RESEARCH IN MANAGEMENT OF TECHNOLOGY AND BUSINESS
e-ISSN: 2773-5044

RMTB

Vol. 5 No. 1 (2024) 403-418
https://publisher.uthm.edu.my/periodicals/index.php/rmtb

The Relationship between Challenges of IoT Adoption and Supply Chain Performance among the Retailers in Kuala Lumpur

Wong Jia Qi[1], Nor Kamariah Kamaruddin[1]*

[1] *Department of Management and Technology, Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia, 86400 Batu Pahat, Johor. MALAYSIA*

*Corresponding Author: ap200341@student.uthm.edu.my, nkamariah@uthm.edu.my
DOI: https://doi.org/10.30880/rmtb.2024.05.01.029

Article Info

Received: 31 March 2024
Accepted: 30 April 2024
Available online: 30 June 2024

Keywords

Challeges of IoT adoption, Organization adjustment, Trustworthiness of technology, Supply chain performance, Retailers

Abstract

The IoT enables the retail industry to gain real-time insight into how it operates relative to it. IoT provides real-time data gathering, analysis, and communication by linking physical items and devices to the internet. The adoption of IoT comes with challenges that can significantly affect the supply chain performance. Although the adoption of IoT can improve supply chain performance, nevertheless there are still many obstacles to overcome. Issues such as limited study focusing on challenges of IoT adoption towards supply chain performance, lack of trust in technology and lack of relevant knowledge on IoT among retailers. Therefore, this research was conducted to examine the relationship between challenges of IoT adoption and supply chain performance among the retailers in Kuala Lumpur. This study encompasses a population of 71,433 individuals, specifically focusing on retailers in Kuala Lumpur. The survey necessitated a total sample size of 382 retailers in Kuala Lumpur for comprehensive data collection. Among the 382 sets of survey questionnaires distributed, 312 responses were received, reflecting a response rate of 81.68%. Based on the correlation analysis conducted in this study, it showed there was a positive relationship between organization adjustment and supply chain performance (r = 0.711). Moreover, there was also a positive relationship between trustworthiness of technology and supply chain performance (r = 0.731). This research study contributes to a deeper understanding of how challenges in IoT adoption can impact the performance of supply chains. Both academia and the retail industry stand to gain valuable insights from this research.

1. Introduction

The topic of this study is the relationship between challenges of IoT adoption and supply chain performance among the retailers in Kuala Lumpur. The content of this section includes the research background, problem statement, research questions, research objectives, research significance, research scope and the conclusion of the first section. The Internet of Things (IoT) enables the retail industry to gain real-time insight into how it operates relative to it.

1.1 Research Background

The Internet of Things, commonly referred to as the IoT, encompasses the multitude of physical devices connected to the internet, numbering in the billions, which actively collect and exchange data among themselves (Ranger, 2020). IoT adoption enables machines and things to interact with one another, find one another, perceive their surroundings, and control one another over a worldwide network (Vass *et al.*, 2018). The capabilities of an industry can be enhanced by adopting IoT (Lee *et al.*, 2022). In addition, IoT-based services and goods largely make use of the following five core IoT technologies such as IoT application software, RFID, middleware, WSN, and cloud computing (Lee *et al.*, 2022). The IoT is widely used in many different industries such as retail, health care, manufacturing, financial and insurance services, materials, and energy (Tang *et al.*, 2018). There are some challenges when using the IoT such as organization adjustment and trustworthiness of technology. Supply chain performance measures how successfully each level of the e-commerce supply chain meets customer expectations while lowering costs, decreasing waste, increasing speed, and enhancing efficiency (Flora, M, 2022). The effectiveness and efficiency of supply chain activities may be evaluated systematically (Ali *et al.*, 2022). In this study, supply chain flexibility, resources, and output are used to measure supply chain performance.

The IoT is essential to the retail industry, but nowhere else. The IoT enables the retail industry to gain real-time insight into how it operates relative to it. According to che nawi *et al.*, (2021), there are significant theoretical and practical implications for the development and marketing of the IoT in retail. IoT has the ability to improve customers' experiences in retail establishments (che nawi *et al.*, 2021). Therefore, IoT is being used by retailers to provide intelligent and engaging shopping experiences (che nawi *et al.*, 2021). However, despite the increasing need for IoT in the world, Malaysia's IoT development has not gotten off to a fast enough start (che nawi *et al.*, 2021).

1.2 Problem Statements

As a main technology in the era of Industry 4.0, the Internet of Things (IoT) has emerged as a focal point of discussion and innovation across diverse fields. Based on the Statista Research Department (2022), Malaysia's wholesale and retail trade sector would contribute 16% to the country's gross domestic product (GDP) in 2021. From 17% of the gross domestic product (GDP) in 2021, this sector's contribution fell by 1% (Statista Research Department, 2022). According to Lee *et al.* (2022), although the adoption of IoT can improve supply chain performance, nevertheless there are still many obstacles to overcome.

The first issue is limited study focusing on challenges of IoT adoption towards supply chain performance. According to previous studies, most of studies focus on manufacturing (Lee *et al.*, 2022), warehousing (Vass *et al.*, 2018), transportation (Tu, M, 2018), and others. However, less research has been done conducted in the context of retailers. This is supported by Rebelo *et al.* (2022) whose claimed, the explanatory studies and empirical studies on the IoT adoption among retailers were still lacking. This will continue to lead to a lack of understanding of how IoT and supply chain performance interact (Rebelo *et al.*, 2022).

The second issue is regarding the lack of trust in technology. According to Chanal, P.M., & Kakkasageri, M.S. (2020), the difficulties IoT faces in terms of security, user privacy, infrastructure and others. For fear of compromising privacy and security, users or non-users have become distrustful of IoT and choose to use it to a lesser extent. This problem also poses a great threat to many fields, especially supply chain performance. Besides, the more intelligent devices and sensors linked to the internet, the easier it is for hackers to break in (Lee, 2022).

The third issue is lack of relevant knowledge on IoT among retailers. According to Chanal, P.M., & Kakkasageri, M.S. (2020), dearth of required knowledge, doing IoT data analysis in a timely and pertinent manner is a significant barrier for retailers, manufacturers, and others. Moreover, there is still a dearth of research on the use of IoT to create a traceability system to guarantee the accuracy and confidentiality of the complete supply chain of warehousing, retail, and distribution. Hence, when manufacturing personnel or retailers lack IoT technical knowledge, they will be unskilled in adopting IoT (Lee *et al.*, 2022). Based on the issues discussed, the researcher has identified a need to further investigate the relationship between challenges of IoT adoption and supply chain performance among the retailers in Kuala Lumpur. Therefore, this study aims to explore the relationship between challenges of IoT adoption and supply chain performance among the retailers in Kuala Lumpur.

