

# Analysis of Relationship between Internet of Things (IoT) Implementation and Digital Marketing Among MSMEs in Selangor

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## Abstract

The implementation of Internet of Things (IoT) technology has become integral to the digital transformation of Micro, Small, and Medium Enterprises (MSMEs) in Selangor. This study explores the dynamic relationship between IoT adoption and digital marketing strategies within this sector. As MSMEs leverage IoT for enhanced operational efficiency, real-time data collection, and process automation, a significant impact on digital marketing practices is observed. The interconnected nature of IoT devices facilitates targeted customer engagement, personalized marketing strategies, and data-driven decision-making. MSMEs in Selangor are increasingly recognizing the symbiotic relationship between IoT implementation and digital marketing, viewing it as a catalyst for competitive advantage and market expansion. The research will use quantitative method to collect data. The population are MSME owners, managers, administrative and staffs. The data collected through the questionnaire will be analysed using Statistical Package for Social Sciences (SPSS) and forecasting techniques.

## 1. Introduction

The Internet of Things (IoT) is causing revolutionary developments in Malaysia's diverse industries. Malaysia, as a country eager to embrace technology breakthroughs, has integrated IoT to improve efficiency, connection, and innovation. Government efforts such as the National IoT Strategic Roadmap have advanced IoT adoption in Malaysia, highlighting the importance of IoT in economic growth and enhancing citizens' quality of life (National IoT Strategic Roadmap, 2020). Collaboration between the public sectors has opened the path for IoT-enabled smart infrastructure, establishing Malaysia's position as a regional leader in this emerging technology. Malaysia has entered on a significant digital transformation journey, with the Internet of Things (IoT) emerging as a critical engine of innovation across several industries. Malaysia is a regional leader in IoT deployment, thanks to strategic initiatives, collaborative collaborations, and widespread acceptance.

The Smart Cities plan is one of the principal domains anticipating strong IoT integration. Malaysia's large urban centers are embracing IoT technology to improve efficiency, sustainability, and overall citizen quality of life. Intelligent traffic control systems, waste management solutions, and energy-efficient public lighting are examples of smart infrastructure that demonstrate the country's dedication to developing connected and living urban environments (Smart Cities, Malaysia, 2022). Industry 4.0 ideas are gaining acceptance in the industrial environment because of IoT adoption. Manufacturing plants are implementing IoT-enabled sensors, robots, and analytics to improve production processes, monitor equipment health, and allow predictive maintenance. This

not only increases productivity but also places Malaysian industries on the forefront of global competitiveness (Industry 4.0 Report, Ministry of International Trade and Industry, Malaysia, 2021).

Malaysia is seeing a rise in the use of the Internet of Things (IoT) by Micro, Small, and Medium Enterprises (MSMEs). The Malaysian government has played a significant role in encouraging MSMEs to use IoT. Grants, training programs, and awareness campaigns have all played a role in fostering an ecosystem suitable to digital change. Collaborations between the government, industry groups, and technology suppliers have also made IoT solutions more accessible to MSMEs, bridging the digital gap.

## 1.1 Research Background

The research aims to investigate the intricate connection between the implementation of Internet of Things (IoT) and the landscape of digital marketing within Micro, Small, and Medium Enterprises (MSMEs) in Selangor. With a substantial population size of 179,271, comprising MSME owners, managers, administrators, and staff, this study seeks to delve into the impact of IoT adoption on digital marketing strategies. The exploration will encompass factors such as new product design and development, big data analytics, customization of good and services, predicting customer taste and preference and buying behaviour and better customer engagement within the unique context of Selangor's MSME sector.

