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A Foresight Study of the Acceptance Level of Internet of Things (Iot) Among SMEs in Shah Alam, Selangor

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Abstract: The Internet of Things (IoT) is a global network of computer devices that connects the globe. It also has the potential to transform organizations by automating activities that range from inventory management to robotics and automation, therefore reducing costs and saving both time and money. Small and medium enterprises, as well as business industries in general, stand to profit from the expansion of IoT. However, many SMEs struggle to adapt the digital world. Hence, this study was aimed at identifying the factors and the level of acceptance of Internet of Things (IoT) among SMEs in Shah Alam, Selangor. STEEPV analysis will be used in the first phase to identify the factors and the level of acceptance on IoT among SMEs in Shah Alam, Selangor. In the second phase questionnaires and Statistical Package for Social Science (SPSS) statistical analysis were used to study the relationships between the factor and level of acceptance on IoT among SMEs. It is anticipated that the findings of this study would give important and insightful information to many businesses in relation to knowledge upon achieving competitive advantage during the emerging digital era. The result of the survey concluded that key driver "Effectiveness of Technology", and secondly the key driver "Environment Sustainability", these results were discovered from scenario building. The findings of this study will help small and medium-sized enterprises (SMEs) and other types of businesses that have the potential to adopt technology and enhance their financial performance, employee productivity, and customer relationships.

Keywords: Internet of things, IoT, SMEs, Foresight

1. Introduction

The Internet of Things (IoT) is an emerging and cutting-edge technology that, by linking physical items to one another, has the potential to revolutionize the world. The term "Internet of Things" refers to low-power gadgets that are connected to one another over the internet. It is anticipated that the Internet of Things will create a favourable environment that will affect and influence a range of aspects

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of day-to-day living and commercial applications, in addition to contributing to the expansion of the global economy (Akpakwu *et al*., 2017). On the other hand, the Internet of Things (IoT) can be viewed as a worldwide framework for the information society. This is because it enables expanded services by connecting physical and virtual things through the use of existing and emerging information communication technologies that are compatible with one another (ICT).

The internet of things, also known as IoT, is a network of interconnected computer equipment, digital machinery, commodities, animals, or people with the capacity to transfer data without the need for human-to-human or human-to-computer contact. This network is also known as the internet of things (Gillis, 2022). An Internet of Things (IoT) ecosystem is made up of web-enabled smart devices that collect, send, and act on data from their surroundings utilizing embedded systems such as CPUs, sensors, and communication gear. These devices may also share this data with other IoT devices in the ecosystem. Internet use is no longer a choice but rather a must for conducting business in today's hyperconnected society, when the number of connected gadgets outnumbers the population. The Internet of Things (IoT) is becoming increasingly important in the workplace as a result of the anticipated rise in the purchasing power of customers in the digital age brought on by the increased use of the internet and social media (Labrecque *et al*. 2013).

Many firms, especially SMEs, struggle to adapt to the digital world. Rapid development in several industries has companies worried about the future. Many of them don't understand how their firm will be affected or what actions must be taken to safeguard its future. Fear and confusion are exacerbated by IoT and digitalization discourse. Popular media and web articles assert that "the Internet of Things can disrupt any corporation or business domain at any time." This produces "digital anxiety," which raises fear but doesn't offer solutions (Holm *et al*., 2015). Small and medium-sized enterprises (SMEs) that employ little or no information technology (IT) in their goods or production processes have a high barrier to entry into the internet of things (IoT), where products are turned into services and all activities become data driven. Companies without software, sensors, actuators, big data, or IoT business model expertise may have difficulty implementing IoT business models. A small company with 10-20 workers may not be able to afford numerous IoT experts (Bossen & Ingemansson, 2016). Changing product categories, production procedures, or corporate strategy may be difficult because of this. This definitely demonstrates that the applications of the Internet of Things have a significant amount of untapped potential in terms of bolstering the economics of the commercial industry. As a result, the purpose of this article is to investigate the level of acceptability of IoT among SMEs in Shah Alam, Selangor.

Therefore, to achieve the research objectives the key drivers of Internet of Things (IoT) among SMEs in Shah Alam, Selangor. Consequently, the future trends of Internet of Things (IoT) among SMEs in Shah Alam, Selangor is identified.

This research will be focusing on Small Medium Enterprise (SME) in Shah Alam, Selangor in order to gain information about the acceptance level of Internet of Things that they used.

The priority of the Internet of Things (IoT) in business especially for SMEs is important to maximize profits as well as to reduce costs at the same time to stay in the market. This study will be able to help businesses by investigating the level of acceptance of the Internet of Things (IoT) in the business industries and improvements on related sectors. In addition, this study also provides some insight into the current trends and priorities of the Internet of Things (IoT) in business.

