus this proves that the IoT based applications help the organization to ensure that their supply and demand match and does not deviate further from one another (Abdallah Jamal Dweekat, 2017).

On top of that, flexibility, reliability and cost reduction can be improved using IoT based application in the production-programming and scheduling activities which offer better product customization levels according to customer request without putting the productivity at risk to meet the customized demand (Abdallah Jamal Dweekat, 2017). Furthermore, an IoT based application also enable an increase in product customization and develop product or strategies in the service sector which allow organization to create value for customer that create competitive advantages for the companies (Abdallah Jamal Dweekat, 2017). Lastly, visibility is undoubtedly one of benefit that made possible by IoT solution. Such smart solutions are smart bins and embedded sensors which assist the development of reverse logistics (Abdallah Jamal Dweekat, 2017).

In this study, the supply chain performance that will be measured is that of non-financial measures. Performance of supply chain will be measured under operational performance in supply chain. A past study had stated that reliability and flexibility can affect the product service supply chain (PSSC) performance (Davood Naghi Beiranvand, 2021). Flexibility is defined as responsiveness as reducing time required to meet customers' demand and encourage customer-oriented culture to reduce response time to customers' expectations (Davood Naghi Beiranvand, 2021). Meanwhile reliability is described as the proper deliver of the promised product and services which includes the deliverance of the product, service quality and ensure

safe delivery to customer (Davood Naghi Beiranvand, 2021). Performance measures also in this study also mention on the standardization and simplification of activities in which standardization is the process of creating and enforcing standards in PSSC which aims at improving consistency, safety and quality of processes and product or services (Davood Naghi Beiranvand, 2021). On the other hand, simplification refers to methods that are used in simplest for to implement supply chain activities. Lastly, this study will look into performance measures under the growth and innovation factor that has been viewed under the PSSC. For the growth performance, organizations' provide valuable chain of human resource policies and actions (employee training, productivity increase, focusing on skilled & capable employees) to improve supply chain performance (Davood Naghi Beiranvand, 2021). Also, to ensure that innovation possible and successful, it was stated that participation of supply chain member, top managers' commitment and use of multifunctional team are a requirement (Davood Naghi Beiranvand, 2021). The indicators mention were critical for deep understanding of supply chain performance or specifically, the PSSC.

2.5 Factors Affecting Organizations' Supply Chain Performance

Factors of reliability and user behaviour towards IoT system was formed for this research by going through various past researches. From the past researches, factor of reliability or the sub-factor of reliability were decided to be discussed further for this study is security and sensitivity. This is due to security is still among most discussed aspects when it comes to implementation of IoT. In addition, security concern are consistently identified as one of the top five issues by senior-level IT (Information Technology) managers. (Rick Sturm, 2017). Next, sensitivity of IoT system will be discussed due to the vigorous activity that are happening in supply chain. From loading, transporting, unloading and advance technology are implemented to keep track of this large-scale activity. Thus, discussing sensitivity of IoT system in this study could enable the researcher to gain more insights on this sub-factor. Furthermore, for factor user behaviour, expertise was determine as one of the sub-factor due to past articles and issues that mention the importance of expert within the organization (ManavalanE.JayakrishnaK., 2019). When an individual with supply chain knowledge know how to leverage IoT, this will impact positively such as simplifying redundant activities and produce more efficient supply chain processes within the organization (ManavalanE.JayakrishnaK., 2019). Lastly, second sub-factor of user behaviour that will be discussed is engagement. This is due an engaged employees are one of the most valuable asset

a company can have (Shyamal, 2022). This means that engagement is critical factor that will affect the outcome such as the supply chain performance.

2.5 Reliability of IoT System

2.5.1 Security

IoT are often associated with security concern due to various layers of network that are not equipped with proper protection. For the organization's security concern, as IoT objects communicate through wireless technologies and are integrated in the company's system, the attacker or hacker that able to get through the protected company's system may gain a very easy access to the network (Zamfiroiu Alin, 2020). On top of that, as the number of IoT device increase due to its popularity and also in consideration of its real advantages, the average number of connected objects in IoT network is also growing (Zamfiroiu Alin, 2020). The possibilities of vulnerabilities to occur within IoT also in risk of increasing and it is limited to growing number of objects in a network but the risks are also due to the diversity of the object. Under the circumstances in which attacker able to gain control over one node in the same IoT environment, he or she can carry out malicious activities on or towards other devices or on the organizations' system (Zamfiroiu Alin, 2020).

Companies also need to address its users' inadequate security knowledge, digital securities awareness culture considering social engineering remains as one of the most common cyber-attacks (Zamfiroiu Alin, 2020). Users can easily compromise the IoT environment by connecting with unsecure device or connecting a device from the environment to unsecure networks (Zamfiroiu Alin, 2020). These proved that the security issues of IoT system certainly come from both user and organizations which result into questioning of reliability of IoT system.

2.5.2 Sensitivity

Within the IoT system, there are device, network, solutions and many more that work together, which builds the IoT system. Under the context of device reliability, sensitivity of a device affect the processing of data. Variance useful life of IoT devices recorded according to their environment as IoT devices may be placed in remote and distant locations.

Often times, the IoT devices will be subjected to various harsh environmental conditions such as heat, freezing temperatures, vibration, mechanical wear as such (Samuel J. Moore, 2020). Therefore, useful life of devices must be determine as the useful life will be reduced if employed in challenging environment which affect the sensors and devices capability to capture and send data (Samuel J. Moore, 2020). This lowers the sensitivity of the devices to encoded and capture data. In addition, device reliability commonly subject to tendency of being "fail-dirty" (Samuel J. Moore, 2020). This describe the sensors which continue to send erroneous readings after suffer from failure. This is also hard to detect as the devices appear and operate normally. This is critical as false reading could affect supply chain performance affect inventory management in term of inventory count and inventory flow which could cause bottlenecks within the supply chain (Eltringham, 2022).

In supply chain, mobility are significant as it was key expectations of an IoT network in which users of the network are able to move in between applications while the device attached on the cargo or good, and identification are happening in the background (Samuel J. Moore, 2020). However, it is difficult to perform global addressing, due to manufacturers does not co-ordinate to make available of globally unique identifiers for all IoT devices (Samuel J. Moore, 2020). Therefore, the responsibility to assign unique identification is within the IoT network itself. In consideration that IoT devices are to be mobile, issue arises as the device ID might change or differ across different networks, which indicates the high risk of losing traceability of the device (Samuel J. Moore, 2020). Thus this result in reliability issue and concern during tracking or auditing the devices moves from one applications to another (Samuel J. Moore, 2020).

In the application layer, studies that observes the effect of anomalous data on the classification in the IoT application of the human activity recognition and had established that some classifiers are more vulnerable to errors compared to others (Samuel J. Moore, 2020). Also, the way of preparing the data is one of the factors that result in application more prone and vulnerable to failure (Samuel J. Moore, 2020).

2.6 User Behaviour of IoT System

2.6.1 Engagement

Engagement of employees are influenced heavily by commitment and communication across all stages of business activities regardless new employees or the existing ones (Robbins, 2019). Since the connectivity of devices and the automation of process decreases human-to-human interaction, communications are the key to manage all dimensions of engagement of the participating actors within the IoT ecosystem (Soltani, 2021). Communications are described by authors as basis for managing behaviour of actors (Robbins, 2019) and enable the sharing of feelings and it prompts and facilitate the decision making activities due to the exchange of information (Soltani, 2021). Another aspect of employee engagement is commitment in which it is defined as readiness to continue a course of action (Soltani, 2021)and it consist of social and cost components as well as emotional components (Soltani, 2021).

Under IoT umbrella, value of commitment is valued as monetary or nonmonetary (Soltani, 2021). One of support system provided within the IoT context, would be training and development programs for either internal (employees, managers etc. at the business and organization level) or external actors (ecosystem level) of the IoT ecosystem (Soltani, 2021). The training provided could be to train employee with new skills which enable the firm to become analytically rigorous and data-driven (Soltani, 2021).

Besides, involvement also play a major role in encouraging engagement in which an author perceived involvement as individual's perceived significance of an object based on intrinsic requirements, interests and values (Soltani, 2021). The degree of involvement are based on role of employees within the organizations. Smaller role in the organization will feel a lower involvement compared to employees with bigger roles (Soltani, 2021). Employees in an IoT firm should have a higher degree of involvement compared to client (Soltani, 2021) as research proven that highly engaged employees are every organizations' critical asset (Soltani, 2021). On top of that, highly engaged employees will have a positive effect on encouraging customer engagement (Soltani, 2021).

2.6.2 Expertise

In a paper discussing about IoT adoption challenges, (Abubaker Haddud, 2017) stated that knowledge about IoT is still limited to only professionals and academics in general. Under the food supply chain (FSC) context, adequate knowledge of emerging IoT technology is one of the notable factor that lead to difficulty adopting IoT into FSC. Also, IoT technology is still at infancy or early-stage development and organization may not have clear vision of potential benefits that they can gain. (De Vass, T., Shee, H. and Miah, S, 2018) had reported that in her research, current IoT applications are still at infancy stage compared to their broader impact in the organizational perception. The infancy factor may be the barrier that some organization face that hinder the adoption of IoT into the organizations.