## 1.2 Problem Statement

In Malaysia there are total of 1,173,601 MSMEs based on the latest data in Malaysia Statistical Business Register (MSBR) published by the Department of Statistics, Malaysia (DOSM) in July 2023. However, the report made by Malaysia Digital Economy Blueprint, there are 875 000 which is 74.5% of MSMEs in Malaysia using digitalization in their business. Nowadays, it's difficult to write about marketing and consumer behavior without mentioning social media. The latter has evolved into an environment in which users engage in many communications as well as the creation and distribution of content. This is aided further by the rise of online communities (Kaplan & Haenlein, 2010), which allow businesses to infiltrate their presence to specific groups (Wirtz *et al.*, 2013). For a long time, commercial organizations have been gathering and analyzing growing amounts of data, resulting in the creation of viable frameworks for distributed data analysis. However, the integration of IoT into the digital marketing strategies creates security challenges including data breaches and privacy concerns which would have deterring businesses from fully embracing IoT technologies in their marketing practices (Abashidze & Dabrowski, 2016).

The next fundamental problem that organizations confront when building successful user interfaces for IoT devices is within the context of digital marketing. As the Internet of Things (IoT) expands, linking a wide range of devices from smartwatches to home appliances, the requirement for smooth and intuitive user interfaces becomes critical. Developing interfaces that not only collect data from IoT-enabled devices but also deliver processed data to end users is a complicated issue. This problem goes beyond simply assuring functioning; it also entails delivering a good and engaging user experience that is compatible with the different nature of IoT devices.

It also emphasizes the need to overcome difficulties in developing user interfaces that adapt to the features of each IoT device in the digital marketing landscape, where user engagement is critical to success. Businesses must manage the intricacies of varied user engagements, whether it is a wearable fitness tracker or a smart home gadget. Achieving a balance between functionality, aesthetics, and user-friendliness is critical for delivering value and ensuring users can quickly understand and act on data offered by IoT devices. This problem necessitates creative design solutions that consider the many settings in which IoT devices function, providing a seamless integration of technology into customers' daily lives while increasing the overall efficacy of digital marketing initiatives.

IoT technology being used in digital marketing campaigns. In today's digital world, the revolutionary potential of data science is hampered by a significant skill gap, with firms unable to find staff skilled in processing and analyzing data for strategic decision-making (Palmer, 2019). Simultaneously, as organizations wrestle with efficiently exploiting IoT technology to maximize consumer interactions and obtain valuable data for targeted marketing activities, the use of IoT in marketing faces challenges (Article, Skelia, 2020). This twofold difficulty represents a substantial impediment to developing a healthy constructive collaboration between data science and IoT in the sphere of digital marketing. The demand for data-driven decision-making demands experienced people who can successfully manage the complexities of comprehending and using data insights (Palmer, 2019). Meanwhile, unmet IoT marketing potential represents a squandered chance for organizations to improve client interaction and adjust tactics based on the amount of data supplied by IoT-enabled devices (Article, Skelia, 2020). Bridging the data science talent gap while improving the integration of IoT technology is a major necessity for firms looking to maximize the potential of their digital marketing efforts.

Therefore, to achieve the research objectives the level of IoT implementation among MSME in Selangor is determined. Furthermore, the level of digital marketing among MSME in Selangor also determined.

Consequently, the relationship between IoT implementation and digital marketing among MSME in Selangor is identified.

### 1.3 Research Scope

This study has been conducted in Selangor; the survey method will be used as a quantitative research method. The respondents for this survey will be the MSMEs owners, managers, administrative, and staff. The questioner will be developed and distributed to 384 respondents. The survey will be held in Selangor because it has the highest number of registered MSMEs.

### 1.4 Significant of Study

Internet of things (IoT) implementations has been grown rapidly in Malaysian for past few years. Hence, this study is conducted to analyze the relationship between IoT implementation and digital marketing among MSMEs in Selangor. This study is conducted to enhance the knowledge of researchers about the topic studied, so they will more be understanding about the IoT implementations. This study will assist the Micro Small Medium Enterprise owners by investigating the relationship between IoT implementation and digital marketing among MSMEs as well as the improvements.