2. Research Methodology

In this chapter, we will go over the standard procedures and approaches used by researchers. Throughout any study, the approach used to conduct the research is crucial. If all goes according to plan, the data collection procedures will bring about the desired results in the research. Everything you

need to know about planning a study, choosing a sample size, gathering data, using a statistical tool, and analysing your findings can be found in this section.

2.1 Research Design

Before the research started, the researcher should decide the design of their research. There are three types of designs which are quantitative, qualitative, and mixed method (Abutabenjeh & Jaradat, 2018). The guidelines of the techniques and steps of the study will be provided by the method chosen in the research. The analysis in this study is purely quantitative in nature. The generation of numerical data and its subsequent transformation into statistical results is the essence of quantitative research. According to Rahi (2017), the strategy will put an emphasis on data collection and analysis from problems affecting large populations, while disregarding the impact of these factors on individual people and their surroundings. Questionsaires, online surveys, mobile phone surveys, and other similar methods will all be used to collect the necessary information. As a result, this study will concentrate on using questionnaires to collect data from respondents and accomplish the study's aims.

2.2 Research Flowchart

The flowchart in a clear view of the plan for the entire research. The flow chart guides the researcher to carry out the research in the correct way.

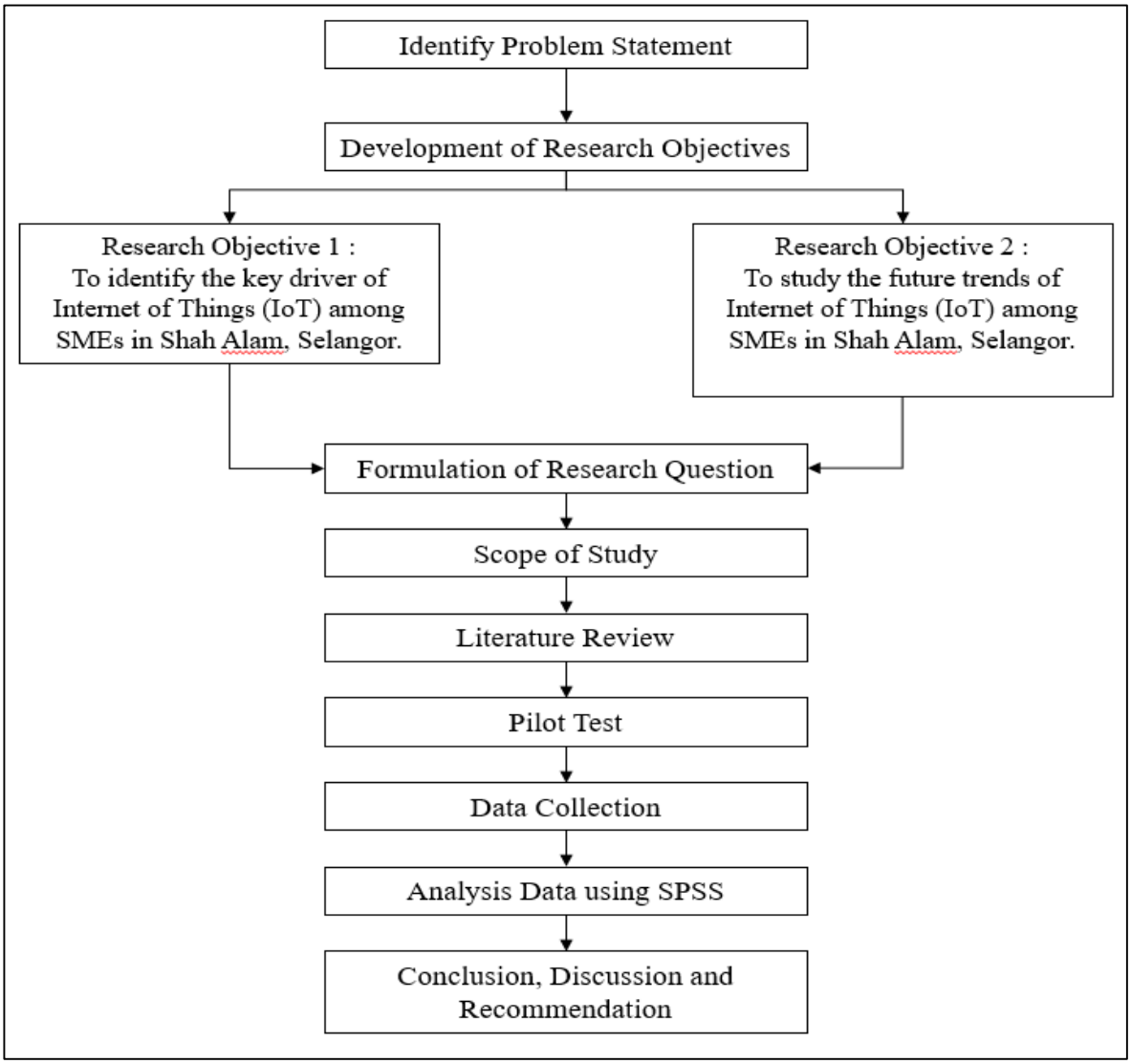

Figure 1: Research Flowchart

2.3 Foresight process and Foresight study

Several processes are included in the foresight process, including horizon scanning, data analysis using the STEEPV approach, and identifying the factors that influence the level of acceptance of Internet of Things (IoT) among SMEs in Shah Alam, Selangor.

a) Horizon scanning

Horizon scanning is the process for identifying potential changes, specific problems and threats, continuing issues, early warning signals, or trends by paying attention to technology and how it impacts things.

b) STEEPV analysis

According to Nazarko and Kuźmicz (2017), STEEPV is a technique used to discover possible driving forces in order to evaluate future demands or capabilities. STEEPV analysis was utilised in this study to measure the level of acceptance of IoT in Shah Alam, Selangor.

Table 1: Area of STEEPV in the research

Drivers	Related area
Social	Income level, lifestyle, demographic structure, and cultural norms
Technological	Advances in technological technology, levels of innovation, automation, research and development and technological change
Economic	Economic growth, exchange rates, inflation rates, interest rates, disposable income, labour costs and unemployment rates
Environmental	Weather and climate, waste management, use of green or eco-friendly products, practises and environmental laws