However technical IoT skills or expertise is still a key challenge in consideration that IoT is an emerging state technology (Abubaker Haddud, 2017). Such as, there is adoption of IoT into the unfamiliar dimension of supply chain such as FSC, will have a high reliance on its user's technical knowledge. Thus, (Aamer, 2021) stated that one of the obstacles that ensure successful IoT implementation in agricultural FSC is the lack of skilled personal expertise to operate the technology. Also, other than success consideration, inadequate technical knowledge also is the contributing factor that prevent some companies from absorbing IoT into their organizations (Abubaker Haddud, 2017).

Although, inadequate knowledge and expertise are among user behaviour of IoT system affect organization's supply chain, knowledge management using IoT also assist organizations. Among the benefits of incorporating IoT in the knowledge management are IoT enable a user to collect data from diverse products, company assets or the operating environment. This enable new generation of better information and analysis which can significantly improve decision-making (Lorna Uden, 2017).

Next, when products that are embedded with sensors, companies are able to track the movements of these product and able to monitor interaction with the products. Companies also can take advantage of customer's behavioural data to execute appropriate decisions (Lorna Uden, 2017). In addition, data from large number of sensors which are deployed in infrastructure can give decision makers amplified

awareness on real-time events, particularly when the sensors are used with advance display or visualization technologies (Lorna Uden, 2017).

Furthermore, IoT can support longer-range and more complex human planning and decision making (Lorna Uden, 2017). On top of that, IoT can raise productivity because assist systems to adjust automatically to complex situations, which result in human intervention not required (Lorna Uden, 2017). Lastly, IoT enable rapid, realtime sensing of unpredictable conditions and ensure instantaneous responses that are guided by an automated systems (Lorna Uden, 2017)

2.7 Definition of Terms

Terms	Definition	Reference
Reliability	Conceptual: According to research paper, reliability is defined as performance of a system or product over a specific windows of time	(Samuel J. Moore, 2020)
User Behavior	Conceptual: User behaviour is defined as the set of actions taken by user interacting with the system in order to reach a goal or complete a task. Although each user is unique and have particular background and other general characteristics, researcher should learn on user's goals in using the system, specific tasks that was done in order to achieve some goals and the users' experience and skills at using a certain kind of system	(What is User Behaviour, 2022)

Internet of Things	Conceptual: IoT is defined as a global infrastructure for the information society, enabling advanced services by interconnecting the physical and virtual of things based on existing and evolving interoperable information and communication technologies.	(Kiran, 2019)
Supply Chain Performance	Conceptual: Supply chain performance is defined as the extended supply chain's activities in meeting end-customer requirements, including product availability, on-time delivery, and all the necessary inventory and capacity in the supply chain to deliver that performance in a responsive manner.	(Supply Chain Performance Measures, n.d.)
Security	Conceptual: Security in the context of IoT defined as cyber-security strategy and protection mechanism that safeguard against possibility of cyber-attacks which specifically target physical IoT devices that are connected to the network.	(Networks, 2023)
Sensitivity	Conceptual: Sensitivity of a sensor is how much the response of the output after a small fractional challenges in the input. A sensor is a device within the IoT system that detects some kind of inputs such as motion, pressure, light, or any environmental phenomena.	(Hayder Natiq, 2019)

Expertise	Conceptual: IoT skills are proficiencies or understanding regarding the IoT system. This is to ensure the sensory devices offer accurate data, professionals in this field typically require a high degree of technical knowledge.	(Team I. E., 2022)
Engagement	Conceptual: Employee engagement is defined as level of enthusiasm and dedication a worker feel towards their job.	(Smith, 2022)

2.8 Proposed Research Framework

In this research, the proposed framework is as shown in Figure 1.1. The first part is the independent variable which comprises the reliability and user behaviour of IoT system. The first part is the independent variable, which is the reliability and user behaviour towards IoT system. Under the reliability, there are two sub-factors, security and sensitivity. The two sub-factors under reliability of IoT system will be discussed from reliability point of view. This means that security and sensitivity will be discussed in this research but it will be referred to as measurement for reliability of IoT system. For user behaviour towards IoT system, there are also another two sub-factors which are engagement and expertise. This indicate that engagement and expertise as the measurement of user behaviour towards IoT system that will be studied in this research. In addition, further discussion of expertise and engagement will be discussed from the point of view of user behaviour towards IoT system.

The second part is dependent variable, which is an organization's supply chain performance. Both of this factor will be discussed under user behaviour point of view. The proposed research framework is modified from research framework that develop an IoT based agricultural supply chain performance (ASC) performance using qualitative and quantitative method (SCOR modelling and Shannon entropy-fuzzy TOPSIS method). This proposed

framework focuses are using quantitative method to find the relationship between reliability and user behaviour towards IoT system with organizations' supply chain performance.

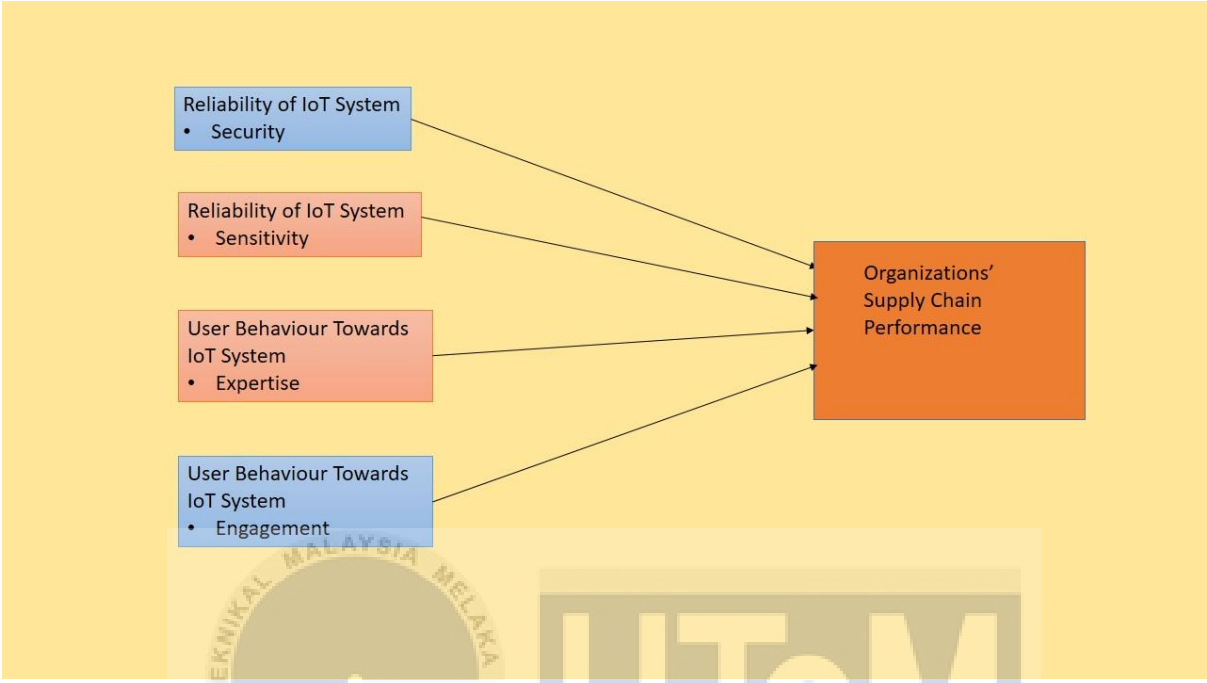

Figure 2.1 Proposed Conceptual Research Framework

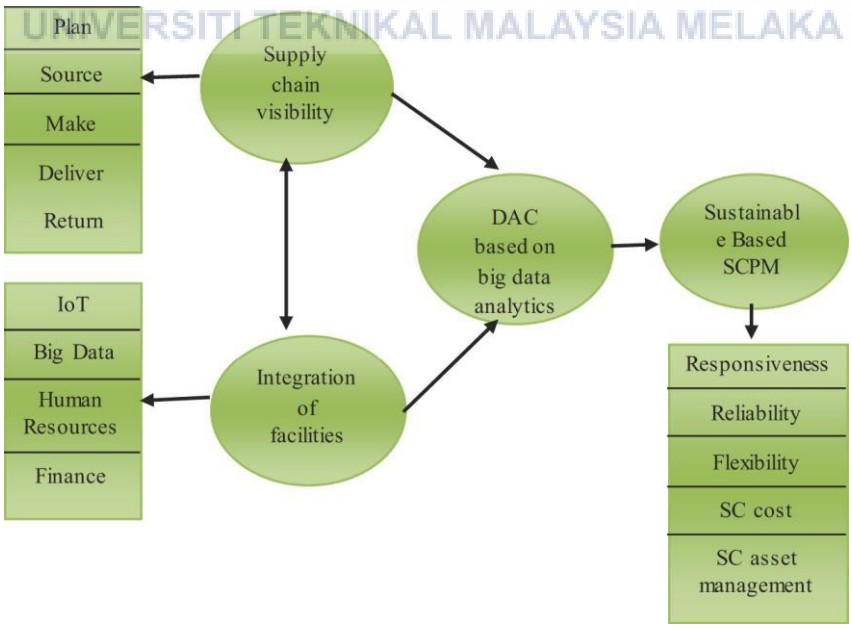

Figure 2.2 Original Research Framework

2.9 Research Hypothesis

i. Reliability Of IoT System (Security)

H0: There is no significant relationship between reliability of IoT system (security) and organizations' supply chain performance.