## 2. Literature Review

### 2.1 Introduction

The study includes a critical examination of literature. The review of the literature should be pertinent to a search and assessment of the body of work on the topic or issue that the researcher has chosen. It provides the researcher with a comprehensive view of the state of the field, enabling them to identify useful concepts, approaches, and research gaps. In this chapter, the definitions of the topic and term will be discussed.

### 2.2 Internet of Things (IoT)

The Internet of Things (IoT) is a transformative paradigm that involves connecting everyday objects and devices to the internet, enabling them to collect and exchange data. These interconnected devices can range from common household items like refrigerators and thermostats to industrial machinery and wearable devices (Antonis, 2019). The primary goal of IoT is to create a network of smart, responsive devices that can communicate with each other and with users, leading to enhanced efficiency, automation, and improved decision-making processes across various domains.

One key aspect of IoT is the deployment of sensors and actuators in physical objects, allowing them to gather real-time data and respond to specific conditions. For example, in a smart home scenario, IoT-enabled sensors in a thermostat can collect information about room temperature, and actuators can adjust the heating or cooling system accordingly. This level of automation and responsiveness is a hallmark of IoT applications, providing convenience and energy efficiency.

The proliferation of IoT has been driven by advancements in communication technologies, such as wireless networks and low-cost sensors, making it feasible to connect a vast array of devices. Standardized communication protocols and the development of cloud computing have also played a crucial role in managing and analyzing the enormous volume of data generated by IoT devices. As a result, IoT has found applications in diverse sectors, including healthcare, agriculture, transportation, and manufacturing, ushering in a new era of interconnected and intelligent systems.

### 2.3 Micro Small Medium Enterprises (MSME)

A review of the definition was done in 2013, and a new MSME definition was approved at the 14th NSDC Meeting in July 2013. This was because the economy has seen numerous changes since 2005, including price inflation, structural changes, and changes in business practices. The definition applies to every industry, including services, manufacturing, agriculture, construction, and mining & quarrying. The "OR" basis is used to determine the definition using the following two criteria: sales turnover and the number of full-time employees. Small to medium-sized businesses (MSMEs) are those with annual sales of less than RM50 million or less than two hundred full-time employees (SME Corp. Malaysia, n.d.).

Businesses that fall below a specific threshold in terms of income, assets, or personnel count are known as micro small and midsize companies (MSMEs). Each nation has its own definition of what small and medium businesses are. To define what a small firm is across sectors; each nation may also establish distinct rules. MSMEs are crucial to the health of an economy because they provide jobs for large numbers of people and foster innovation. Governments frequently provide incentives, such as preferential tax treatment and easier access to loans, to support the continuation of MSMEs.

Every country's economy in the globe benefits from the MSMEs sector. They serve as the cornerstones for the expansion of both the domestic and global economies. They currently produce over 60% of the world's economic output. Over 90% of businesses globally, which account for more than half of all employment, are MSMEs operations, according to the International Finance Corporation.

## 2.4 Internet of Things (IoT) Implementations in MSME

The implementation of Internet of Things (IoT) in Malaysian Micro, Small, and Medium Enterprises (MSMEs) has gained significant attention due to its potential to enhance operational efficiency and competitiveness. Malaysia, as a developing economy, recognizes the importance of leveraging technological advancements to propel its MSME sector forward. The integration of IoT technologies in MSMEs allows for real-time monitoring, data analytics, and automation, which can lead to improved decision-making processes and cost-effective operations. For instance, IoT can be implemented in supply chain management to optimize inventory levels, track shipments, and reduce wastage. Additionally, IoT applications in manufacturing can lead to predictive maintenance, minimizing downtime and increasing overall productivity. These advancements are crucial for MSMEs to remain agile in a globalized market.