Political	Restriction, foreign trade and tax policies
Values	Human ethics, morals and beliefs

2.4 Research Populations and Sample

According to Manna and Mete (2021), The term "population" refers to a group of people or institutions that have a common trait of interest to researchers. After collecting data from a subset (sample) of a large group (population), the results are used to determine the sample size needed for the target population.

a) Population

The population for this research will focusing on the SMEs from the medium level which indicates that the numbers of employees in the range of 30 to 75 employees with the sales turnover RM 3 million to RM 20 million for services and other sectors while 70 to 200 employees with sales turnover RM 15 million to RM 50 million is for manufacturing sectors.

b) Sampling

This research was based on purposive sampling, from the one who was willing to participate in the survey was selected. Purposive sampling techniques were used since only selected residents would be the ones to answer the questionnaire. Out of 179271 SMEs in Selangor, Krejcie and Morgan (1970) indicated 384 respondents for the sample size of this study. Respondents are among the SMEs in

Selangor, especially those under the medium size of SMEs. The questionnaires will be distributed to 384 SMEs in Selangor to get feedback from the respondents.

2.5 Research Instrument

According to Sathiyaseelan (2015), Instruments used by researchers to collect data are called research instruments. A questionnaire survey was employed as a research tool in this study.

a) Questionnaire

Researchers are sending out questionnaires to find out how well Internet of Things (IoT) is accepted by small and medium-sized enterprises (SMEs) in Selangor. Table 2.2 shows how the questionnaire is put together.

Table 2: Structure of Questionnaire

Part	Elements
A	Demographic background
B	The importance on acceptance of Internet of Things (IoT) among SMEs in Shah Alam, Selangor
C	The impact of Internet of Things (IoT) among SMEs in Shah Alam, Selangor
D	The uncertainty of acceptance of Internet of Things (IoT) among SMEs in Shah Alam, Selangor.

2.6 Pilot Study

According to Ismail, Kinchin & Edwards (2018), Research projects that are smaller than the final full-scale study are called pilot studies. Cronbach's alpha is a measure of internal consistency that may also be used to evaluate the dependability of a scale. Pilot studies and genuine research will include these tests. Internal consistency ranges from extremely low (low) to very high (high) for the alpha range of 0–1. The scales are internally consistent, as indicated by an alpha value of 0.07 (Bernadi, 1994).

2.7 Data Collection

In general, there are two types of information: primary and secondary. In this study, the researchers used data from both of these places. Kabir (2016) defines "primary data" as evidence gathered directly from a subject. When people talk about "secondary data," they mean information gleaned from sources that have previously been made public in some way (Kabir, 2016).