Therefore, to achieve the research objectives the level of organization adjustment and trustworthiness of technology among the retailers in Kuala Lumpur are determined. Furthermore, the level of trustworthiness of technology among the retailers in Kuala Lumpur also determined. Consequently, the relationship between challenges of IoT adoption and supply chain performance among the retailers in Kuala Lumpur is identified.

1.3 Research Scope

The research scope is focused on the retailers in Kuala Lumpur. According to the Chief Statistician of Malaysia, Dato' Sri Dr Mohd Uzir Mahidin, "W.P. Kuala Lumpur has 71,433 establishment of retailers which contributed the highest total revenue at RM391.6 billion (29.6%)." According to Wu, S. (2020), Kuala Lumpur has seen the emergence of extremely sizable contemporary retailers hub during the last three decades. This also means that malls in Kuala Lumpur area have substantially more foot traffic (Wu, S, 2020). It can also promote the development of the retail industry. In this research, the measurement for challenges of IoT adoption includes organization adjustment and technology trustworthiness while the measurement for supply chain performance such as supply chain flexibility, resources, and output.

1.4 Research Significance

This research study contributes to a deeper understanding of how challenges in IoT adoption can impact the performance of supply chains. The integration of IoT is poised to enhance supply chain performance for retailers. Moreover, future researchers can leverage this study as a reference for exploring challenges in IoT adoption and its impact on supply chain performance. Both academia and the retail industry stand to gain valuable insights from this research. Furthermore, this study seeks to address a theoretical gap left by previous research, adding substantial value to the existing body of knowledge. Researchers undertaking future studies to comprehend the effects of IoT on supply chain performance within the retail sector can consider this study as a key reference.

2. Literature Review

This section establishes the definitions of independent variables, dependent variables, and others. The outcome of this study is the relationship between the impact of IoT adoption on supply chain performance. This study makes a comparison from any article to get a more specific scope of the independent and dependent variables.

2.1 Definition of Internet of Things (IoT)

The IoT encompasses the multitude of physical devices connected to the internet, numbering in the billions, which actively collect and exchange data among themselves (Ranger, S, 2020). The convergence of the digital and physical worlds via the IoT is empowering our surroundings to become increasingly intelligent and responsive (Ranger, 2020). IoT-based services and goods largely make use of the following five core IoT technologies such as IoT application software, RFID, middleware, WSN, and cloud computing (Lee *et al.*, 2022). IoT application software refers to software programs or applications that are able to run and control IoT devices and systems. RFID employs electromagnetic or electrostatic coupling within the radio frequency range of the electromagnetic spectrum to precisely identify and distinguish things, individuals, or animals (Amsler, & Shea, 2021). Middleware is software and cloud services that give common services and capabilities to applications and aid developers and operators in more effectively creating and deploying applications (Gillis, 2023). WSN is an IoT technology that uses autonomous sensors to keep an eye on physical or environmental settings (Lee *et al.*, 2022). A computer paradigm known as "cloud computing" permits on-demand access and allows a group of users to share a single configured source of computing (Lee *et al.*, 2022).

2.2 Internet of Things (IoT) in Malaysia supply chain

The IoT has had an important influence on multiple industries, particularly supply chains, in Malaysia as it has in many other nations (Lee *et al.*, 2022). IoT technology has been utilized to increase the supply chain's overall visibility, efficiency, and productivity (Lee *et al.*, 2022). Via an entirely novel computing paradigm, IoT has the potential to alter company processes, plans, and capabilities across a wide range of sectors (Krotov *et al.*, 2017). This will enable the start of identifying and addressing challenges and adopting IoT to enhance supply chain performance, gain competitive advantage, and meet changing customer demands in a more digital marketplace. The Malaysian government has put in place programs to assist the adoption of IoT across industries, including the supply chain sector, because of its recognition of the significance of IoT in fostering digital transformation.

2.3 Challenges of IoT Adoption

While the adoption of IoT will bring some benefits, it is not without challenges, and these challenges can help improve various aspects. The retail industry faces hurdles related to organization adjustment and trustworthiness of technology (Vass *et al.*, 2018). The scenario for organization adjustment enables the implementation of projects when an organizational unit's development and process structure are adjusted. For organization adjustment, adopting IoT solutions requires new skills and expertise within the organization, as

well as hiring talent with IoT-related skills. If the company likewise promotes an innovative and open-to-advancement culture, integration will occur well.

Technology trustworthiness relates to how confident one is that the system works as intended as well as attributes include security, safety, dependability, privacy, and resilience in the face of outside disturbances, inside mistakes, and outside assaults (Martin, B, 2021). For technology trustworthiness, the integrity, accuracy, and consistency of data must be maintained throughout the IoT ecosystem, otherwise wrong decisions will be made, or wrong insights will be obtained. Moreover, end-to-end security needs to be ensured across the entire IoT infrastructure, which is critical to establishing trustworthiness. This is because it can improve the trustworthiness of technology by addressing device and network security risks and vulnerabilities as well as enabling efficient integration and synchronization of data and cloud computing systems (Vass *et al.*, 2018).

2.4 Supply Chain Performance

Supply chain performance measures how successfully each level of the e-commerce supply chain meets customer expectations while lowering costs, decreasing waste, increasing speed, and enhancing efficiency (Flora, 2022). Companies may improve competitiveness, boost customer happiness, and promote overall success by prioritizing supply chain performance (Flora, 2022). In this study, the measurements for supply chain performance such as supply chain flexibility, resources, and output. Supply chain flexibility is a key measurement for evaluating supply chain performance. Supply chain flexibility also refers to the capacity to respond to and modify oneself in response to new goods, markets, or rivals (Lee *et al.*, 2022). Besides, the numerous assets, parts, and organizations involved in the administration and operation of supply chain are referred to as supply chain resources. Both tangible and intangible components may be a part of them. Supply chain resources involve raising the value-added productivity of each employee (Lee *et al.*, 2022). According to Lee *et al.* (2022), enhancing product quality, supply chain delivery dependability, sales, order fulfillment rates, and other factors are also part of supply chain output. Additionally, deliveries that are made on schedule, how quickly customers respond, and the number of customer complaints are other supply chain outputs (Lee *et al.*, 2022).

2.5 Past studies on the relationship between challenges of IoT adoption and supply chain performance

The issues that enterprises and individuals have while incorporating and integrating IoT technology into their daily lives or activities are referred to as challenges of IoT adoption (Lee *et al.*, 2022). These challenges require careful analysis and strategic planning to overcome in order to prevent the effective acceptance, implementation, and exploitation of IoT devices (Lee *et al.*, 2022). Thus, the retail industry faces challenges related to organization adjustment (Vass *et al.*, 2018). Supply chain performance is expected to be enhanced when firms successfully modify their structures, procedures, and cultures to suit IoT technologies and see the technology as dependable, secure, and privacy-conscious (Lee *et al.*, 2022). These modifications allow greater IoT data use, optimal decision-making, improved supply chain partner communication, and ultimately support operational effectiveness, accuracy, and customer happiness (Flora, 2022). To satisfy more complex client needs, improved technological integration is necessary (Caputo *et al.*, 2016). The success of a company is not just based on how it responds to the requirements of its clients or its internal stakeholders (Lee *et al.*, 2022). Supply chain performance was enhanced among companies that proactively accepted and implemented organization adjustments (Lee *et al.*, 2022).