Several initiatives and programs have been introduced in Malaysia to facilitate the adoption of IoT among MSMEs. Government agencies, such as the Malaysia Digital Economy Corporation (MDEC), have been actively promoting awareness and providing support to encourage MSMEs to embrace digital technologies, including IoT. The Smart Automation Grant by MDEC, for example, aims to assist businesses in adopting Industry 4.0 technologies, including IoT, to enhance their operational capabilities. Furthermore, collaborations between the public and private sectors, along with academic institutions, contribute to creating a conducive ecosystem for IoT adoption in MSMEs.

As MSMEs in Malaysia embark on their IoT journey, challenges such as initial investment costs, cybersecurity concerns, and the need for skilled workforce are being addressed through various initiatives and collaborations. The Malaysian government's commitment to the digital transformation of the economy, coupled with the concerted efforts of industry stakeholders, positions IoT as a key driver for the growth and sustainability of MSMEs in the country.

### 2.4.1 New Product Design Development

IoT-enabled technologies enable marketers to collect massive amounts of data and thus understand their customers' tastes and preferences, as well as what products or services they expect from their company or brands. This process will assist marketers in designing new products and improving product quality. IoT not only improves product quality but also helps to create and forecast demand, marketing plans, and tactics for new items. Thus, IoT-enabled gadgets help businesses make better, more reliable, and timely judgments (Letterbug, 2016).

### 2.4.2 Big Data Analytics

IoT-enabled smart devices, such as touch screen equipment, smart TVs, CCTV cameras, speech recognition technologies, and other smart devices, assist marketers in collecting diverse data about customers and designing and implementing an effective marketing plan, strategy, and campaigns. IoT-enabled devices capture more data on customers through various types of sensors than traditional marketing research, and this data appears to be more accurate without human bias. Furthermore, it is estimated that by 2020, around 45 zettabytes of data would be acquired via IoT-enabled devices. As a result, big data provides more specific insights about customers and assists marketers in reducing risk and expanding commercial chances (smstudy.com, 2018).

### 2.4.3 Customization of Goods and Services

Customization of goods and services is an effective technique to reach customers and persuade them to purchase a certain brand's goods and services. IoT technology enables marketers to communicate with customers in real time. It allows marketers to reach out to customers more accurately and increases the efficiency of marketing campaigns. IoT-enabled devices capture a variety of data on customers, assisting in the design of campaigns based on customer capacity. Based on the data acquired, marketers may also build the ideal message at the perfect moment to conclude the customer's purchasing process (Diogo, 2021).

### 2.4.4 Predicting Customers' Taste and Preferences and Buying Behavior

IoT-enabled gadgets assist marketers in comprehending customers' tastes, preferences, and purchasing intentions from beginning to end and establishing a clear image of the customers and their purchasing journey. IoT technology also aids in the evaluation of consumers' requirements and desires, their purchasing habits, how market changes impact customer purchasing patterns, and the areas in which marketers must adjust goods and services accordingly. As a result, IoT-enabled devices provide more detailed information on consumers' interests and preferences (Letterbug, 2016).

#### 2.4.5 Better Customer Engagement

IoT enables smart devices to be utilized as a medium for client engagement. In one way or another, IoT-enabled smart devices are assisting many marketers. Consequently, marketers may better understand their clients' needs and desires and offer them better through real-time engagement (Michael, 2020). Thus, IoT is a disruptive technology that has altered how firms manufacture and transport items, market their products, and offer customer support. IoT devices can help enterprises while also providing several economic opportunities.

### 2.5 Digital Marketing in MSMEs

Digital marketing in Micro, Small, and Medium Enterprises (MSMEs) in Malaysia has witnessed significant evolution, aligning with the global shift towards digitalization. Digital marketing, as defined by (Hassan, Mohd Nasir, Khairudin & Adon, 2018), encompasses the use of digital channels such as websites, social media, email, and search engines to promote products or services. In the Malaysian context, MSMEs are increasingly recognizing the transformative power of digital marketing in reaching a broader audience, building brand awareness, and driving sales. The adoption of social media platforms like Facebook, Instagram, and Twitter has become commonplace among MSMEs, providing cost-effective avenues for targeted advertising and customer engagement (Hassan, Mohd Nasir, Khairudin & Adon, 2018). Additionally, search engine optimization (SEO) strategies are employed to enhance online visibility, ensuring that MSMEs remain competitive in the digital marketplace (Lin *et al.* 2018).