2.8 Data Analysis

The data was analysed using SPSS, which stands for the Statistical Package for Social Science. The researcher uses SPSS to analyse the data obtained from the questionnaire once respondents have finished it.

a) Descriptive analysis

The characteristics of a set of data may be summarised and classified using descriptive statistics (Pritha Bhandari, 2020). The data gathered by distribute the questionnaire, SPSS will be used to analyse the results. The study's findings will be interpreted based on the mean score. As a result, the interpretation of the mean score is provided in table.

Table 3: Mean Score

Mean score	Interpretation
1.00 - 1.80	Very low
1.80 - 2.60	Low
2.61 - 3.20	Medium
3.21 - 4.20	High
4.21 - 5.00	Very high

b) Impact-uncertainty analysis

In a scenario project, participants can use the Impact-Uncertainty Grid to identify two key uncertainties that they can use to the design of four distance possibilities (Wulf, Meissner & Stubner, 2011). In order to develop the impact-uncertainty analysis, a list of variables is produced based on importance, impact, and uncertainty.

c) Development of scenario analysis

For the impact-uncertainty study, we used the top two drivers to produce the scenario analysis. Defining possible outcomes such as future trends, strategy and future-related development is the purpose of this document. In order to better understand the future consequences of the degree of IoT adoption among SMEs in Selangor, four possible alternative scenarios were formulated.

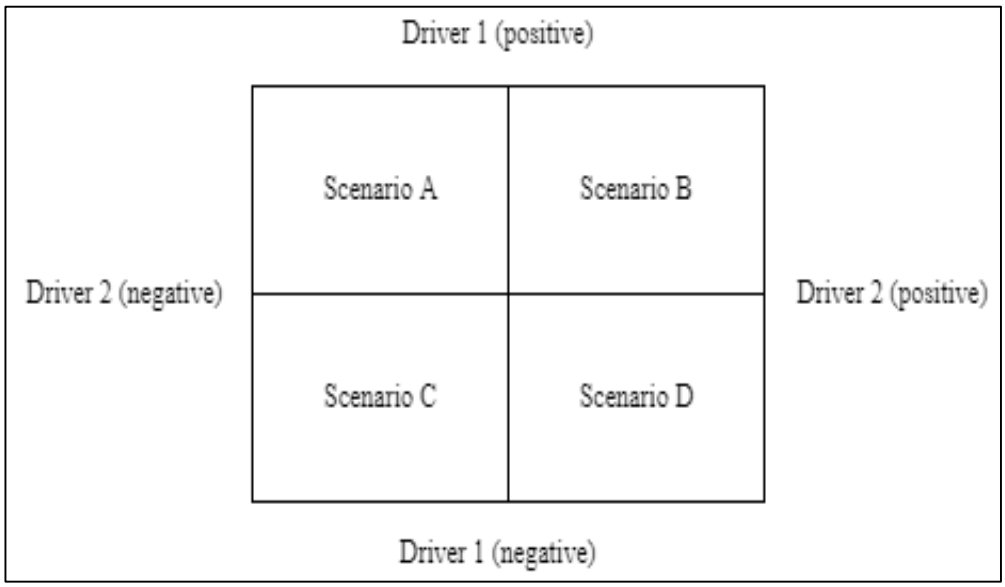

Figure 2: Scenario Analysis

3. Literature Review

A literature review examines previous studies, theses, papers, books, and websites on a particular subject in order to discover applicable theories, methodologies, and research gaps (Shona, 2019).

3.1 STEEPV Analysis

In the form of a more systematic table, a wide range of relevant issues and drivers toward the acceptance level of Internet of Things (IoT) among SMEs were identified in the social, technological, economic, environmental, political, and values (STEEPV) analysis.

a) Issue and challenges related to social

Product demand and business operations depend on money, lifestyle, demographics, cultural norms, and preferences. Changes in society can affect business. Thus, understanding trends and consumer tastes is crucial.

Table 4: Issue and challenges related to social

No	Issues and Challenges	Drivers
1	Exposure and misuse of sensitive customer information, such as credit card details and phone numbers, constitutes a privacy risk (Forsythe and Shi, 2003).	Privacy
2	An Inadequate Code (other unique identifier) Concerning safety, many Internets of Things gadgets are released to the wild with insecure factory-issued passphrases, keys, or secrets.	Security
3	A proper skilled resource working on the IoT application development. (GeeksforGeeks, 2021)	Lack of skill set
4	Many European Union residents avoided making purchases online because they did not feel safe doing so (Flavián & Guinalu, 2006).	Lack of trust

b) Issue and challenges related to technological

Innovation can benefit or hurt an industry. Technology has transformed work. Technology at work speeds up and reduces errors. Business success depends on innovation, automation, R&D, and technological transformation.