H1: There is a significant relationship between reliability of IoT system (security) and organizations' supply chain performance.

ii. Reliability of IoT System (Sensitivity)

H0: There is no significant relationship between reliability of IoT system (sensitivity) and organizations' supply chain performance.

H1: There is a significant relationship between reliability of IoT system (sensitivity) and organizations' supply chain performance.

iii. User Behaviour Towards IoT System (Expertise)

H0: There is no significant relationship between user behaviour towards IoT system (expertise) and organizations' supply chain performance.

H1: There is a significant relationship between user behaviour towards IoT system (expertise) and organizations' supply chain performance.

iv. User Behaviour Towards IoT System (Engagement)

H0: There is no significant relationship user behaviour towards IoT system (engagement) and organizations' supply chain performance.

H1: There is a significant relationship between user behaviour towards IoT system (engagement) and organizations' supply chain performance.

2.10 Conclusion

In this chapter, the reliability and user behaviour toward IoT system, concept of IoT in general and concept of IoT in supply chain have been discussed. The proposed research framework that consists of dependent variable (organizations' supply chain performance) and independent variable (reliability and user behaviour towards IoT system) also discussed. The factors of reliability for this study is security and sensitivity. Meanwhile, the factor of user behaviour towards IoT system are engagement and expertise. This chapter also include the conceptual definition of terms. Lastly, the following chapter will discuss and describe about research methodology that is used in this study.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

This chapter will discusses the methodologies used to collect the data and information for this research. The section of this chapter will begin with explanatory research design to explain and describe the relation between the variables. Quantitative method is utilizes in methodological choice. The type of data acquired for this study is primary and secondary data. The following sections in this chapter will discusses further on the research location, research strategy, time horizon, reliability and validity of the data analysis method. The research will be carried out according to these research methodology procedure to ensure it can be better understood and evaluated.

3.2 Research Design

The nature of this research is explanatory in which it is a research method that explores the reason on why something occurs when limited information is available. The subject of reliability and user behaviour has been studied but there is small number of researchers that discusses the topic indirectly. This method could increase the researchers understanding on the topic. Explanatory are termed as "cause and effect" model that investigate patterns and trends that are shown in existing data that has not been studied.

3.3 Methodological Choices

This research will be done using the quantitative study in order to examine the relationship between variables stated in the research. The study will be conducted quantitatively as the methods are highlighting objective measurements and the statistical, mathematical or numerical analysis of data collected through questionnaire, surveys and polls as well as by utilizing the pre-existing statistical data using computational techniques. It is common that quantitative research associated with deductive approach, in which it focuses on utilizing data to test the theory. This method speculates theory that is properly formed by relating them back to general principles and definitions through sets of observable data (Huygens, 1629). Then, the researcher will reconfirm the radical relationship exists or not as the relationship has been established. This research will be conducted quantitatively as the research want to determine the relationship between the independent variable (reliability and user behaviour toward IoT system) and the dependent variable (organizations' supply chain performance).

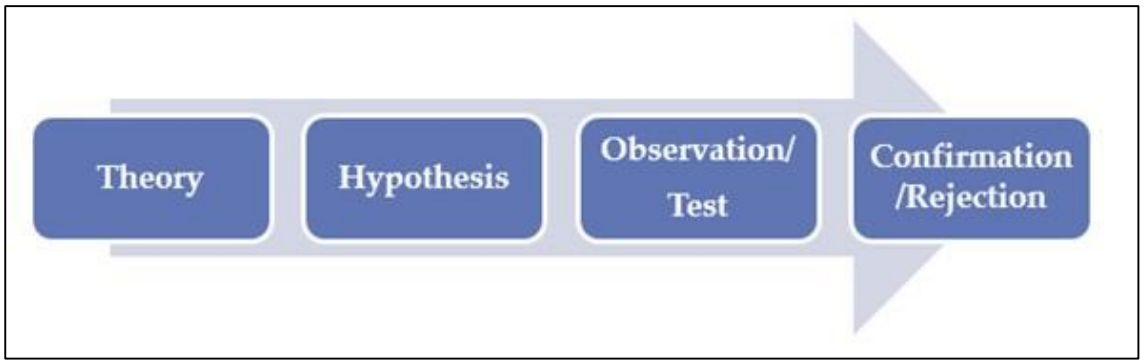

Figure 3.1: Deductive Approach by Huygens in 1629

3.4 Primary and Secondary Data Sources

The primary and secondary data will be acquired and to be applied in this research in order to further carry out this research. For primary data, data will be collected by the researcher through surveys, questionnaire and interviews for the research problems that is being studied in this case.

As for secondary data, data that have been obtained by market research agencies and other organization and individuals which is available to the public, will be utilized in the research. This is due to using secondary data save time and effort as the process to collect secondary data is much easier than process to collect primary data. Secondary data are to be gathered from website and library database by selecting appropriate journals, articles, reports, as the data sources to be utilized as references for this research.

3.5 Research Location

This study will be conducted at selected organizations located at Ayer Keroh, Melaka. This is because the selected organizations are organizations that utilize IoT system to manage its supply chain. The target respondent are the employees of the organizations. The age of the respondents are between 18 years old and above whom are appropriate to work in a supply chain operated company that utilize IoT system and have been educated about using the IoT system.

3.6 Research Strategy

Research strategy for this study is to conduct survey through questionnaire towards selected organization. The survey strategy is selected in this research as it was easier to perform data comparison from a sizeable population using questionnaire in survey strategy. In addition, researcher also will select archival or documentary research strategy since these sources are able to be sourced online.

3.6.1 Questionnaire Design

For this research, researcher will conduct the questionnaire through internet (online Google Form) where the respondents able to use web or smartphone to gain access to the questionnaire to answer the question. The questionnaire contains three part. The first part is the demographics of the respondent which includes age, gender, educational level, occupation and on their working experience to assess their experience with IoT system. The second part will be focusing on the independent variables: Reliability (security, sensitivity) and user behaviour (engagement, expertise). The last part of the questionnaire will be questioning about the dependent variable which is the organization's supply chain performance.

Likert scale will be apply in the questionnaire to measure the responses by the respondents. According to Dr. Saul McLeod, "Likert scale is a five (or seven) point scale which is used to allow the individual to express how much they agree or disagree with a particular statement". Likert scale are to be utilized in this research as it assumes the strength or intensity of an attitude is linear on a continuum from strongly agree to strongly disagree and makes the assumption that attitudes can be measured. Likert scale is applied in second part and third part of the questionnaire and are based on five points rating scale in which 1 represented "strongly disagree", 2 represented "disagree", 3 represented "neutral", 4 represented "agree" and 5 represent "strongly agree".

Table 3.1: Five points rating scale by Rensis Likert in 1932

Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

3.6.2 Sampling Design

In this research, convenience sampling will be used. The convenience sampling is a method adopted by researchers that enable researchers to gather their data from conveniently available pool of respondents (Convenience Sampling: Definition, Advantages and Examples, 2022). It is one of the most common sampling technique used as is an expensive methodology, much easier to conduct research and, and able to collect data quickly (Convenience Sampling: Definition, Advantages and Examples, 2022).

Population of one of the organization is 50 employees in which its operations focused on logistical and supply chain activity. The number of employees is referred from one of the Job Street website (SEEK, n.d.). Another organization studied in this research has about 50 amount of employees based on the Glassdoor website which it sensing module uses IoT for data collection (glassdoor, n.d.). Also, the amount of population are further strengthen from websites that list down the population of employees within the company. Thus accumulated sample amount for respondents in this research is about 80 respondents. The determined total was based on Krejcie and Morgan (1970) that develop the sample size based on the population size of the company.

Table 3.2: Determining sample size of a known population

Source: Krejcie and Morgan (1970)

Population Size (N)	Sample Size (S)
100	80
200	132
300	169
400	196
500	217
600	234
700	248
800	260
900	269

1000	278
2000	322
3000	341
4000	351
5000	357
6000	361
7000	364
8000	367
9000	368
10 000	370
15 000	375
20 000	377
30 000	379
40 000	380
50 000	381
75 000	382
1 000 000	384

3.6.3 Pilot Test

Pilot test will be conducted for this research on members of target population to evaluate the reliability prior to their final distribution. According to Matt Wright & Nick So, it is a rehearsal for my research study that in which it allow researchers to test their research approach with a small number of test participant before the main study is launched. It is important that the research are critiqued, test, and iteratively improve the research design before the execution phase (So, 2022).