Furthermore, the rise of e-commerce platforms and mobile applications has created new opportunities for MSMEs to expand their market reach in Malaysia (Ngai *et al.*, 2019). The ease of transactions and accessibility offered by these digital platforms align with consumer preferences for online shopping and convenience. To remain competitive, MSMEs are leveraging digital marketing tools to create personalized customer experiences and analyze consumer behavior, allowing for targeted and data-driven marketing approaches. As MSMEs continue to navigate the digital landscape in Malaysia, understanding and effectively implementing digital marketing strategies are crucial for sustained growth and competitiveness in the dynamic business environment.

### 2.6 Relationship between IoT and Digital Marketing

IoT has been steadily growing and developing for decades; however, the function of IoT in the digital marketing arena is overpowering and more visible. The Internet of Things (IoT) is altering digital marketing for better or worse. IoT-enabled devices connect several types and numbers of devices into the daily lives of individuals and businesses, collecting a massive volume of data that marketers can use to generate necessary information about consumers, recognize patterns of customer communications, and forecast customers' purchasing behavior and way of life. This makes it easier to imagine clients' tastes and preferences and tie them to purchasing intent (seo-alien.com, 2021). The rise of IoT has altered the landscape of digital marketing and sustainability. Marketers are gaining several benefits from client data because of the increasing use of IoT-enabled devices in all companies and services. With the aid of data collected by IoT devices, On the other hand, marketers may identify customers' buying intentions, purchasing behaviors, and expectations, and then analyse market demand for goods and services, business possibilities, and so on. As a result, IoT-enabled solutions provide immediate, actionable, and up-to-date information about consumers and organizations, allowing marketers to forecast the unprecedented prospects accessible to enterprises.

### 2.7 Previous Study

Many previous studies were conducted to justify the importance of IoT implementation among MSMEs's. According to Hansen & Bgha's analysis from 2021, MSMEs do not have the necessary knowledge of IoT and other industry 4.0 technologies. To maintain their market position, MSMEs must acquire and implement digital technology. According to Rönnerberg & Areback's study (2020), cultural differences, poor external communication, a lack of resources, and a lack of a strategy are the main obstacles to the adoption of IoT by MSMEs. According to a Vistage survey, 29.5% of CEOs of small and medium-sized businesses support the use of IoT technologies. They passionately believe that MSMEs should utilize IoT to save costs, lower risk, optimize task completion, and boost productivity and efficiency across all business functions (Entrepreneurship, 2021).

Data analysis employs big data analytics and IoT based technology. However, the cost of adopting IoT and big data and the requirement of skilled human resources are significant obstacles for small and medium enterprises (Jung *et al.*, 2021).

### 3. Methodology

This chapter discusses the method and steps that are generally adopted by researchers during the research study. Research methodology consists as the important part throughout the research. The planned methodology will ensure the methods of data collection would achieve the research objectives in the right direction. In this chapter, it will discuss and explain research design, sampling method, data collection, research instrument and data analysis.

#### 3.1 Research Design

The researcher should decide on the design of their research before beginning it. Designs are classified into three types: quantitative, qualitative, and hybrid approach (Abutabenjeh & Jaradat, 2018). The research method chosen will give recommendations for the methodologies and phases of the investigation. In this research, the method that is used to conduct the analysis is quantitative research. Quantitative research is the method to generate numeral data and transform it to statistical results. According to (Rahi, 2017), the approach will focus on the data collection from problem of large population and analyzes the data while ignoring the emotions of the person and the environment of it. The data collection process will be conducted by the forms of survey such as questionnaire, online surveys, mobile surveys and so on. Therefore, this research will be focused on the questionnaires that distributed to respondents to collect the data thus achieving the research objectives.