Table 5: Issue and challenges related to technological

No	Issues and Challenges	Drivers
1	IoT is revolutionising the connection between customers and service providers.	Operations
2	IoT faces are related to traffic loads and various traffic models	Software and OS
3	Businesses need to increase the number of sensors, routers, gateways, and cameras they use as part of the Internet of Things (IoT), as well as the number of monitoring platforms and services they use (Shacklett, 2021).	Network
4	The decrease in price, size, and power consumption of sensors is directly proportional to these factors (Comini, 2021).	Sensors
5	The high energy consumption (Samizadeh Nikoui *et al*., 2020)	System architecture

c) Issue and challenges related to economic

Economic elements determine an economy's performance. Business decisions are influenced by economic growth, exchange rates, inflation, interest rates, consumer disposable income, labour expenses, and unemployment. Corporate social responsibility (CSR) helps businesses survive.

Table 6: Issue and challenges related to economic

No	Issues and Challenges	Drivers
1	A major incentive for business creation, investment, and operation	Capital
2	Maintenance of Complementary Product Technology Development	Innovation Sector

d) Issue and challenges related to environmental

Environmental issues can affect business. Weather, climate, waste management, green goods and practises, and environmental regulations all affect environmental development.

Table 7: Issue and challenges related to environmental

No	Issues and Challenges	Drivers
1	There is a great deal of information to learn.	Green ICT principles
2	Low power equipment	Energy Consumption

e) Issue and challenges related to political

The political climate and state of a country are two aspects of its government. Regulatory agencies have the power to affect private sector organisations. It is important to take into account a possible market's restrictions, foreign trade, and tax rules.

Table 8: Issue and challenges related to political

No	Issues and Challenges	Drivers
1	Incentives can be offered through the IoT in an effort to change consumer or employee behaviour, whether it be to buy a product, engage in healthier behaviours, or adopt a new approach to the workplace.	Privacy Issues and The Potential for Reduced Autonomy
2	Internet of Things (IoT) and pervasive computing allow for more commercial channels to reach customers with messaging and adverts.	Manipulation For the Economic Gain of Big Business
3	Although the Internet of Things (IoT) is still in its infancy, its potential political and economic effects on citizens and end-users are already being felt.	Citizens ruled by software

f) Issue and challenges related to value

Human ethics, morals, and beliefs are examples of value-based elements. Values describe what matters most in life, such as how things should be or how people act.

Table 9: Issue and challenges related to value

No	Issues and Challenges	Drivers
1	A customer may be deemed dissatisfied if the level of service they received falls short of their expectations. On the other hand, it's safe to assume that the customer is delighted when the service's quality exceeds their expectations (Schuetz *et al*., 2014).	Level of service satisfaction

3.2 Merged Issues and Drivers

Table 10: Merged Issues and Drivers

No	Issues	Drivers
1.	Internet of Things (IoT) provides better solution and compliance to business.	Effectiveness of Technology
2.	Hacker threats and potential in personal data leak needed to construct highly secure system	Privacy and security challenge
3.	Easy access of data by using Internet of Things (IoT)	Shorter processing time
4.	Internet of Things capable to process big data.	Data Analytics
5.	Internet of Things (IoT) reduce carbon emissions, hence protecting the environment	Environmentally friendly
6.	Internet of Things (IoT) provide high efficiency, productivity and less errors.	Improve Productivity
7.	Move toward use of high technology and growth in the service market	Technology Accessibility
8.	Higher successful rate of Internet of Things (IoT) compared to conventional method	Higher level of efficiency
9.	Internet of Things (IoT) provide better service and serve a wide range of customers	Unrestricted location
10.	Internet of Things (IoT) replace the employee and require higher education level, skills, and knowledge for working with technology.	Less job opportunities for unskilled people

4. Data Analysis and Findings

4.1 Response Rate

Krejcie and Morgan's (1970) formula for calculating a sample size from a given population suggests that at least 384 participants will be needed for this study's questionnaire. The survey was sent out via several social media and messaging apps including Facebook, WhatsApp, Gmail, and Telegram. According to Table 4.1, only 200 of the 384 eligible respondents have finished the survey's questionnaire. This equates to a response rate of 52.08 percent for this survey.

Table 11: Questionnaire Response Rate

Population (SME's)	Sample Size	Returned (Valid) Questionnaires	Response Rate (%)
125,904	384	200	52.08

4.2 Respondent Demographic Information

The table 12 displays the respondents' total results broken down by frequency and percentage. Statistics on the gender and age breakdowns, the number of different ethnic groups found in Malaysia, the size and education levels of businesses, and more are all included.