H1: There is a positive relationship between organization adjustment and supply chain performance.

Moreover, the retail industry also faces challenges related to trustworthiness of technology (Vass *et al.*, 2018). The challenges facing IoT development include difficulties with data management, data mining, and a lack of security and privacy (Lee *et al.*, 2022). It can improve technology trustworthiness by addressing device and network security risks and vulnerabilities and enabling efficient integration and synchronization of data and cloud computing systems (Vass *et al.*, 2018). Hence, the research results highlighted how important data quality and integrity are for fostering technological trust (Vass *et al.*, 2018). Reliable and trustworthy data enabled quicker decision-making, more accurate demand forecasts, and inventory optimization, which improved the responsiveness of the supply chain and increased customer satisfaction (Lee *et al.*, 2022).

H2: There is a positive relationship between trustworthiness of technology and supply chain performance.

This is supported by the studies of Lee *et al.* (2022) whose found there is a positive (+ve) relationship between challenges of IoT adoption and supply chain performance. Then, the study by Rebelo *et al.* (2022) also found a positive (+ve) relationship between challenges of IoT adoption and supply chain performance.

Research in Management of Technology and Business Vol. 5 No. 1 (2024) p. 403-418

2.6 Conceptual Framework

Fig. 1 *Conceptual framework*

Based on the discussion on the empirical findings and hypotheses developed, this study derives a conceptual framework as depicted in Fig. 1 This study examines the relationship between challenges of IoT adoption and supply chain performance among the retailers in Kuala Lumpur.

3. Research Methodology

This section will discuss every aspect of the research, such as the type of research design, measurement development, and population and sample. This section also will discuss the chosen data collection technique and data analysis technique in detail.

3.1 Research Flow Chart

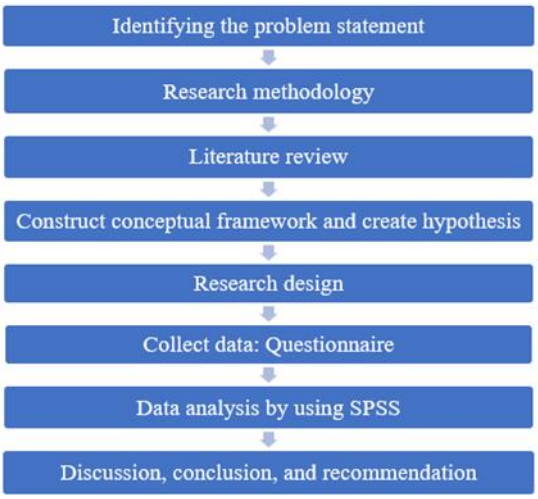

Fig. 2 *Research flow chart*

Based on Fig. 2, the research began with the definition of the problem, and then a title was selected based on that. The problem with this study is that in recent years due to the increased adoption of IoT, there have been some challenges that have also impacted supply chain performance. The next step is determining the research objectives based on the research questions. It was revealed that literature evaluations were done about the challenges of IoT adoption and supply chain performance. The researcher had created a questionnaire and prepared to gather data using Google Forms before beginning the data-collecting process. After collecting the data, it was analyzed with SPSS. All findings were categorized and organized before being shown in tables, bar charts, pie charts, and others. An explanation was given for the debate and the conclusion linked to the research objectives. In short, the study's limits and some suggestions for further research were presented.

3.2 Research Design

The quantitative method was used by the researcher in this study. The quantitative method is used to fulfill the research objective. A quantitative approach was a method to quantify the numerical data collected by researchers by using statistical analysis to meet their study questions. During this research, the researchers have prepared a questionnaire survey to collect data from the respondents.

Moreover, researchers must create systematic strategies for collecting and evaluating data. This is due to being able to draw reliable conclusions about the relationship between two variables. The respondent in this study consisted of retailers in Kuala Lumpur. The sampling technique for collecting the data was using the convenience sampling approach. The reason for using the convenience sampling approach is because it was an easy method to collect the data based on their willingness and availability (Simkus, J, 2023). Besides, this study used SPSS as the data analysis technique. Hence, the data was analyzed through reliability analysis, descriptive analysis, normality analysis, and correlation analysis to extract meaningful results. One of the reasons for using

this data analysis technique is that it will be very helpful to the researcher when evaluating the data by presenting the results in a table or graphical display (William, K, 2022).

3.3 Research Population and Sampling

The population size for this study consists of retailers in Kuala Lumpur. Based on the DOSM 2019, the population number of retailers in Kuala Lumpur was 71,433. Based on the table of Krejcie and Morgan (1970), the sample size was 382. Moreover, the respondents were selected from retailers in Kuala Lumpur via convenience sampling technique. The convenience sampling technique is the selection of a sample based on their availability and willingness to join in the research (Fleetwood, D, 2023). Participants in this technique are chosen because they are readily available to the researcher rather than being chosen at random from a larger population (Fleetwood, D, 2023).

3.4 Research Instrument

3.4.1 Survey Design

As the data collection instrument, a questionnaire was designed for the study to conduct a survey among retailers in Kuala Lumpur. The questionnaire was designed to understand challenges of IoT adoption and supply chain performance. Therefore, the questionnaire has three sections such as Section A, Section B, and Section C. Section A is about the demographic respondents. The instrument was designed in nominal scale style. Section B is about the challenges of IoT adoption. Section C is about supply chain performance. The instrument was designed in Likert scale style, with a five-scale range from "Strongly Disagree", "Disagree", "Neutral", "Agree", and "Strongly Agree". It helps the research gauge the views of the respondents and determine whether they agree with the questions.

Table 1 *Survey design*

Section	Interpretation	Scale
A	Demographic respondents	Nominal scale
B	Challenges of IoT adoption Organization adjustment Trustworthiness of technology	Five-point Likert scale: Strongly disagree Disagree Neutral Agree Strongly agree
C	Supply chain performance Supply chain flexibility Supply chain resources Supply chain output	

3.4.2 Sub Section Headings

Based on Table 2, the items measurements for the organization adjustment and trustworthiness of technology are adopted from the study of Haddud *et al.* (2017); Vass *et al.* (2018); Lee *et al.* (2022), there are 10 and 7 items used to measure organization adjustment and trustworthiness of technology respectively, all the items are measured using 5-point Likert scale.