3.7 Time Horizons

This study is categorized as cross-sectional studies as the data that are gathered for this research are only once which take about 3 to 4weeks to conduct. The cross-sectional studies are chosen due to limited amount of time to complete this research. The research are done in a total of ten months which includes the development of Chapter 1 to Chapter 5 within ten months. There is only one month of time period to conduct the data collection and analysis.

3.8 Reliability and Validity

Reliability and validity of this research will be measure using Cronbach's Alpha to measure the reliability of the variables. The range in alpha coefficient is between 0 and 1. According to Cronbach's Alpha, when the values shows more than 0.7 is considered acceptance, more than 0.9 is considered good, and equal or more than 0.9 result is considered good, and equal or more than 0.9 is considered excellent. Meanwhile, if the value of Cronbach's Alpha displayed less than 0.6, it is considered poor which indicate not-reliable. Value 0.5 and below is considered unacceptable that shows inaccurateness on the data when the value result in a negative number.

Table 3.3: Cronbach's Alpha Coefficient Range and Strength of Association

Sources: Saunders et al., (2016)

Cronbach's Alpha Coefficient Range	Strength of Association
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

3.9 Data Analysis Method

Once the data are obtained from the questionnaires, Statistical Package of Social Sciences (SPSS) will be utilized to analyse the data collected from the respondents. For this part of the research, descriptive analysis, Pearson's correlation analysis and multiple regression analysis will be used to analyse data used in this research.

3.9.1 Descriptive Analysis

Descriptive analysis refers to the use of numerical description and comparison of variables that target on the central tendency and dispersion (Saunders, 2016). The general method to measure descriptive static are to measure the means, medians, modes and standard deviation. For this research paper, descriptive analysis will be utilize to analyse the gender, age, occupation and educational level among the respondents. Then, once the raw data are done analysed and turned into information in order to ensure better understanding of the data.

3.9.2 Pearson's Correlation Analysis

In order to compute linear relations intensity between the dependent variable (organizations' supply chain performance) and independent variables (reliability and user behaviour), Pearson's Correlation analysis will be used. Pearson's correlation coefficient is between -1 to +1 represent perfect negative and perfect positive correlations. Thus, the value of 0 will indicate no association correlation.

Correlation Coefficient Value (r)	Direction and Strength of Correlation
-1	Perfectly negative
-0.8	Strongly negative
-0.5	Moderately negative
-0.2	Weakly negative
0	No association
0.2	Weakly positive
0.5	Moderately positive
0.8	Strongly positive
1	Perfectly positive

Figure 3.2 Value of correlation coefficient

Sources: (Saunders, 2016)

3.9.3 Multiple Regression Analysis (MRA)

The MRA also will be used in this study as the research objective is to determine whether the relationship between two variables (reliability & user behaviour) depends on the value of third variable (organization's supply chain performance). Multiple regression analysis is a statistical tool that enable the researcher to assess the strength of the cause and effect relationship between two independent variables and one dependent variable (Saunders, 2016). In this research, the researcher will need to understand the relationship between the independent variable (reliability and user behaviour) toward the dependent variable (organizations' supply chain performance). The multiple regression analysis will be able to assist the researcher to determine the independent variable that has the greatest impact on the dependent variable. The following is the equation of multiple regression analysis:

Equation of MRA: $Y = a + bX1 + cX2$

Where:

Y = Dependent Variable (Consumer Behaviour)

a = Constant value or Intercept b = Influence of

X1 (IMC tools) c = Influence of X2 (types of

media)

X1, X2 = Independent variables

3.10 Conclusion

Conclusively, this explanatory research is require the researcher to conduct survey questionnaire to a total of 300 respondent from organizations in Melaka. The respondents are required to answer the questionnaire through Google Form. This research is using cross-sectional time studies, in which the data are collected only once. Before the survey questionnaire is launched, pilot test will be conducted to test and improve the research. Besides, secondary data are referred for this study, in which it includes online journal, articles, reports and books. In order to measure the reliability of the variables, Cronbach's Alpha is utilized. Once the data are obtained, the data will be analysed using descriptive analysis, SPSS (Statistical Package of Social Sciences) Pearson's correlation analysis, and multiple regression analysis. The data that has been analysed and discussed will be discussed in Chapter 4.

CHAPTER 4 FINDINGS

4.0 Introduction

This chapter will be discussing the findings for this research based on the analysis of data collection from the supply chain industry. This chapter will begin with the discussion of the respondents' demographic characteristics that will be presented in the form of frequency and percentage. The second section of this chapter will include the data reliability analysis. Then, the third section of this chapter will be presenting output from SPSS for Pearson Correlation Analysis and Multiple Regression which will used to test the research hypotheses stated in this research. Lastly, this chapter will be concluded with short conclusion.

4.1 Reliability Analysis (Pilot Test)

Table below shows the reliability result of the study. Based on the table below, Cronbach's Alpha value for dependent variable (organizations' supply chain performance) and independent variables (reliability and user behaviour towards IoT system) overall is 0.928. Thus, based on the reliability presented in the form of Cronbach's alpha, 0.928 is considered acceptable for the study.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based On Standardized Items	N of Items
.928	.940	24

Table 4.1: Reliability Statistic

(Source: SPSS Output)

4.2 Descriptive Statistics Analysis

4.2.1 Respondent Demographic Profile

The respondents' demographic characteristic in this study include gender, age, race, status, education qualification, current job position and duration of working experience in their current organizations. This study analysed a total of 122 sets of questionnaires that are distributed in the form of Google Form to multiple organizations. The table below shows the summarization of demographic profiles of the respondents. According to the data that had been collected, majority of the respondents were female, which accounted for 62 respondents, and the percentage is 50.8%. Age range of most of the respondent are 18-30 years old which represents 46 respondents (37.7%). The lowest age range that responded to the online questionnaire were those who aged 51-60 which accounted for only 9 respondents (7.4%). Next, for race, the highest number of respondents in this study were Malay (49.2%), meanwhile for status of the respondents, most are married which consists of 69 respondents (43.4%) while the rest of 53 respondent remained unmarried (43.4%). Most of the respondents possessed degree (46.7%) for the education qualification and the minimum education qualification that respondents obtained was SPM/O-Level which accounts for 5.7 % of the respondents. Majority of the respondent current job position were within the operation (32.8%). Lastly, most of the respondents had working experience in current organization of 5-7 years (36.1%) which is an intermediate length of working experience.

Variables	Items	Frequency	Percentage
Gender	Male	60	49.2
	Female	62	50.8
Age	18-30	46	37.7
	31-40	40	32.8
	41-50	27	22.1

	51-60	9	7.4
Race	Malay	60	49.2
	Chinese	42	34.4
	India	15	12.3
	Dusun	1	0.8
	Iban	2	1.6
	Kayan	1	0.8
	Kenyah	1	0.8
Status	Single	53	43.4
	Married	69	56.6
Education Qualification	SPM/O-Level	7	5.7
	STPM/A-Level	16	13.1
	Certificate/Diploma	19	15.6
	Degree	57	46.7
	Postgraduate	23	18.9
Current job position	Finance	19	15.6
	Operations	40	32.8
	Human Resource	29	23.8
	Manufacturing	29	23.8

	Deliveryman	1	0.8
	Engineering	1	0.8
	Research Assistant	1	0.8
	Senior IT Technician	1	0.8
	Supervisor	1	0.8
Duration of Working Experience in Current Organization	0-2	10	8.2
	3-5	20	16.4
	5-7	44	36.1
	8-10	30	24.6
	10>	18	14.8

Table 4.2: Summarized Demographic Profile of Respondent

(Source: SSPS Output)

Items of Reliability of IoT System-Security

	N	Minimum	Maximum	Mean	Standard Deviation
1. The quality of monitoring, real time responsiveness and theft reduction is guaranteed by the high security within the IoT system	122	3	5	3.93	0.658

2. The sources of the vulnerabilities is eliminated by effective layers of security.	122	3	5	3.89	0.645
3. The low security level is causing loss of privacy, trust, confidentiality and availability risk.	122	3	5	4.03	0.703
4. Effective layers of security is necessary to be implemented to avoid malicious and unintentional security incidents.	122	3	5	3.94	0.719
Valid N (listwise)	122				

Table 4.3: Descriptive Analysis for Reliability of IoT system (Security)

(Source: SSPS Output)

From the table above, the findings reveal that the maximum mean of reliability of IoT system was (M=4.03) on the items “The low security level is causing loss of privacy, trust, confidentiality and availability risk.” The standard deviation value is 0.703. Meanwhile, the lowest mean value (M=3.89) on the item “The sources of the vulnerabilities is eliminated by effective layers of security.” and the standard deviation is 0.645. The minimum rating scale for this factor is 3 for which accounted for all item and the maximum rating scale is 5 which also accounted for every item.