Table 12: Respondent Demographic Information

Demographic Information		Frequency (f)	Percentage (%)
Gender	Male	156	78
	Female	44	44
	Total	200	100
Age	Below 30 years old	10	5.0
	31 – 35 years old	25	12.5
	36 – 40 years old	61	30.5
	41 – 45 years old	68	34.0
	46 years old and above	36	18.0
	Total	200	100
Races	Malay	129	64.5
	Chinese	54	27.0
	Indian	17	8.5
	Total	200	100
Size of Enterprise in Terms of Number of Employees	Micro (1-9 employees)	0	0
	Small (10-99 employees)	117	58.5
	Medium (100-199 employees)	83	41.5
	Total	200	100
Level of awareness of Internet of Things (IoT)	High awareness	108	54.0
	Moderate awareness	92	46.0
	Total	200	100
Prefer using Internet of Things (IoT)	Yes	200	100
	Total	200	100

4.3 Impact-Uncertainty Analysis

The mean value comparison between the level of impact and the level of uncertainty is shown in Table 13. In the impact-uncertainty study, this table indicates the associated mean for each driver.

Table 13: Descriptive Analysis on Impact Variables

No	Drivers	Mean	
		Uncertainty	Impact
D1	Effectiveness of Internet of Things (Iot)	1.95	4.20
D2	Privacy and Security challenges	1.87	4.21
D3	Easy access	1.90	4.38
D4	Data Analytics	1.88	4.10
D5	Environment sustainability	2.01	4.38
D6	Business Benefits	1.83	4.25
D7	Technology Accessibility	1.94	4.17
D8	Multichannel Communication	1.80	4.27
D9	Access of location	1.83	4.35
D10	Human capital competencies	1.94	4.10

A complete effect and uncertainty analysis was performed using all available information. The top two coordinate with high impact and high uncertainty analyses. The most significant and questionable coordinates were (1.95, 4.20) and (D1, D5) (2.01, 4.38)

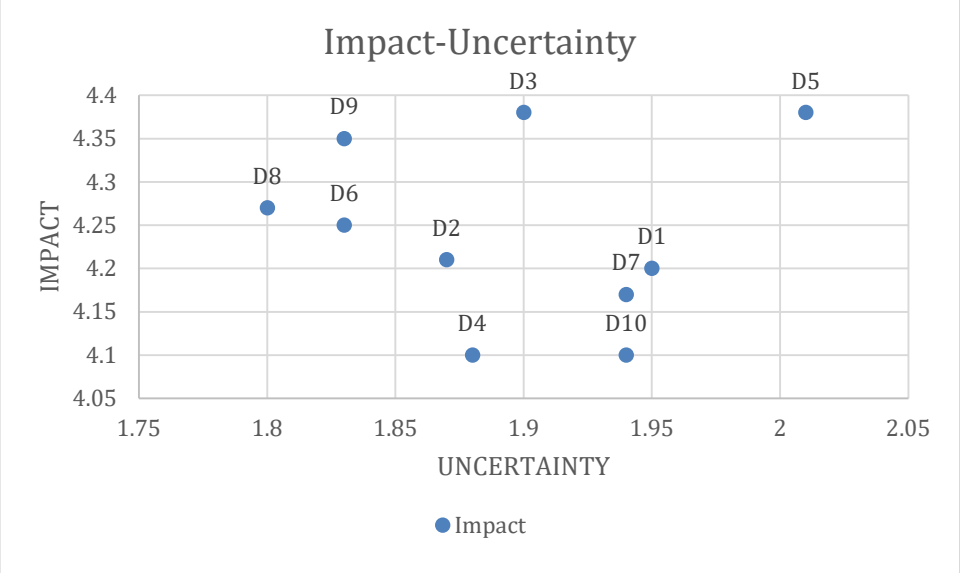

Figure 3: Impact-Uncertainty Analysis

4.4 Importance-Uncertainty Analysis

The mean value comparison between the level of impact and the level of uncertainty is shown in Table 14. In the importance-uncertainty study, this table indicates the associated mean for each driver.