Table 2 *Measuring development table of challenges of iot adoption*

Sec	*Challenges of IoT adoption*	*Measurement*	*Scale*	*References*
B	Organization adjustment	1. Challenges in obtaining the needed supporting staff with right skills and knowledge. 2. Technical and technological integration. 3. Employees' resistance to new technologies and practices. 4. Compatibility among sensors, networks, and applications from different technology and vendors. 5. Availability of financial resources to support implementation and maintenance. 6. Applications coding development. 7. Integration along multiples supply chains with heterogeneous technologies and data services. 8. Global standard of IoT communication protocol for smart objects and systems. 9. Financial investments from all participants to design and deploy IoT technologies and solutions. 10. Design of new supply chain business models to support the still unstructured firm oriented ecosystems.	Five-point Likert scale: - Strongly disagree - Disagree - Neutral - Agree Strongly agree	(Haddud et al., 2017; Vass et al., 2018; Lee et al., 2022)
	Trustworthiness of technology	1. Device and network security risks and vulnerabilities. 2. Services platforms of storage to accommodate large volume of data with high levels of security and reliability. 3. Platforms to manage and control huge volume of data, velocity of processing, validation, and diversity of information. 4. Effective integration and synchronization of data and cloud computing systems. 5. Services and technological products still not mature. 6. Solutions for communication and signal coverage to attend different modes of transport and products. 7. Seamless integration of business processes, information and communication technologies in cyberspace.		

Based on Table 3, the items measurements for the supply chain flexibility, resources, and output are adopted from the study of Haddud *et al.* (2017); Vass *et al.* (2018); Lee *et al.* (2022), there are 5, 5 and 8 items used to measure supply chain flexibility, resources, and output respectively, all the items are measured using 5-point Likert scale.

Table 3 *Measuring development table of supply chain performance*

Sec	Indicators	Measurement	Scale	References
C	Supply chain flexibility	1. Improve supply chain flexibility (react to product changes, volume, and mix). 2. Respond and accommodate demand variations, such as seasonality. 3. Respond and accommodate the periods of poor supplier performance. 4. Respond and accommodate the periods of poor delivery performance. 5. Respond and accommodate new products, new markets or new competitors.	Five-point Likert scale: - Strongly disagree - Disagree - Neutral - Agree - Strongly agree	(Kaliani Sundram et al., 2016; Vass et al., 2018; Lee et al., 2022)
	Supply chain resources	1. Improve value-added productivity per employee. 2. Reduce total cost of resources used. 3. Reduce total cost of distribution, including transportation and handling cost. 4. Reduce cost associated with held inventory. 5. Improve return on investment.		
	Supply chain output	1. Improve product quality. 2. Improve supply chain delivery reliability. 3. Improve sales. 4. Improve order fill rate. 5. Improve the product delivery cycle time. 6. Improve perfect order fulfilment (deliveries with no errors). 7. Improve customer response time. 8. Reduce customer complaints.		

3.5 Pilot Study

In this study, the questionnaire is used as a pilot test to evaluate the results and determine whether the variable was adequately understood, and the questionnaire was acceptable. The researcher rectifies and addresses errors in the questionnaire, conducting subsequent pilot tests until no mistakes remain and no further amendments were deemed necessary. Both the dependent and independent variables undergo the Cronbach's alpha reliability test as a part of the pilot test. The questionnaire needs to be distributed to 30 retailers in Kuala Lumpur. The data was processed via SPSS software to see the preliminary result.

3.6 Data Collection

The data collection method chosen by the researcher will depend on the research question posed. In this research, two types of data sources are included, namely primary data and secondary data. Online survey was the primary data collected by the researcher. This study conducts a survey to obtain primary data by distributing Google Forms to 382 retailers in Kuala Lumpur. This study has the objective of the secondary data whereby it is to collect information as a reference and requirements for the researcher in this relevant field. Hence, the researcher collects secondary data by reading relevant written sources like scholarly journals, related reference articles, books, and so on.

3.7 Data Analysis

This study used SPSS as the data analysis technique. Quantitative data calculations are made more straightforward using SPSS, which improves accuracy (William, 2022). SPSS was used for descriptive analysis, reliability analysis, normality analysis and correlation analysis. Descriptive analysis is a sort of data analysis that aids in describing, demonstrating, or summarizing data points in a positive way so that patterns may develop that satisfy all of the conditions of the data (Rawat, 2021). Studying the characteristics of measuring scales and the components that make up the scales is possible using reliability analysis. In this study, used Cronbach's alpha to determine the internal consistency of the survey (Zach, 2022). The most often employed techniques to check the normality of the data are the two well-known tests of normality, namely the Kolmogorov-Smirnov test and the Shapiro-Wilk test (Mishra *et al.*, 2019). The statistical technique of correlation analysis is employed to determine whether there is a link between two variables or datasets and the potential strength of that association (James, 2022).

4. Data Analysis and Result

The researchers distributed questionnaires to retailers in Kuala Lumpur, providing the questionnaire forms via a Google Forms link. The distribution was conducted by the researcher either online or in person with the respondents. Hence, a total of 382 questionnaires were distributed to respondents, and 312 questionnaires were successfully returned. The response rate of this study was 81.68%.

4.1 Reliability Analysis

4.1.1 Pilot Study

In this study, the pilot study was undertaken to assess the questionnaire by employing SPSS. Firstly, Cronbach's alpha for organization adjustment with 10 items is 0.829 and the result was considered very good. Moreover, Cronbach's alpha for trustworthiness of technology with 7 items is 0.725 and the result was considered good. Besides, Cronbach's alpha for supply chain performance with 18 items is 0.886 and the result was considered very good.

Table 4 *Reliability for pilot study result*

Variables	No. of Items	Cronbach's Alpha	Interpretation
Independent Variable:			
Organization Adjustment	10	0.829	Very Good
Trustworthiness of Technology	7	0.725	Good
Dependent Variable:			
Supply Chain Performance	18	0.886	Very Good

4.1.2 Actual Study

The actual study took place following the pilot study, which confirmed the reliability and validity of the questionnaires. Firstly, Cronbach's alpha for organization adjustment with 10 items is 0.730 and the result was considered good. Besides, Cronbach's alpha for trustworthiness of technology with 7 items is 0.667 and the result was considered moderate. In addition, Cronbach's alpha for supply chain performance with 18 items is 0.872 and the result was considered very good.