Items of Reliability of IoT System-Sensitivity

	N	Minimum	Maximum	Mean	Standard Deviation
1. The compatibility among sensors, networks and applications from different technology and vendors reflect high level of sensitivity.	122	3	5	3.94	0.672
2. There are no major technical and technological integration issues within IoT system indicate a good level of sensitivity.	122	1	5	3.92	0.699
3. System sensitivity are affected by global standard of IoT communication protocol for smart objects and systems.	122	3	5	3.91	0.668
4. It is important to ensure the IoT devices and system works effectively by establishing effective IoT architecture.	122	3	5	4.02	0.771
Valid N (listwise)	122				

Table 4.4: Descriptive Analysis for Reliability of IoT system (Sensitivity)

(Source: SSPS Output)

From the table above, the finding reveal that the maximum mean of reliability of IoT system-sensitivity was (M=4.02) on the item “It is important to ensure the IoT devices and system works effectively by establishing effective IoT architecture.” and the standard deviation is 0.771. Meanwhile, the lowest mean value is (M=3.91) on item “System sensitivity are affected by global standard of IoT communication protocol for smart objects and systems.” and the standard deviation is 0.668. The minimum rating scale for each item is 1 and the maximum rating scale is 5.

Items of User Behaviour towards IoT System-Expertise

	N	Minimum	Maximum	Mean	Standard Deviation
1. Obtaining the needed supporting staff with right skills is posing challenges to synchronize IoT knowledge within the organizations.	122	3	5	4.11	0.666
2. The employees need to have adequate knowledge of emerging IoT technologies and IoT system.	122	3	5	4.03	0.738
3. Organization is ensuring employees have the chance to use the skills they had obtain about IoT system and applications.	122	3	5	4.04	0.685

4. The technical IoT skills is significant skills for employees to possess.	122	2	5	3.98	0.766
Valid N (listwise)	122				

Table 4.5: Descriptive Analysis for User Behaviour towards IoT system (Expertise)

(Source: SSPS Output)

From the table above, the finding reveal that the maximum mean of user behaviour towards IoT system-expertise is (M=4.11) on the item "Obtaining the needed supporting staff with right skills is posing challenges to synchronize IoT knowledge within the organizations." and the standard deviation is 0.666. Meanwhile, the lowest mean value is (M=3.98) on item "The technical IoT skills is significant skills for employees to possess." and the standard deviation is 0.766. The minimum rating scale for each item was 2 and the maximum rating scale is 5.

Item of User Behaviour towards IoT System-Engagement

	N	Minimum	Maximum	Mean	Standard Deviation
1. Employee adoption of new technology and practices contribute to IoT successful implementation.	122	3	5	4.06	0.722
2. Higher availability of financial resources to support implementation and maintenance of IoT system result in an increase of employees' engagement.	122	3	5	4.00	0.739

3. Clear comprehension about IoT benefits ensure better employees adaptation towards IoT system.	122	3	5	4.11	0.741
4. The IoT devices interact and communicate with each other to perform various tasks promotes employees' engagement as human effort is minimized.	122	3	5	4.13	0.727
Valid N (listwise)	122				

Table 4.6: Descriptive Analysis for User Behavior towards IoT system (Engagement)

From the table above, the finding reveal that the maximum mean of user behavior towards IoT system- engagement is (M=4.13) on the item "The IoT devices interact and communicate with each other to perform various tasks promotes employees' engagement as human effort is minimized." and the standard deviation value is 0.727. Meanwhile, the lowest mean value is (M=4.00) on the item "Higher availability of financial resources to support implementation and maintenance of IoT system result in an increase of employees' engagement." and the standard deviation is 0.739. The minimum rating scale for each item is 3 and the maximum rating scale is 5.

Item of Organizations' Supply Chain Performance

	N	Minimum	Maximum	Mean	Standard Deviation
1. The delivery reliability in supply chain is ensuring an efficient processes.	122	3	5	4.05	0.628
2. Responsiveness of supply chain system using IoT is one of the significant attribute that affect supply chain performance.	122	3	5	3.92	0.756
3. Flexibility of the supply chain using IoT is important as one of organizations' competitive advantage.	122	3	5	3.97	0.655
4. The cost and asset management efficiency within supply chain of organizations are better managed with IoT system.	122	2	5	4.18	0.716
Valid N (listwise)	122				

Table 4.7: Descriptive Analysis for Organizations' Supply Chain Performance

From the table above, the findings reveal that the maximum value of organizations' supply chain performance is (M=4.18) on the item "The cost and asset management efficiency within supply chain of organizations are better managed with IoT system." and the standard deviation 0.716. Meanwhile, the lowest mean value is (M=3.92) is on item "Responsiveness of supply chain system using IoT is one of the significant attribute that affect supply chain performance." and the standard deviation is 0.756. The minimum rating scale for each item is 2 and the maximum rating scale is 5.

4.3 Inferential Analysis

In order to identify the relationship between reliability and user behaviour towards IoT system as independent variable and organizations' supply chain performance as dependent variable, Pearson Correlation Analysis and Multiple Regression Analysis was used in this study. Pearson Correlation analysis was used due to measure how well the two variables related and whether a change in one variable is associated with a change in another variable. Meanwhile, multiple regression was utilized to determine the dominant factor that affect organizations' supply chain performance.

Coefficient Range	Description of Strength
±0.81 to ±1.00	Very Strong
±0.61 to ±0.80	Strong
±0.41 to ±0.60	Moderate
±0.21 to ±0.40	Weak
±0.00 to ±0.20	Weak to no relationship

Table 4.8: Strength of the Correlation Coefficient (Hair et al., 2010)

The independent and dependent variable use in this study are as follow:

a) Independent Variables: Reliability of IoT System, User Behaviour Towards IoT System
b) Dependent Variable: Organizations' Supply Chain Performance.

4.3.1 Pearson Correlation Analysis

RSEC: Reliability Security

RSEN: Mean Reliability Sensitivity

UBEXP: Mean Reliability Expertise

UBENG: Mean Reliability Engagement

ORGSCPM: Mean Organization Supply Chain Performance

		ORGSCPM	
RSEC	Pearson Correlation Sig.(2-tailed) N	.564** .000 122	There is a significant, moderate, positive relationship between reliability of IoT system (security) with organizations' supply chain performance, such that as the security level of IoT system increases, the organizations' supply chain performance also improve, r(56) = 0.56, p<0.01. This suggests that increasing security level would lead to improved supply chain performance.
RSEN	Pearson Correlation Sig.(2-tailed) N	.311** .001 122	There is a significant, weak, positive relationship between reliability of IoT system (sensitivity) with organizations' supply chain performance, such that as sensitivity level of IoT system increases, the organizations' supply chain performance also improve, r(31) =

			0.31, p<0.01. This suggests that increasing sensitivity level of IoT system would lead to an increase in supply chain performance.
UBEXP	Pearson Correlation Sig.(2-tailed) N	.406** .000 122	There is a significant, moderate, positive relationship between user behaviour towards IoT system (expertise) and organization's supply chain performance, r (41), =0.4, p<0.01. Hence, this illustrates that increase in user behaviour towards IoT system (expertise), will lead to an increase in organizations' supply chain performance.
UBENG	Pearson Correlation Sig.(2-tailed) N	.433** .000 122	The r value shows moderate, positive relationship with organizations' supply chain performance, r (43), p<0.01. Thus, this shows that an increase in user behaviour towards IoT system (engagement) will result in an increase in organizations' supply chain performance.

**Correlation is significant at the 0.01 level (2-tailed)

Table 4.9: Result of Correlation Analysis for All Variable

4.4 Multiple Regression Analysis

Model Summary

Model	R	R Square	Adjusted R Square	Std.Error of Estimate
1	.629[a]	.395	.374	.34315

a) Predictors: (Constant), User Behaviour-Engagement, Reliability-Sensitivity, Reliability-Security, User Behaviour-Expertise
b) Dependent Variable: Organization Supply Chain Performance

Table 4.10 Model Summary

Source: (SPSS Data Output)

According to the table above, the R value is 0.629, which indicate that the independent variable (reliability-security, reliability-sensitivity, user behaviour-expertise, user behaviour-engagement) were relevant to be associated with organizations' supply chain performance to meet the study's goals. Furthermore, the R square value is 0.395, which imply that overall variation to achieve that objectives with organizations' supply chain performance is 39.5 percent. There is a total 60.5% of respondents that were not affected.

Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig
	B	Std.Error	Beta		
1 (Constant)	.713	.413		1.728	.087
Reliability-Security	.425	.085	.424	5.023	.000
Reliability-Sensitivity	.136	.086	.125	1.588	.115
User Behavior-Expertise	.086	.089	.084	.967	.335
User Behavior-Engagement	.185	.080	.192	2.297	.023

a) Dependent Variable: Organizations' Supply Chain Performance

Table 4.11 Table Coefficients

(Source: SPSS Output)

Based on the table above, the beta for reliability-security, reliability-sensitivity, user behaviour-expertise, user behaviour-engagement are 0.424, 0.125, 0.084 and 0.192 respectively. According to the beta, all variables have a positive relationship as there is no independent variable with negative sign, which indicates there were no negative relationship with organizations' supply chain performance. The constant is 0.713. Therefore the researcher formed the following equations:

Y = A + Bx1 + Bx2 + Bx3 + Bx4

Where:

Y= Dependent Variable

A= Constant from coefficients table

B = Independent Variable

x = Beta, B value

Bx1 = Reliability-Security

Bx2 = Reliability-Sensitivity

Bx3 = User Behavior-Expertise

Bx4 = User Behavior-Engagement

Organizations' supply chain performance= 0.713+ 0.425 (Reliability-Security) + 0.136 (Reliability-Sensitivity) + 0.086 (User Behaviour-Expertise) + 0.185 (User Behaviour-Engagement)

The equation illustrates that when the reliability-security increases by one unit while the other variable remain constant, the linear equation shows that the organizations' supply chain performance will grow by 0.425 units. Followed by, when the reliability-sensitivity increases by one unit while other variables remain constant, organizations' supply chain performance will grow by 0.136 units. Furthermore, when user behaviour-expertise increases by one unit and other predictor remain constant, organizations' supply chain performance will increase by 0.086. Lastly, the organizations' supply chain performance will increase 0.185 unit when user behaviour-engagement increases with the other predictors remain unchanged.