Table 14: Descriptive Analysis on Importance Variables

No	Drivers	Mean	
		Uncertainty	Importance
D1	Effectiveness of Internet of Things (Iot)	1.95	4.17
D2	Privacy and Security challenges	1.87	4.24
D3	Easy access	1.90	4.31
D4	Data Analytics	1.88	4.10
D5	Environment sustainability	2.01	4.31
D6	Business Benefits	1.83	4.24
D7	Technology Accessibility	1.94	4.17
D8	Multichannel Communication	1.80	4.24
D9	Access of location	1.83	4.31
D10	Human capital competencies	1.94	4.17

All data were utilised to provide an impact uncertainty analysis, as shown in Figure 4.2. D1 (1.95, 4.17) and D5 were the top two coordinates with the highest impact and uncertainty analyses (2.01, 4.31).

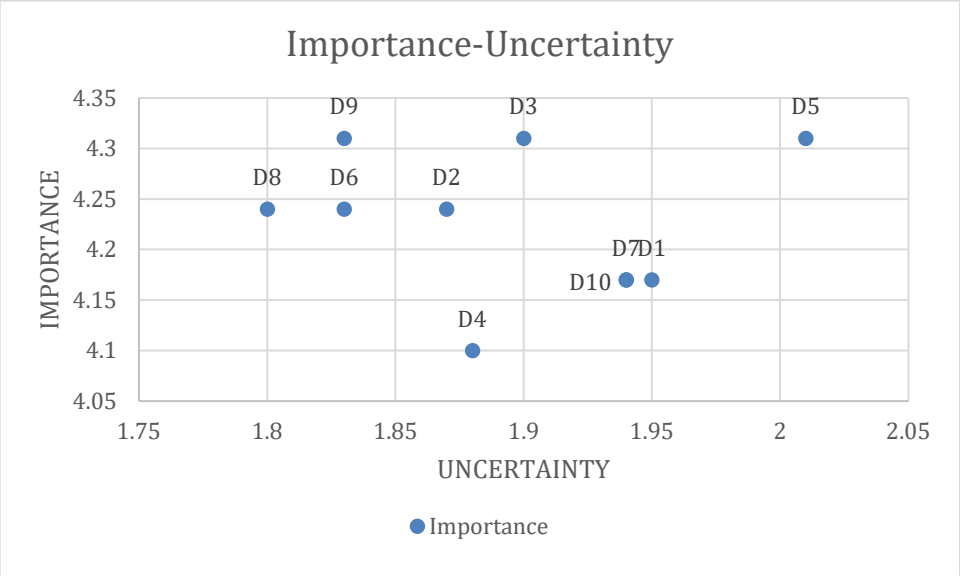

Figure 4: Importance-Uncertainty Analysis

5. Discussion and Findings

5.1 First Objective

In this research, the first objective has been completed and achieved in Chapter 3. Past research journals and recent legitimate technology websites from various resources regarding the Internet of Things (IoT) were filtered and categorized according to the STEEPV analysis which are social, technological, economic, environmental, political and values.

5.2 Second Objective

Through quantitative research approach. The second objective of this research was achieved through impact-uncertainty analysis in Chapter 4. The results of the impact-uncertainty analysis found that two key drivers that have the highest impact and highest uncertainty are "Effectiveness of Internet of Things (IoT)" and Environment Sustainability". To further understand the impact of the key drivers on the future of Internet of Things (IoT) technology, a 2*2 matrix scenario was developed. There are two dimensions for each key driver, as shown in figure 5.