Table 5 *Reliability for actual study result*

Variables	No. of Items	Cronbach's Alpha	Interpretation
Independent Variable:			
Organization Adjustment	10	0.730	Good
Trustworthiness of Technology	7	0.667	Moderate
Dependent Variable:			
Supply Chain Performance	18	0.872	Very Good

4.2 Demographic Analysis

Based on the result that shows all 312 respondents are retailers in Kuala Lumpur. The number of respondents based on gender with a total of 174 male (55.80%) and 138 female (44.20%) out of 312 respondents. Moreover, most of the respondents are 28 years old and above, which is 177 respondents (56.73%). A few numbers of respondents between 18 to 22 years old which is 16 of respondents (5.13%). From the result of race, the number and percentage of Chinese respondents a total of 144 respondents (46.15%). The Indian respondents have the lowest number and percentage of respondents which is 68 respondents (21.8%). From the number of respondents that have been grouped by the Kuala Lumpur district where the organization is located, 157 respondents (50.32%) are organizations located in Bukit Bintang, which is the highest district. Besides, 9 respondents (2.88%) are organizations located in others District, which is the lowest district. From the result of education level, most of the respondents are degree holders which are 213 respondents (68.3%). Then, no respondents from PT3 or PMR or SRP level. From the number of respondents that have been grouped by time of service to the organization, most of the respondents had served the organization for more than 9 years, which is 120 respondents (38.46%). A few numbers of respondents had served the organization for 7 to 9 years, which is 42 respondents (13.46%). From the result of designation, respondents are from the managers and executives which are 191 respondents (61.22%) and 121 respondents (38.78%) respectively.

Table 6 *Demographic profile respondents*

Variable	Detail	Frequency	Percentage (%)
Gender	Male	174	55.80
	Female	138	44.20
Age (Years)	18 – 22 years old	16	5.13

	23 – 27 years old	119	38.14
	28 years old and above	177	56.73
Race	Malay	100	32.05
	Chinese	144	46.15
	Indian	68	21.80
	Others	0	0
Which district in Kuala Lumpur is your organization located?	Bukit Bintang	157	50.32
	Cheras	78	25.00
	Kepong	53	16.99
	Seputeh	15	4.81
	Others	9	2.88
Your Education Level	PHD	14	4.50
	Master	44	14.10
	Degree	213	68.30
	Diploma	30	9.60
	STPM	6	1.90
	SPM	5	1.60
	PT3/PMR/SRP	0	0
How long have you serve the organization?	1 -3 years	58	18.59
	4 – 6 years	92	29.49
	7 – 9 years	42	13.46
	More than 9 years	120	38.46
Your Designation	Manager	191	61.22
	Executive	121	38.78

4.3 Descriptive Analysis

In this part, the researcher utilized the SPSS software to compute the mean and standard deviation derived from participants' responses. The average mean for the 10 items in independent variables of organization adjustment is 4.0353 and the average standard deviation is 0.39267. Moreover, the average mean for the 7 items in independent variables of trustworthiness of technology is 4.0284 and the average standard deviation is 0.42090. In addition, the average mean for the 18 items in dependent variables of supply chain performance is 4.0287 and the average standard deviation is 0.38580. The table for a summary of the descriptive analysis in mean and standard deviation for each variable is listed in Appendix A.

Table 7 *Overall mean and standard deviation score of factors*

Item	Mean	Standard Deviation	Interpretation
Independent Variable:			
Organization Adjustment	4.0353	0.39267	High
Trustworthiness of Technology	4.0284	0.42090	High
Dependent Variable:			
Supply Chain Performance	4.0287	0.38580	High

4.4 Normality Analysis

The normality analysis is employed to assess the likelihood that the surveyed sample conforms to a normal distribution. The most often employed techniques to check the normality of the data are the two well-known tests of normality, namely the Kolmogorov-Smirnov test and the Shapiro-Wilk test (Mishra *et al.*, 2019). Table 8 displays the outcomes of two distinct normality tests, namely the Kolmogorov-Smirnov and Shapiro-Wilk tests applied to the dependent variable of supply chain performance. The Kolmogorov-Smirnov test yielded a statistic of 0.071 with 312 degrees of freedom, corresponding to the number of respondents, and an associated p-value was found to be <0.001. Thus, the data distribution was deemed not normal, as evidenced by the Kolmogorov-Smirnov normality test registering the p-value < 0.001.

Table 8 *Results of normality test for supply chain performance*

ZVariable	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Overall Mean Supply Chain Performance	.071	312	<.001	.986	312	.004

a. Lilliefors Significance Correction

4.5 Correlation Analysis

In this study, the Spearman correlation was employed to analyze the data. Spearman correlation is employed to examine the strong or weak of the relationship between the dependent and independent variables. Based on Table 4.5, it shows the value of Spearman's Correlation Coefficient, r was 0.711 and p-value is smaller than 0.001 which shows that there is a strong and positive correlation between organization adjustment and supply chain performance. Based on Table 9, it shows the value of Spearman's Correlation Coefficient, r was 0.731 and p-value is smaller than 0.001 which shows that there is a strong and positive correlation between trustworthiness of technology and supply chain performance. Hence, all independent variables have a strong and positive relationship with supply chain performance representing all hypotheses that are acceptable in this research. As a result, the finding shows that all the challenges have a significant positive influence on supply chain performance among retailers in Kuala Lumpur. The table for a summary of the results for hypothesis is listed in Appendix A.

Table 9 *Result for correlation analysis*

			Supply Chain Performance
Spearman's rho	Organization Adjustment	Correlation Coefficient	0.711
		Sig. (2-tailed)	<.001
	Trustworthiness of Technology	Correlation Coefficient	0.731
		Sig. (2-tailed)	<.001

5. Conclusion

5.1 Overview of study

The main purpose of this study is to determine the relationship between challenges of IoT adoption and supply chain performance among the retailers in Kuala Lumpur. This study is focused on retailers in Kuala Lumpur, which is the sample of this study. All the data is collected employing quantitative research methods created and executed on Google Forms. Data were analysed using SPSS software to determine efficiency. Then, Microsoft Excel developed the quantitative reports presented in the form of frequency, percentage, mean and standard deviation. Correlation analysis revealed that all independent variables have a significant relationship with supply chain performance.

5.2 Discussion on objectives

5.2.1 First objective: To investigate the level of supply chain performance among the retailers in Kuala Lumpur.

Based on the descriptive analysis conducted in this study, it showed that the level of supply chain performance among the retailers in Kuala Lumpur is categorized as high with an overall mean of 4.0287. Supply chain performance is categorized into supply chain flexibility, resources, and output. Based on the outcomes obtained from the questionnaire survey, the majority of respondents highly recognized supply chain performance.

Based on the outcomes of the questionnaire survey, most of the respondents agreed that supply chain flexibility is related to responding and accommodating to new products, new markets, or new competitors. This is because the capability of the supply chain to adjust and react to changes in demand, market circumstances or disruptions is measured by supply chain flexibility. Reacting to product changes, quantities, and combinations will enhance supply chain flexibility (Lee *et al.*, 2022). Supply chain flexibility also refers to the capacity to respond to and modify oneself in response to new goods, markets, or rivals (Lee *et al.*, 2022). This will facilitate the development of supply chain processes.