#### 3.2 Research Population and Sample

In this research, the target population in this research will be the owners, managers, administrative and staff of MSMEs in Selangor. The population consists of 179271.

The size of the sample in this research will be determined by referring to the Krejcie and Morgan table. According to Krejcie & Morgan (1970), the sample size of this study is 384 the owners, managers, administrative and staff of MSMEs in Selangor

**Table 1** Table for determining sample size from a given population

<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>	<i>N</i>	<i>S</i>
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	100000	384

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

There are two sorts of sampling methods: random sampling and non-random sampling. According to (Taherdoost, 2017), probability sampling refers to the process in which every individual in the population has a chance to be picked, whereas non-random sampling focuses on smaller samples and more details and particular. In this investigation, a non-random sampling strategy was employed. Quota sampling, snowball sampling, judgement sampling, and convenience sampling are the four forms of non-random sampling. Convenient sampling was employed to acquire data. The strategy was chosen by the researchers due to its simplicity in sampling and convenience of study.

### 3.3 Data Collection

Data collection is a crucial aspect of research to guarantee that the research process works well and that the study objectives are met. It is the process of gathering data from appropriate sources, testing hypotheses, and assessing the results. The categories of data used in this study are primary data.

#### 3.3.1 Primary Data

There are three approaches for the researchers to collect primary data which are observation, interviewing and questionnaire. In this research, researchers use questionnaires to collect primary data. The questionnaire is distributed to the owners, managers, administrative and staff of MSMEs in Selangor. The purpose of the questionnaire is to analyze the Internet of Things (IoT) implementation in digital marketing among MSMEs in Selangor.

#### 3.4 Pilot Study

The questionnaire used in this research was developed by referring to the relevant previous studies and literature review. Hence, a pilot test will be carried out before the distribution of the questionnaire to measure the validity and the reliability of the questionnaires. Based on Resch Measurement Approach Model (Bond & Fox, 2013), the reliability of the study tool is measured by the alpha Cronbach method. The reliable value is acceptable between 0.71 - 0.99. In reliability tests usually involve the number of respondents less than the actual number of respondents and only a small number of responses in the population are taken to serve as respondents in the reliability test. Therefore, the researcher took only 30 employees for this reliability test. Table 2 shows the pilot test of Cronbach's Alpha.

**Table 2** Pilot test Cronbach Alpha

No	Variables	Number of elements	Cronbach Alpha
1	New Product Design and Development	4	0.799
2	Big Data Analytics	4	0.712
3	Customization of Goods and Services	4	0.763
4	Predicting Customers Taste and Preference Buying Behavior	4	0.711
5	Better Customer Engagement	4	0.751
6	Digital Marketing in MSMEs	6	0.801

### 3.5 Research Instrument

The research instrument is a method used to collect, evaluate, and analyze data from subjects related to the research topic. In this research study, a questionnaire is used as the data collection instrument.

#### 3.5.1 Questionnaire

The questionnaire is the instrument that includes a series of questions with the purpose of collecting information from respondents. The data collected from the questionnaire were used to determine the implementation of IoT in digital marketing among MSME's. The questionnaire is divided into three parts, part A, part B and part C. Part A will be the demography of the respondent, part B will deal with the IoT implementation in MSMEs, and part C is to identify the level of digital marketing in MSMEs.

### 3.6 Data Analysis

The data received from the questionnaire were analysed using descriptive statistics in this study. Descriptive analysis is a technique for simplifying, summarizing, and organizing numerical data. Statistical Package for Social Sciences (SPSS) and forecasting techniques are used to evaluate data.