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig
1	**Regression**	8.998	4	2.249	19.104	.000[b]
	Residual	13.777	117	.118		
	Total	22.775	121			

a) Dependent Variable: Organizations' Supply Chain Performance

b) Predictors: (Constant), User Behavior-Engagement, Reliability-Sensitivity, Reliability-Security, User Behavior-Expertise

Table 4.12: ANOVA

(Source: SPSS Output)

Based on the ANOVA table, F=19.104 with p=0.000, which result in the model's fit had been confirmed. The entire regression model, which includes four constant: user behaviour-engagement, reliability-sensitivity, reliability-security, user behaviour-expertise, has done a good job on explaining factors of reliability and user behaviour towards IoT system.

According to the entire table of MRA above, it showed that the organizations' supply chain performance was tested with predictors, user behaviour (engagement), reliability (sensitivity), reliability (security) and user behaviour (expertise) using multiple regression. The overall model was significant, F= 19.104, $p<0.05$, however it only counted 62.9% variability in support for organizations' supply chain performance. Reliability-security was the strongest and sole predictor, $\beta = .42$, $t(117) = 5.02$, $p<0.05$, showing the reliability-security of IoT system affecting the organizations' supply chain performance.

4.5 Summary of Findings

The findings of this study were summarized in the table below. The findings of this study show that only two hypothesis are accepted and another two hypothesis are rejected.

Hypotheses	Result	Measure	Significance
H1	There is a significant relationship between reliability of IoT system-security and organizations' supply chain performance.	Pearson Correlation r=0.564	p=0.000 (p<0.05) (Accepted)
H2	There is no significant relationship between reliability of IoT system-sensitivity and organizations' supply chain performance.	Pearson Correlation r=0.311	p=0.115 (p<0.05) (Rejected)
H3	There is no significant relationship between user behaviour towards IoT system-expertise and organizations' supply chain performance.	Pearson Correlation r= 0.406	p=0.335 (p<0.05) (Rejected)
H4	There is a significant relationship between user behavior towards IoT system and organizations' supply chain performance.	Pearson Correlation r=0.433	p=0.023 (p<0.05) (Accepted)

Table 4.13: Summarized Hypothesis Acceptance based on Significance Value

4.6 Conclusion

The researcher utilized IBM SPSS software version 26 to accomplish the data analysis and interpretation of the data in this chapter. There are a total of 122 respondents that were analysed in this data. The association between reliability (security), reliability (sensitivity), user behaviour (expertise) and user behaviour (engagement) was found to be adequate. As a result, four hypotheses that were provided in this study were explained. In the next chapter, researcher will discuss more over the facts and have discussion on the results that were shown in this chapter.

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter will present the finding of a study on the reliability of IoT system and user behaviour towards IoT system that are affecting organizations' supply chain performance. The study purpose is to understand the usage of IoT system in organizations' supply chain. In order to achieve this aim, a literature review was written to gain understanding on the IoT system application within organizations' supply chain. Also, a survey was conducted to gather primary data from employees who utilizes IoT for their supply chain activities. First section will review the findings and reasons the findings based on past research, which will be divided into three parts according to the three research objective. This chapter also will describe the implication, recommendation, as well as contributions of this research to the knowledge and industry

RO1: To identify factor of reliability and user behaviour towards IoT system that is affecting organizations' supply chain performance.

RO2: To analyse the factors of reliability and user behaviour towards IoT system that is affecting organizations' supply chain performance.

RO3: To determine the most significant contributing factors of reliability and user behaviour towards IoT system that affect organizations' supply chain performance.

5.2 Discussion of Findings

Based on chapter 4, the findings that the researcher obtain through the online questionnaire was that those who are current job position "Operation" were the one who frequently uses IoT system within their supply chain activities. This is due to one of the important function of operation management closely relate to management of inventories through the supply chain and this operation were known as operations and supply chain management (OSCM) (Hayes, 2022). Next is that the highest education qualification that most of the respondents possess is degree level. Lastly, those who has working experience for 5-7 years in organization shows highest frequency in using IoT system among the respondent

In order to identify factor of reliability and user behaviour towards IoT system, literature review were conducted beforehand to find the sub-factor of reliability and user behaviour. Then a set of questionnaire were developed for respondents who are employees

within the organization uses IoT system for their supply chain activities. A total of 122 questionnaires distributed were analysed using the IBM SPSS Statistics Version 26.0 to calculate the statistics. Researcher used two factors with each factors divided into two sub-factors that affecting organizations' supply chain performance. The following factors that researchers wanted to focus on for this research are reliability-security, reliability-sensitivity, user behaviour (expertise) and user behaviour (engagement)

5.2.1: To identify factor of reliability and user behaviour towards IoT system that affecting organizations' supply chain performance.

The first objective of this study is to identify factor of reliability and user behaviour that is affecting organizations' supply chain performance. In previous chapter, researcher had suggested two sub-factor of reliability (security, sensitivity) and user behaviour towards IoT system (expertise, engagement). The first objective has been achieved through literature review in Chapter 2. The critical factor for this research had been proved by previous researchers. Therefore, the researcher comes out with the respective factor, reliability of IoT system (security, sensitivity) and user behaviour towards IoT system (expertise and engagement) that is affecting organizations' supply chain performance.

According to (Elham Ali Shammar, The Internet of Things (IoT): a survey of techniques, operating systems, and trends, 2020), IoT devices are typically wirelessly connected and have serious vulnerabilities due to insecure web interfaces, insufficient software protection and inadequate authorization. This made security as one of the critical sub-factor to measure reliability of IoT system. Then, sensitivity of IoT devices were measured through its ability to transmit and capture accurate data as sometimes these devices were installed in harsh conditions and this reduces its useful life and produce different and inaccurate reading under the harsh conditions (Samuel J. Moore C. D., 2020). Furthermore, for the sub-factor of user behaviour towards IoT system (expertise), lack of knowledge and complex system implementation. The lack of knowledge includes the management of IoT within the organization and the availability of experts such as data analysts (Hendrik Sebastian Birkel, 2019). Lastly, for the sub-factor of user behaviour (engagement), in which involvement plays a major aspect in driving engagement that concludes employee of an IoT firm will need to participate more than clients (Soltani, B2B engagement within an internet of things ecosystem, 2021). Previous research had proven that highly engaged employees were one of organizations' most critical asset (Soltani, B2B engagement within an internet of things ecosystem, 2021).

5.2.2: To analyze the factor of reliability and user behavior towards IoT system that is affecting organizations' supply chain performance.

The second objective can be achieved through Multiple Regression Analysis from Statistical Package for Social Sciences (SPSS) software. Based on table 4.11 in chapter 4, the p-value shows that reliability of IoT system (security) and user behaviour towards IoT system (engagement) were factors that are significant that are affecting organizations' supply chain performance. Another two sub-factors which is the reliability of IoT system (sensitivity) and user behaviour towards IoT system (expertise) were shown as not significant due to the p-value shown in table 4.11 is higher than ($p<0.05$). The significant factors, which was reliability of IoT system (security) and user behaviour towards IoT system (expertise) will be discussed in the next section. In this section, factors that are not significant will be discussed with supporting details on the outcome of the results in table 4.11.

One of the factors studied in this research that was found as not significant with its p-value = 0.115 which is higher than ($p<0.05$) is user behaviour towards IoT system (sensitivity). This was due to device sensitivity to capture and transfer accurate data had not been studied on a deeper level. Also less research is done on the sensitivity of the whole IoT system and not just focusing on devices. This made it difficult to discuss sensitivity of IoT although there was correlation with organizations' supply chain performance according to the Person's Coefficient Correlation Analysis value. Subject of sensitivity of IoT were discussed in the past but more on the risk event identification. This past research by (Md Zakirul Alam Bhuiyan, 2019) discussed the IoT devices recorded different reading and transferred data at various rate according to temperature, humidity and light intensity. Another factor was that in Malaysia, the subject of sensitivity level of devices in the supply chain context is still at infancy level. Lack of research on sensitivity of IoT system within the supply chain field among one of the reasons on why this study could not agree on the alternative hypothesis stated in this study.