Moreover, respondents agreed that supply chain resources are related to improving return on investment. According to Lee *et al.* (2022), effective supply chain management improves process efficiencies, thereby reducing operating costs. Via the optimization of resources, reduction of waste, and enhancement of productivity, businesses can improve their overall cost-effectiveness. Companies capable of swiftly adjusting to

changes in consumer preferences or market trends are better situated to seize opportunities, which can result in heightened sales (Lee *et al.*, 2022). Utilizing technology in the supply chain, including advanced analytics, automation, and digital platforms, can boost visibility, efficiency, and decision-making (Lee *et al.*, 2022). These technological advances can increase resource utilization, reduce errors and improve overall performance. These ultimately have a positive impact on ROI.

According to Lee *et al.* (2022), enhancing product quality, supply chain delivery dependability, sales, order fulfillment rates, and other factors are part of supply chain output. Deliveries that are made on schedule, how quickly customers respond, and the number of customer complaints are also other supply chain outputs (Lee *et al.*, 2022). Products or services are guaranteed to reach the customer on time if the supply chain is efficiently handled. This efficiency can directly impact how quickly customer orders are processed, fulfilled, and delivered. An optimized supply chain helps in maintaining optimal levels of inventory. This implies that products are accessible at the time customers require them, minimizing the likelihood of running out of stock and avoiding delays in order fulfillment. Lastly, the high level of supply chain performance among the retailers in Kuala Lumpur.

5.2.2Second objective: To identify the level of organization adjustment among the retailers in Kuala Lumpur.

For the second research objective, organization adjustment is one of the challenges of IoT adoption. Based on the descriptive analysis conducted in this study, it showed that the level of organization adjustment among the retailers in Kuala Lumpur is categorized as high with an overall mean of 4.0353. Based on the results of the questionnaire survey, most of the respondents highly recognized organization adjustment. Furthermore, the majority of respondents agreed that organization adjustment is related to the global standard of IoT communication protocol for smart objects and systems. This is because a global standard for IoT communication protocols ensures interoperability among different devices and systems. Having a standardized communication protocol can enhance the efficiency of managing and upkeeping IoT systems (Vass *et al.*, 2018). Adopting a globally accepted standard has the potential to lower costs linked to development, maintenance, and troubleshooting for organizations. This efficiency can be a strong motivator for organizations to adjust their processes (Vass *et al.*, 2018). Lastly, the majority of respondents highly recognized organization adjustment.

5.2.3Third objective: To identify the level of trustworthiness of technology among the retailers in Kuala Lumpur.

For the third research objective, trustworthiness of technology is one of the challenges of IoT adoption. Based on the descriptive analysis conducted in this study, it showed that the level of trustworthiness of technology among the retailers in Kuala Lumpur is categorized as high with an overall mean of 4.0284. Based on the results of the questionnaire survey, most of the respondents highly recognized trustworthiness of technology. Moreover, most of the respondents agreed that trustworthiness of technology is related to effective integration and synchronization of data and cloud computing systems. This is because integration and synchronization of data across systems often involve the transfer and sharing of sensitive information (Martin, B, 2021). Cloud computing systems usually employ sophisticated security measures (Martin, B, 2021). For instance, encryption and access controls, to protect data from unauthorized access and breaches. Integration aids in maintaining data accuracy and consistency across different systems. Inaccurate or inconsistent data contributes to errors and distrust of technology (Vass *et al.*, 2018). Effective synchronization of data instills confidence in users, enabling them to depend on the information delivered by the system and thereby bolstering overall trust. Lastly, the majority of respondents highly recognized the trustworthiness of technology.

5.2.4 Fourth objective: To examine the relationship between challenges of IoT adoption and supply chain performance among the retailers in Kuala Lumpur.

Based on the results of spearman correlation, the correlations between organization adjustment and trustworthiness of technology and supply chain performance are 0.711 and 0.731 respectively. Hence, there is a strong and positive correlation between challenges of IoT adoption and supply chain performance. This hypothesis was also supported, where challenges of IoT adoption had a positive impact on supply chain performance (Lee *et al.*, 2022). Moreover, the study by Rebelo *et al.* (2022) also found a positive (+ve) relationship between challenges of IoT adoption and supply chain performance.

Supply chain performance is expected to be enhanced when firms successfully modify their structures, procedures, and cultures to suit IoT technologies and see the technology as dependable, secure, and privacy-conscious (Lee *et al.*, 2022). Supply chain performance was enhanced among companies that proactively accepted and implemented organization adjustments (Lee *et al.*, 2022). The challenges facing IoT development include difficulties with data management, data mining, and a lack of security and privacy (Lee *et al.*, 2022). It

can enhance the trustworthiness of technology by reducing security risks and vulnerabilities in devices and networks (Vass *et al.*, 2018). It facilitates the seamless integration and synchronization of data and cloud computing systems for improved efficiency (Vass *et al.*, 2018). The supply chain performance was enhanced for organizations that gave data quality management, including data validation, cleaning, and verification processes, a high priority (Vass *et al.*, 2018). Thus, this study found a positive relationship between the challenges of IoT adoption and supply chain performance.

5.3 Limitation of the study

In this study, there exist numerous limitations encountered throughout the course of conducting research and collecting data. These limitations impede the overall effectiveness and thoroughness of the study. The first limitation is the range of sample size. This is because of a limited geographical area. Therefore, the sample size limited to range of this research is only focused on the Kuala Lumpur area. Moreover, data can only be analysed and collected from respondents who are retailers in the Kuala Lumpur area. Therefore, this study is unable to represent the entire population fully. Besides, relevant persons from other fields and other areas of Malaysia were not included in this survey.

In addition, the second limitation is related to the limited methodology. This is because this study only used quantitative methods. While the quantitative methodology employed in this research provides valuable insights and allows for statistical analyses, it is essential to acknowledge certain limitations associated with this approach. One notable limitation is the potential for oversimplification of complex phenomena inherent in the reliance on numerical data. Quantitative methods cannot capture the richness and depth of contextual factors that could significantly influence the research outcomes. Additionally, the use of predetermined survey questions or structured instruments can limit the scope of respondents' responses, potentially overlooking nuanced perspectives that qualitative methods might uncover. Furthermore, the cross-sectional nature of the data collection can hinder the establishment of causal relationships, as it captures a snapshot at a specific point in time.

5.4 Recommendation

This section serves the purpose of improving and addressing the limitations inherent in the scope of the research study, thereby aiming to overcome its limitations and contribute to its overall improvement. This study required a longer period of time to collect and analyse the data. A longer period would have allowed the researchers to collect a sufficient sample size and to have access to respondents from other fields and other districts of Malaysia. For instance, ample time would be available solely for collecting and analysing responses exclusively from retailers located in Kuala Lumpur. A sufficient sample size can make the research findings more accurate and reliable. Moreover, an ample sample size can provide better research results and guarantee the results' ability to reflect the entire population so that the study has more data for research and reference.