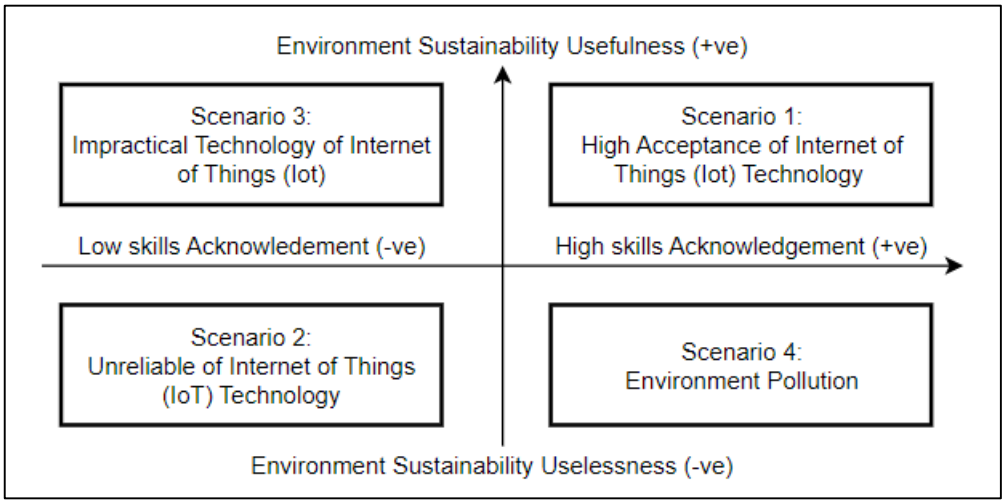

Figure 5: Matrix Scenario

(a) Scenario 1: High acceptance of Internet of Things (IoT) Technology

In the first scenario, we leverage two factors that have the potential to increase people's interest in and adoption of IoT: environmental sustainability and recognition of highly developed skill sets. Both the "Malaysia Digital Economy Blueprint" and the "National 4IR Policy" were recently released. They were released because Malaysia saw a need to close the gap in digitalization adoption and Internet connectivity. In addition, the manufacturing sector is the only one that the industry 4wrd policy applies to (Abbas, 2022). Thanks to IoT, businesses may cut down on manual labour and streamline their operations. It offers transparency into consumer transactions, reduces waste, and enhances service delivery, all while lowering manufacturing and shipping costs (Gillis, 2022).

(b) Scenario 2: Unreliable of Internet of Things (IoT) Technology

Scenario 2 the worst imagine that the internet of things (IoT) cannot supply customers with environmental sustainability, uselessness, and poor skill acknowledgement. But it's dark. First, IoT devices will generate and send a lot of data. All that network traffic uses electricity. Batteries will power several of these devices. The frequency of battery replacement increases landfill waste. Because billions of "things" need billions of batteries, the Internet of Things (IoT) may provide a growing dilemma (Fong, 2017). Many Internets of Things products are rushed to market without security or privacy protections. 77% of global customers stated privacy and security information influences their buying decisions. Privacy and security concerns prevented 28% of non-owners from buying linked gadgets. The survey found that security and privacy concerns outweigh cost concerns when buying IoT devices (Rayome, 2019).

(c) Scenario 3: Impractical Technology of Internet of Things (IoT)

For scenario 3, if able to obtain environmental sustainability usefulness by using internet of things (IoT) but have low skills acknowledgement. Ironically, there is less anxiety about jobs being eliminated because of the rise of the Internet of Things (IoT), and more concern about skills shortages and how to

fill new roles that are being created as a result of its expanding adoption. The Internet of Things (IoT) networks require new levels of skill centred on data analytics and data science; nevertheless, there is a dearth of relevant knowledge. The Internet of Things (IoT) calls for a combination of information and operational technology skills, which might be difficult to locate in a single individual. Businesses are hampered by a fragmented skills system as well as a lack of systematic engagement between school and business, both of which contribute to a skills shortage. This shortfall is particularly pronounced in digital engineering talents. The Internet of Things (IoT) innovation has been concentrated on domains in which machine learning can readily outperform humans. These are the tasks that are being digitalized first, and as a result, retraining and filling the skills gap are becoming increasingly important (Easen, 2022).

(d) Scenario 4: Environment Pollution

The last scenario has high talents and environmental uselessness. Few environmental factors also affect customers. These acts affect the surroundings before the gadget is plugged in and turned on. After turning on the computer, the effect changes drastically. A normal desktop PC uses 60–300 watts. Some programs need more processing or display power. Some computers idle. Imagine the heat produced by forty 100-watt light bulbs in a room. An eight-hour workday requires 32 kilowatt hours. Imagine suppose 10 million such rooms shipped 10 million new computers in the future. Electricity needs 320 gigawatt hours. Given that desktop computers last three to five years, their power usage could be five times that amount. Whether power is generated by fossil fuels, nuclear energy, or "renewable" sources like wind or solar, it affects the environment. Wait—more. there's Computers waste a lot of energy as heat. Temperature management systems are necessary because people and computers behave unreliably over a particular temperature. Air conditioning requires power to maintain workplace temperatures (Poor, 2019).

5.3 Conclusion

In sum, this study accomplished what the researcher set out to do. The STEEPV process's initial goal is to determine the primary factors influencing customers' positive attitudes about the Internet of Things (IoT) through a review of relevant literature. The STEEPV framework considers the interplay of socioeconomic, technological, ecological, political, and value considerations. Based on the results of STEEPV, the author concludes that social factors (23 frequencies) are more influential than technological factors (16 frequencies) in determining future Internet of Things (IoT) adoption and use.

Future trends in the Internet of Things were analysed to accomplish the second goal (IoT). A questionnaire survey was used to accomplish this goal. The researcher conducted an impact-uncertainty study to determine that environmental sustainability effectiveness and skills acknowledgment on Internet of Things (IoT) technology were the two most important factors. Customers may help Malaysia achieve its goal of becoming an innovative developed nation by investing in cutting-edge technology so that everyone can benefit in the future.

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