## 4. Data Analysis and Result

### 4.1 Survey Return Rate

**Table 3** Survey return rate

Population	Sample Size	Questionnaire Distribute	Questionnaire Returned	Percentage
179271	384	384	340	88.5%

### 4.2 Reliability and Validity Analysis

#### 4.2.1 Reliability and Validity for Actual Study

**Table 4** Reliability test for actual study

No	Variables	Number of Items	Cronbach's Alpha
1	New product design and development	4	0.817
2	Big Data Analytics	4	0.804
3	Customization of goods and services	4	0.802
4	Predicting Customers taste and preference and buying behavior	4	0.822
5	Better Customer Engagement	4	0.826
6	Digital Marketing in MSMEs	6	0.857

The reliability test for the actual study had been summarized in Table 4. The results showed that the value of Cronbach's Alpha of new product design and development is 0.817. Meanwhile, Cronbach's Alpha for big data analytics is 0.804, for customization of good and services are 0.802 meanwhile for predicting customers taste, preference and buying behavior are 0.822, for better customer engagement is 0.826 and digital marketing in MSME's is 0.857. All items adopted in the questionnaire for this study are reliable as all independent variables and dependent variables have at least a minimum value of 0.5 for its Cronbach Alpha.

Among these variables, the digital marketing MSME's have the highest Cronbach's Alpha with the value of 0.857 whereas customization of goods and services have the lowest Cronbach's Alpha with the value of 0.802.



### 4.3 Descriptive Analysis (Demographic Analysis)

**Table 5** Frequency and percentage for demographic analysis

Item	Frequency	Percentage
Gender		
Male	167	49.1
Female	173	50.9
Age		
18-22years	67	19.7
23-26 years	95	27.9
27-30 years	84	24.7
31-34 years	57	16.8
35 years above	37	10.9
Race		
Malay	145	42.6
Chinese	101	29.7
Indian	93	27.4
Other	1	0.3
Highest academic qualification		
Primary education	24	7.1
Secondary education	42	12.4
Diploma	98	28.8
Degree	121	35.6
Master	40	11.8
PHD	15	4.4
Did you own/works in MSME?		
Yes	333	97.9
No	7	2.1
What is your position in the company?		
Owner	80	23.5
Manager	78	22.9
Administrative	79	23.2
Staff	103	30.3
Working duration in MSME?		
Less than 1 year	79	23.2
1-3 years	98	28.8
3-5 years	91	26.8
More than 5 years	72	21.2

### 4.4 Descriptive Analysis (Variables)

Table 6 indicated the average mean of each dimension for the questionnaire. The results showed that predicting customers taste and preference and buying behavior obtained the highest mean which is 3.97. However, the lowest mean value of 3.91 is scored by the big data analytics and digital marketing in MSMEs. From the result, we know that the main criteria that affect the digital marketing in MSMEs is predicting customers taste and preference and buying behavior. Hence, the second highest mean value is scored by customization of goods and services. Moreover, the better customer engagement had a mean value of 3.94.

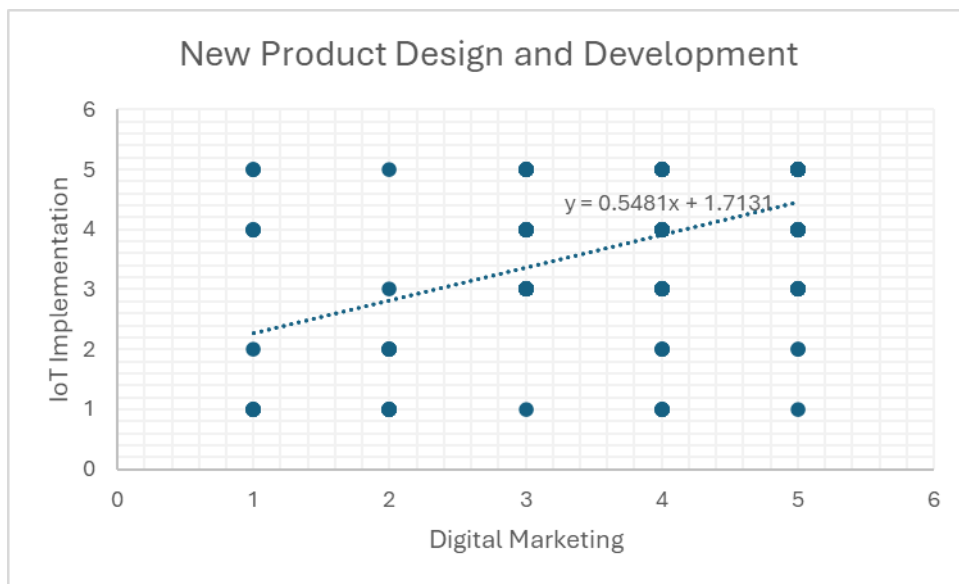
**Table 6** Summary analysis of each average of mean