Besides, it is also advised that future research can use quantitative and qualitative methods for simultaneous data collection. This is because quantitative and qualitative methods provide a better understanding of the thoughts and feelings of the interviewees themselves. Qualitative methods provide a more comprehensive understanding of the phenomenon under investigation, ensuring a more robust and nuanced interpretation of the findings. Therefore, the collected data will be more accurate and precise than the normal collected data or answers. This will enable researchers to carry out the study with greater ease, as they will gather a sufficient amount of more precise data for thorough analysis.

Lastly, the researchers can examine the distinct impact of adopting IoT on the supply chain performance. This is aimed at understanding how the supply chain performance can be enhanced further. Every invention has advantages and disadvantages. Therefore, various companies can use the findings from the future study as a reference when considering investments in additional technologies to complement IoT adoption.

5.5 Conclusion

In conclusion, the purpose of this study is to explore the challenges faced by retailers in Kuala Lumpur when adopting IoT and how it affects supply chain performance. This is because the retail industry in Kuala Lumpur needs to know more about the challenges of IoT adoption and supply chain performance in order to be able to identify the possible positive impact of IoT adoption in the supply chain on supply chain performance. Hence, there are a few significant findings in this study. Firstly, the high level of supply chain performance among the retailers in Kuala Lumpur. Secondly, most of the respondents highly recognized challenges of IoT adoption. Thirdly, this research found a positive relationship between the challenges of IoT adoption and supply chain performance. This is because supply chain performance is expected to improve when retailer companies successfully modify their structures, procedures, and culture to adapt to IoT technology and view the technology as dependable, secure and privacy-conscious. This means that the adoption of IoT in the supply chain can have a positive impact on supply chain performance. If retailer companies have good management, IoT adoption will

enhance supply chain performance as well as maintain and increase competitiveness in the market. Lastly, it is recommended to get more respondent data for future studies. If it is possible to receive responses from respondents from other states in Malaysia, more varied data will be available. This can identify a higher average rate among respondents.

Appendix A

1. Descriptive analysis

(a) Descriptive Data for Independent Variable (Organization Adjustment)

Table 10 *Descriptive data for independent variable (organization adjustment)*

Statement	Mean	Standard Deviation	Interpretation
Challenges in obtaining the needed supporting staff with right skills and knowledge.	3.9551	0.65487	High
Technical and technological integration.	3.9647	0.67717	High
Employees' resistance to new technologies and practices.	3.9231	0.76950	High
Compatibility among sensors, networks, and applications from different technology and vendors.	4.0641	0.73217	High
Availability of financial resources to support implementation and maintenance.	4.1058	0.78881	High
Applications coding development.	4.0064	0.82949	High
Integration along multiples supply chains with heterogeneous technologies and data services.	4.0865	0.71426	High
Global standard of IoT communication protocol for smart objects and systems.	4.1346	0.66697	High
Financial investments from all participants to design and deploy IoT technologies and solutions.	4.0705	0.69553	High
Design of new supply chain business models to support the still unstructured firm oriented ecosystems.	4.0417	0.72719	High
Total Average	4.0353	0.39267	High

(b) Descriptive Data for Independent Variable (Trustworthiness of Technology)

Table 11 *Descriptive data for independent variable (trustworthiness of technology)*

Statement	Mean	Standard Deviation	Interpretation
Device and network security risks and vulnerabilities.	3.9840	0.71932	High
Services platforms of storage to accommodate large volume of data with high levels of security and reliability.	4.0577	0.68742	High
Platforms to manage and control huge volume of data, velocity of processing, validation, and diversity of information.	3.9744	0.72572	High
Effective integration and synchronization of data and cloud computing systems.	4.1506	0.69430	High
Services and technological products still not mature.	4.0000	0.80593	High
Solutions for communication and signal coverage to attend different modes of transport and products.	4.0032	0.76708	High
Seamless integration of business processes, information and communication technologies in cyberspace.	4.0288	0.69620	High

Total Average	4.0284	0.42090	High

(c) Descriptive Data for Dependent Variable (Supply Chain Performance)

Table 12 *Descriptive Data for Dependent Variable (Supply Chain Performance)*

Statement	Mean	Standard Deviation	Interpretation
Supply chain flexibility			
Improve supply chain flexibility (react to product changes, volume, and mix).	3.9487	0.68324	High
Respond and accommodate demand variations, such as seasonality.	4.0513	0.63443	High
Respond and accommodate the periods of poor supplier performance.	3.9744	0.69863	High
Respond and accommodate the periods of poor delivery performance.	3.9487	0.75479	High
Respond and accommodate new products, new markets or new competitors.	4.2115	0.63661	High
Supply chain resources			
Improve value-added productivity per employee.	4.0769	0.68082	High
Reduce total cost of resources used.	3.9455	0.67589	High
Reduce total cost of distribution, including transportation and handling cost.	3.9583	0.73160	High
Reduce cost associated with held inventory.	3.8910	0.71793	High
Improve return on investment.	4.2404	0.61328	High
Supply chain output			
Improve product quality.	4.0000	0.70369	High
Improve supply chain delivery reliability.	4.0513	0.65929	High
Improve sales.	4.0609	0.66575	High
Improve order fill rate.	3.9808	0.75203	High
Improve the product delivery cycle time.	3.9167	0.75192	High
Improve perfect order fulfilment (deliveries with no errors).	3.9968	0.70596	High
Improve customer response time.	4.2051	0.60244	High
Reduce customer complaints.	4.0577	0.66845	High
Total Average	4.0287	0.38580	High

2. Summary of Result for Hypothesis

Table 13 *Summary of Result for Hypothesis*

Hypothesis	Variables	Relationship	Findings
There is a significant relationship between organization adjustment and supply chain performance.	Organization Adjustment	Strong	Accepted
There is a significant relationship between trustworthiness of technology and supply chain performance.	Trustworthiness of Technology	Strong	Accepted

Acknowledgement

The authors would like to thank the Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia for its support.

Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** W.J.Q. and N.K.K.; **data collection:** W.J.Q.; **analysis and interpretation of results:** W.J.Q. and N.K.K.; **draft manuscript preparation:** W.J.Q. and N.K.K. All authors reviewed the results and approved the final version of the manuscript.