Another factor in this study that was not significant is user behaviour towards IoT system (expertise), in which its p-value=0.335, which is higher than ($p<0.05$). This is due to an expert in IoT is still rare job specification especially in countries like Malaysia. According to an article written by Alison DeNisco Rayome for Tech Republic article, as IoT expands further into organizations, organizations will need more employees with expertise in technology, data and security. In the past, near the end of 2017, about 8.4 billion were used worldwide which exceed the amount of people on Earth at that moment (Rayome, 2018). This lead to increase in

IT spending, various security concerns and job market that continuously try to seek employees with amazing skillsets in order to deploy and manage connected system. With this rising events within the implementation of IoT into the organization, it was still uncommon to see a job known as IoT specialist (Rayome, 2018).

The outcome of the research which lead to two factors came out as not significant, probably due to the strength of the factors studied in this research. Based on the table 4.10, which is model summary, the R square value shows that the strength of the factors that had been studied in this research is only 39.5%. This means that 60.5% other factors which are much more strongly correlated with organizations' supply chain performance are not studied or are yet to be studied with organizations' supply chain performance as dependent variable.

5.2.3: To determine the most significant contributing factor of reliability and user behaviour towards IoT system that affect organizational supply chain performance.

The third research objective is to examine the most significant factor that affecting organizations' supply chain performance. This objective can be achieved through the output of Multiple Linear Regression analysis from SPSS. Based on the table 4.11, reliability-security is the most significant factor that affecting organizations supply chain performance with p value= 0.000 which is lower than ($p<0.05$).

This can be proven by past research in which security are most mentioned factor when reliability of IoT system are discussed. According to (Shancang Li, 2016) the success of IoT within an organization depends on the standardization of security at various levels, which provides secure interoperability, compatibility, reliability and effectiveness of the operations on a global scale. Thus, this strongly suggest security as measure of reliability of IoT system within the organizations. In addition, based on the Beta value of the factor reliability (security), it shows the highest value which is 0.425 which followed by user behaviour (engagement), reliability (sensitivity) and lastly the factor of user behaviour towards IoT system (expertise). The Beta value coefficients table provide additional supporting detail on the outcome of the research, in which reliability of IoT system (security) as the most significant contributing factor that is affecting organizations' supply chain performance. The second most-significant factor that affect organizations' supply chain performance was user behaviour towards IoT system (engagement). Based on past research by, assistive technology which composed of smart editor, smart communication was specially developed for supporting office workers with disabilities (Ingrid Nappi, 2022). Hence we can conclude that IoT enabled inclusivity in workplace through

application of IoT system which also can promote and improve engagement of employees towards IoT system.

5.3 Research Implications

The findings of this research is to have deeper understanding about critical factor that affecting organizations' supply chain performance. From the research, there are only two factor with each factor extended into two factor are being studied. However, the researcher believed that there are still other factors that can affecting organizations' supply chain performance.

In this study, the researcher is able to achieve the research objectives through literature review, Pearson's Correlation Coefficient's analysis and Multiple Linear Regression Analysis and testing the hypothesis on relationship of independent variable (reliability-security, sensitivity, user behaviour-expertise, engagement) that affecting organizations' supply chain performance. In conclusion, reliability of IoT system (security) and user behaviour (engagement) affecting organizations' supply chain performance and reliability of IoT system (security) is the most significant factor that affecting organizations' supply chain performance among other factors studied in this research.

It is highly crucial to have a deeper understanding on the critical factors that affecting organizations' supply chain performance for supply chain and logistics activity to be efficient and considering customer require transparency on their goods whereabouts. By including transparency in supply chain activity, rapport between customer can be build, gain trust from customers, employees, organization and other stakeholders (Transparency: the Key to Improve Relationships with Customers, 2022) which will all together will lead to an improvement of organizations' supply chain performance. Organizations should encourage and transform supply chain to explore IoT system in depth and its ability to create a smart process which will reduce bottlenecks and identify problem areas within the supply chain.

5.4 Contribution to Knowledge

IoT system in the context of supply chain is changing the supply chain process to certain heights. Among the notable changes were more direct analysis of the user demand and more fluent transformation of valuable and useful information which definitely improves the

efficiency of supply chain management (Li Cui, 2020). Example of common IoT technologies that we often heard of is RFID, sensor network technology and information security technology which can quantify the efficiency of each link within the supply chain management through the combination of intelligent sensor devices and the Internet (Li Cui, 2020).

For this research, contribution of knowledge that had been made is understanding on a deeper level on how reliability of IoT system and how user behaviour towards IoT system affecting organizations' supply chain performance. Researchers are examining how reliable is the IoT system overtime and the impact that it could have on supply chain after certain period of time. Also, the researcher also study how the user behaviour of employees within the organization can affect the performance. This can give early insight for organizations on what aspect that they should look out for when maintaining IoT within their supply chain.

This research touches the security of the system on the frequency of the system to transfer accurate data even when the system are facing attacks and botnets. For the sensitivity of the IoT device, the system touches briefly how well the devices can connect, transfer and scan data even under challenging circumstances such as high temperature and humidity. This also illustrate how well the sensors and actuators connect with each other to produce accurate reading even under the challenging circumstances.

For the user behaviour towards IoT system, the researcher study the expertise regarding IoT system in the organization. The study outline how skills are transforming the way employees could use the IoT system. Dependency towards sole skills of an expert could be reduced and employees could enrich and familiarize themselves with IoT by gaining knowledge and spreading it towards employees that are under them. Lastly, user behaviour in which engagement shows that being involved in the transformation of traditional to smart supply chain is important for the successful adoption of IoT and transformation with success rather than transformation but performance are still falling behind.

5.5 Contribution to Industry

Through this research, contribution made from this research is given clear perspective to organization that security within the IoT system of organizations should be strengthen to improve the reliability of IoT system. This could be done by investing and acquiring skills to shape more firm cyber-security for the system which protect the valuable and confidential data that are crucial for the organization. Next, this research give industry new insights on the sensitivity of IoT devices under challenging circumstance and give IoT devices manufacturer the push and reasons why and how they should create devices such as sensors that could withstand the harsh environments. On top of that, in term of user behaviour in which engagement was shown as significant, companies was given illustration that engagement and involvement of employees could improve organizations' supply chain performance. This could lead to organization propose new ideas on how to increase employees' involvement. For an example provide training for employees to encourage higher engagement with the system. Last but not least, user behaviour towards IoT system in which expertise are very much needed when it comes to IoT. This research could give the industry a picture on the strategy and action that could be taken to ensure there is lower gap when it comes to IoT and how well users can use it to execute supply chain activities and other managerial activity.

5.6 Limitation

Throughout this study, there are several limitation that were faced by researcher. Firstly, the limited time to collect responses. This stop the researcher from collecting more responses from employees of organization due to analysis of data needs to be conducted to conclude the study. Another limitation is that respondents in organizations are harder to access to fill in the distributed question due to these employees were pre-occupied with their tasks within the organization. This result in employees unable to respond at appropriate amount of time.

In addition, some of the respondent may not have clear idea about IoT as some of the respondents' jobs probably interact less with IoT. This result in the questionnaire distribute not be able to provide evidence as to why reliability and user behaviour are based on the stated factors. Thus, collected data is not enough to support variables in which two factors result are not significant with organizations' supply chain performance.

5.7 Recommendations & Future Research

For future research, the researcher proposed new conceptual framework as this study only consists of 2 independent variables with each contain two sub-factors, of which are reliability (security), reliability (sensitivity), user behaviour (expertise) and user behaviour (engagement). The researcher believed that there are other critical factors that have yet to be discussed. Based on the study by (Samuel J. Moore C. D., 2020), network reliability and application reliability are discussed within the context of IoT.

The topic of this research should be studied by expanding the scope. Rather than only do research on organizations based in one area, the study should include organizations of multiple state within the country. Furthermore, this study of IoT which also involves employees of organizations' as respondents should be conducted with longer period of time to enable more collection of data. This study also should be approached with mixed-method to examine how the IoT perceptions within the supply chain are viewed and understand by employees.

5.8 Conclusion.

This research was conducted to gain deeper understanding on factors of reliability and user behaviour that influence the organizations' supply chain among employees within the organizations. This research has successfully achieved the research objectives of this study that were proposed at the initial stage. The researcher also had disclose the limitation that were faced in order to complete the study. The constraints prompts researcher to put forwards some recommendations in order to be able to conduct research without facing this constraints. Finally, independent variables, reliability (security), user behaviour (engagement) are critical factor that affect organizations' supply chain performance. Meanwhile, for the factors in which are not critical that affect organizations' supply chain performance, reliability (sensitivity) and user behaviour (expertise), the result was discussed as to why the factor are less significant compared to the other two factors.

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Section A: Demographic Background

Bahagian A: Latar Belakang Demografi

Please tick (√) in the boxes provided and fill in your details.

Sila tandakan (/) dalam kotak yang disediakan dan isikan butiran anda.

1) Gender/Jantina

☐ Male/Lelaki

☐ Female/Perempuan

2) Age/Umur

☐ 18-30

☐ 31-40

☐ 41-50

☐ 51-60

3) Race/Bangsa

☐ Malay/Melayu

☐ Chinese/Cina

☐ Indian/India

☐ Others/Lain-lain: _____

4) Status

- [ ] Single/Belum Berkahwin
- [ ] Married/ Telah Berkahwin

5) Education Qualification/ Kelayakan Pendidikan

- [ ] SPM/O Level
- [ ] STPM/A-Level
- [ ] Certificate/Diploma
- [ ] Degree/Ijazah
- [ ] Post-graduate/Pasca-Sarjana

6) Current Job Position/Jawatan Pekerjaan Semasa

- [ ] Finance/Kewangan
- [ ] Operations/Operasi
- [ ] Human Resource/Sumber Manusia
- [ ] Manufacturing/Pembuatan
- [ ] Other/Lain-lain: _____

7) Duration of working experience in current organization/Tempoh pengalaman bekerja dalam organisasi semasa.

	0-2 years old
	3-6 years old
	5-7 years old
	8-10 years old
	10>

Section B: Reliability and User Behavior toward IoT System

Bahagian B: Kebolehpercayaan dan SIfat Pengguna Terhadap Sistem IoT

Please indicate the extent to which you agree or disagree with each of the following statements by ticking (√) in the provided box for the most appropriate response based on the following statements.

Sila nyatakan sejauh mana anda bersetuju atau tidak bersetuju dengan setiap pernyataan berikut dengan menandakan (/) dalam kotak yang disediakan untuk jawapan yang paling sesuai berdasarkan pernyataan berikut.

Opinion	**Strongly disagree (SD)**	**Disagree (D)**	**Neutral (N)**	**Agree (A)**	**Strongly Agree (SA)**
Pendapat	**Sangat Tidak Setuju (SD)**	**Tidak Setuju (D)**	**Neutral (N)**	**Setuju (A)**	**Sangat Setuju (SA)**

	Section B1: Reliability (Security) *Bahagian B1: Kebolehpercayaan (Sekuriti)*	SD	D	N	A	SA
1.	The quality of monitoring, real time responsiveness and theft reduction is guaranteed by the high security within the IoT system / *Kualiti pemantauan, responsif masa nyata dan penurunan kadar kecurian dijamin oleh keselamatan yang bertaraf tinggi dalam sistem IoT*					

2.	The sources of the vulnerabilities is eliminated by effective layers of security / *Punca kelemahan dihapuskan oleh lapisan keselamatan yang berkesan.*					
3.	The low security level is causing loss of privacy, trust, confidentiality and availability risk / *Tahap keselamatan yang rendah menyebabkan kehilangan privasi, kepercayaan, rahsia sulit dan risiko ketersediaan (sesuatu yang dapat dipergunakan atau diperoleh secara mudah).*					
4.	Effective layers of security is necessary to be implemented to avoid malicious and unintentional security incidents / *Lapisan keselamatan yang berkesan perlu diimplementasikan untuk mengelakkan insiden keselamatan yang berniat untuk mengancam dan insiden keselamatan yang tidak disengajakan.*					

	Section B2: Reliability (Sensitivity) *Bahagian B2: Kebolehpercayaan (Sensitiviti)*	SD	D	N	A	SA
1.	The compatibility among sensors, networks and applications from different technology and vendors reflect high level of sensitivity / *Kesesuaian antara penderia, rangkaian dan aplikasi daripada teknologi dan vendor yang berbeza mencerminkan tahap sensitiviti yang tinggi*					
2.	There are no major technical and technological integration issues within IoT system indicate a good level of sensitivity/ *Tiada isu integrasi teknikal dan teknologi utama dalam sistem IoT menunjukkan tahap sensitiviti yang baik.*					
3.	System sensitivity are affected by global standard of IoT communication protocol for smart objects and systems / *Kepekaan sistem dipengaruhi oleh piawaian global protokol komunikasi IoT untuk objek pintar dan sistem pintar*					
4.	It is important to ensure the IoT devices and system works effectively by establishing effective IoT architecture / *Adalah penting untuk memastikan peranti dan sistem IoT berfungsi*					

	dengan berkesan dengan mewujudkan struktur IoT yang berkesan					

	Section B3: User Behavior Towards IoT System (Expertise) *Bahagian B3: Sifat Pengguna Terhadap Sistem IoT (Kepakaran)*	SD	D	N	A	SA
1.	Obtaining the needed supporting staff with right skills is posing challenges to synchronize IoT knowledge within the organizations / *Mendapatkan kakitangan sokongan yang diperlukan dengan kemahiran yang tepat menimbulkan cabaran untuk memastikan pengetahuan IoT dalam organisasi adalah selari*					
2.	The employees need to have adequate knowledge of emerging IoT technologies and IoT system / *Pekerja perlu mempunyai pengetahuan yang mencukupi tentang teknologi IoT dan sistem IoT yang baru menaik*					
3.	Organization is ensuring employees have the chance to use the skills they had obtain about IoT system and applications / *Organisasi memastikan pekerja berpeluang untuk menggunakan kemahiran yang mereka perolehi tentang sistem IoT dan cara untuk mengaplikasikannya*					
4.	The technical IoT skills is significant skills for employees to possess / *Kemahiran teknikal IoT adalah kemahiran penting yang perlu dimiliki oleh pekerja*					

	Section B4: User Behavior Towards IoT System (Engagement) *Bahagian B4: Sifa Pengguna Terhadap Sistem IoT (Penglibatan)*	SD	D	N	A	SA

1.	Employee adoption of new technology and practices contribute to IoT successful implementation / *Penggunaan teknologi dan amalan baharu oleh pekerja menyumbang kepada kejayaan pelaksanaan IoT*					
2.	Higher availability of financial resources to support implementation and maintenance of IoT system result in an increase of employees' engagement / *Kadar tersedianya sumber kewangan yang lebih tinggi untuk menyokong pelaksanaan dan penyelenggaraan sistem IoT membuahkan peningkatan dalam penglibatan pekerja*					
3.	Clear comprehension about IoT benefits ensure better employees adaptation towards IoT system / *Pemahaman yang jelas tentang faedah IoT memastikan pekerja dapat menyesuaikan diri dengan lebih baik terhadap sistem IoT.*					
4.	The IoT devices interact and communicate with each other to perform various tasks promotes employees' engagement as human effort is minimized / *Peranti IoT berinteraksi dan berkomunikasi antara satu sama lain untuk melaksanakan pelbagai tugas menggalakkan penglibatan pekerja apabila usaha manusia diminimumkan*					

Section C: Organizations' Supply Chain Performance

Bahagian C: Prestasi Rantaian Bekalan Organisasi

Please indicate the extent to which you agree or disagree with each of the following statements by ticking (√) in the provided box for the most appropriate response based on the following statements.

Sila nyatakan sejauh mana anda bersetuju atau tidak bersetuju dengan setiap pernyataan berikut dengan menandakan (√) dalam kotak yang disediakan untuk jawapan yang paling sesuai berdasarkan pernyataan berikut.

Opinions	**Strongly disagree (SD)**	**Disagree (D)**	**Neutral (N)**	**Agree (A)**	**Strongly Agree (SA)**

Pendapat	**Sangat Tidak Setuju (SD)**	**Tidak Setuju (D)**	**Neutral (N)**	**Setuju (A)**	**Sangat Setuju (SA)**

	Section C1: Organizations' Supply Chain Performance *Bahagian C1: Prestasi Rantaian Bekalan Organisasi*	SD	D	N	A	SA
1.	The delivery reliability in supply chain is ensuring an efficient processes / *Kebolehpercayaan penghantaran dalam rantaian bekalan memastikan proses yang cekap*					
2.	Responsiveness of supply chain system using IoT is one of the significant attribute that affect supply chain performance / *Responsif sistem rantaian bekalan menggunakan IoT adalah salah satu atribut penting yang mempengaruhi prestasi rantaian bekalan*					
3.	Flexibility of the supply chain using IoT is important as one of organizations' competitive advantage / *Fleksibiliti rantaian bekalan menggunakan IoT adalah penting sebagai salah satu kelebihan buat organisasi untuk berdaya saing*					
4.	The cost and asset management efficiency within supply chain of organizations are better managed with IoT system / *Kecekapan pengurusan kos dan aset dalam rantaian bekalan organisasi diurus dengan lebih baik dengan sistem IoT*					

APPENDIX A

Gantt Chart of Final Year Project (FYP) 1

WEEK/ ACTIVITIES	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
FYP talk																
Search for FYP topic																
Meeting with supervisor																
Topic discussion																
Title confirmation																
RO & RQ Construction																
Submission Chapter 1																
Submission Chapter 2																
Submission Chapter 3																
First draft of FYP 1																
Submission of FYP 1																
Presentation 1																
Revised of FYP 1																

MID SEMESTER BREAK

APPENDIX B

Gantt Chart of Final Year Project (FYP) 2

WEEK/ ACTIVITIES	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Create Questionnaire									MID SEMESTER BREAK							
Distribute Questionnaire																
Collect Questionnaire																
Analysis Data																
Submission Chapter 4																
Submission Chapter 5																
Proposal Correction																
Slide Preparation																
Submission of FYP 2																
Presentation 2																

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