References

Ali, N., M. Ghazal, T., Ahmed, A., Abbas, S., A. Khan, M., Alzoubi, H., Farooq, U., Ahmad, M., & Adnan Khan, M. (2022). Fusion-Based Supply Chain Collaboration Using Machine Learning Techniques. Intelligent Automation and Soft Computing. Retrieved April 15, 2023, from https://www.researchgate.net/publication/355163382_Fusion-Based_Supply_Chain_Collaboration_Using_Machine_Learning_Techniques

Amsler, S., & Shea, S. (2021, March 31). What is RFID and how does it work?. IoT Agenda. Retrieved Jun 1, 2023, from https://www.techtarget.com/iotagenda/definition/RFID-radio-frequency-identification

Caputo, A., Marzi, G., & Pellegrini, M. M. (2016, April 4). The Internet of Things in manufacturing innovation processes: Development and application of a conceptual framework. Business Process Management Journal. Retrieved April 16, 2023, from https://www.emerald.com/insight/content/doi/10.1108/BPMJ-05-2015-0072/full/html

Chanal, P. M., & Kakkasageri, M. S. (2020, July 29). Security and privacy in IOT: A survey - wireless personal communications. SpringerLink. Retrieved April 15, 2023, from https://link.springer.com/article/10.1007/s11277-020-07649-9

che nawi, N., Mamun, A., Isa@Yusoff, Y., Salameh, A. A., Muhammad, M. Z., & Hayat, N. (2021). Motivation towards adoption of internet of things (IOT) services in ... Malaysian Journal of Consumer and Family Economics. Retrieved Jun 12, 2023, from https://www.researchgate.net/publication/353355462_Motivation_Towards_Adoption_of_Internet_of_Things_IoT_Services_in_Retailing_Among_Malaysian_Youth

Department of Statistics Malaysia. (2019, December 27). Preliminary Report Wholesale & Retail Trade Census 2019. Retrieved April 14, 2023, from https://www.dosm.gov.my/?r=column/cthemeByCat&cat=463&bul_id=MEo4aFVOWlo4aGNlelpjeTZLWUNwQT09&menu_id=b0pIV1E3RW40VWRTUkZocEhyZ1pLUT09

Fleetwood, D. (2023, May 8). Convenience sampling: Definition, advantages and examples. QuestionPro. Retrieved May 27, 2023, from https://www.questionpro.com/blog/convenience-sampling/

Gillis, A. S. (2023, May 2). What is middleware?: Definition from TechTarget. App Architecture. Retrieved Jun 1, 2023, from https://www.techtarget.com/searchapparchitecture/definition/middleware

James, E. (2022, April 8). What is correlation analysis? A definition and explanation. flexMR. Retrieved May 29, 2023, from https://blog.flexmr.net/correlation-analysis-definition-exploration

Krotov, V., Bauernfeind, A. J., & Building, B. (2017, September 12). The Internet of Things and new business opportunities. Business Horizons. Retrieved April 16, 2023, from https://www.sciencedirect.com/science/article/abs/pii/S0007681317301076

Lee, K., Romzi, P., Hanaysha, J., Alzoubi, H., & Alshurideh, M. (2022). Investigating the impact of benefits and challenges of IOT adoption on supply chain performance and Organizational Performance: An empirical study in Malaysia. Uncertain Supply Chain Management. Retrieved April 14, 2023, from http://growingscience.com/beta/uscm/5278-investigating-the-impact-of-benefits-and-challenges-of-iot-adoption-on-supply-chain-performance-and-organizational-performance-an-empirical-study-in-malaysia.html

Lee. (2022, March 4). 3 challenges of IOT adoption & how enterprises can overcome them. TechGenies. Retrieved May 26, 2023, from https://techgenies.com/3-challenges-of-iot-adoption-and-how-enterprises-can-overcome-them/

Mishra, P., Pandey, C. M., Singh, U., Gupta, A., Sahu, C., & Keshri, A. (2019). Descriptive statistics and normality tests for statistical data. Annals of cardiac anaesthesia. Retrieved May 28, 2023, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6350423/

Ranger, S. (2020). What is the IoT? Everything you need to know about the internet of things right now. ZDNET. Retrieved April 15, 2023, from https://www.zdnet.com/article/what-is-the-internet-of-things-everything-you-need-to-know-about-the-iot-right-now/

Rawat, A. S. (2021, March 31). What is descriptive analysis? - types and advantages: Analytics steps. Analytics Steps. Retrieved May 28, 2023, from https://www.analyticssteps.com/blogs/overview-descriptive-analysis

Rebelo, R. M. L., Pereira, S. C. F., & Queiroz, M. M. (2022, February 10). The interplay between the internet of things and Supply Chain Management: Challenges and opportunities based on a systematic literature review. Benchmarking: An International Journal. Retrieved April 14, 2023, from https://www.emerald.com/insight/content/doi/10.1108/BIJ-02-2021-0085/full/html

Simkus, J. (2023, March 7). Convenience sampling: Definition, method and examples. Simply Psychology. Retrieved from Jun 13, 2023, from https://www.simplypsychology.org/convenience-sampling.html

Simkus, J. (2023, April 14). Pilot study in research: Definition & Examples. Simply Psychology. Retrieved May 28, 2023, from https://www.simplypsychology.org/pilot-studies.html

Statista Research Department. (2022, October 14). Malaysia: Share of wholesale and retail trade to the GDP 2021. Statista. Retrieved Jun 2, 2023, from https://www.statista.com/statistics/1338886/malaysia-share-of-wholesale-and-retail-trade-to-the-gdp/

Tang, C., Huang, T. C., & Wang, S. (2018, July 12). The impact of internet of things implementation on firm performance. Telematics and Informatics. Retrieved April 15, 2023, from https://www.sciencedirect.com/science/article/abs/pii/S0736585318302995

Tu, M. (2018, February 12). An exploratory study of internet of things (IOT) adoption intention in logistics and Supply Chain Management: A mixed research approach. The International Journal of Logistics Management. Retrieved April 14, 2023, from https://www.emerald.com/insight/content/doi/10.1108/IJLM-11-2016-0274/full/html

Vass, T., Shee, H., & Miah, S. J. (2018, June 27). The effect of "internet of things" on supply chain integration and performance: An organisational capability perspective. Australasian Journal of Information Systems. Retrieved April 16, 2023, from https://journal.acs.org.au/index.php/ajis/article/view/1734

Vass, T., Shee, H., & Miah, S. (2020, June 30). IOT in Supply Chain Management: A narrative on retail sector sustainability. International Journal of Logistics Research and Applications. Retrieved April 17, 2023, from https://www.tandfonline.com/doi/full/10.1080/13675567.2020.1787970

Vass, T., Shee, H., & Miah, S. (2021, January 9). IOT in Supply Chain Management: Opportunities and challenges for businesses in early industry 4.0 context. OSCM Journal. Retrieved April 15, 2023, from https://journal.oscm-forum.org/publication/article/iot-in-supply-chain-management-opportunities-and-challenges-for-businesses-in-early-industry-4.0-con

William, K. (2021, August 10). Survey design: Examples, question types, guidelines. SurveySparrow. Retrieved May 29, 2023, from https://surveysparrow.com/blog/survey-design/

William, K. (2022, September 23). What is SPSS? definition, features, types, and use cases. SurveySparrow. Retrieved May 27, 2023, from https://surveysparrow.com/blog/what-is-spss/
Zach. (2022, May 3). What is reliability analysis? (definition & example). Statology. Retrieved May 28, 2023, from https://www.statology.org/reliability-analysis/