Items	Mean	Standard Deviation
New Product Design and Development	3.93	0.872
Big Data Analytics	3.91	0.84
Customization of Goods and Services	3.95	0.846
Predicting Customers Taste and Preference and Buying Behavior	3.97	0.861
Better Customer Engagement	3.94	0.856
Digital Marketing in MSME's	3.91	0.83

### 4.5 Correlation Analysis

Based on the graph shows, it indicates that when the implementation of IoT increases, the level of digital marketing also increases in MSME's in Selangor. This is because they manage to solve whatever issue or challenge that they face. They manage to implement IoT in digital marketing successfully. Besides that, they also proven that the IoT implementation has successfully brought positive outcome in digital marketing among MSME's in Selangor.

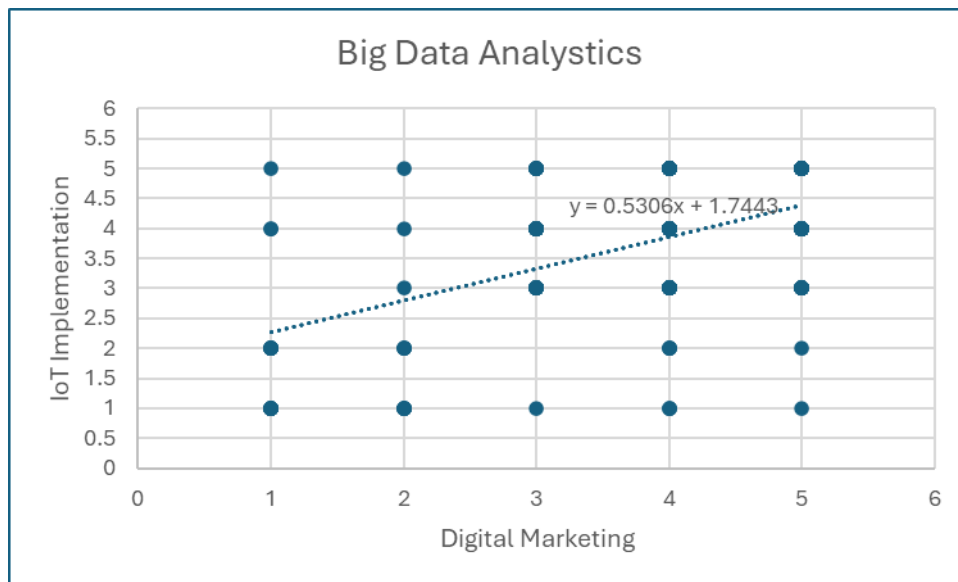
#### 4.5.1 New Product Design and Development



**Fig. 1** New product design and development

The Fig. 1 demonstrates that the level of digital marketing increases with the highest implementation of IoT. The IoT implementation influences the new product design and development. It is because with IoT-enabled technology, marketers may collect massive amounts of data and therefore understand their consumers' tastes and preferences, as well as what products or services they demand from their firm or brands; this process will aid marketers to develop the new product as well as to improve the product's quality.

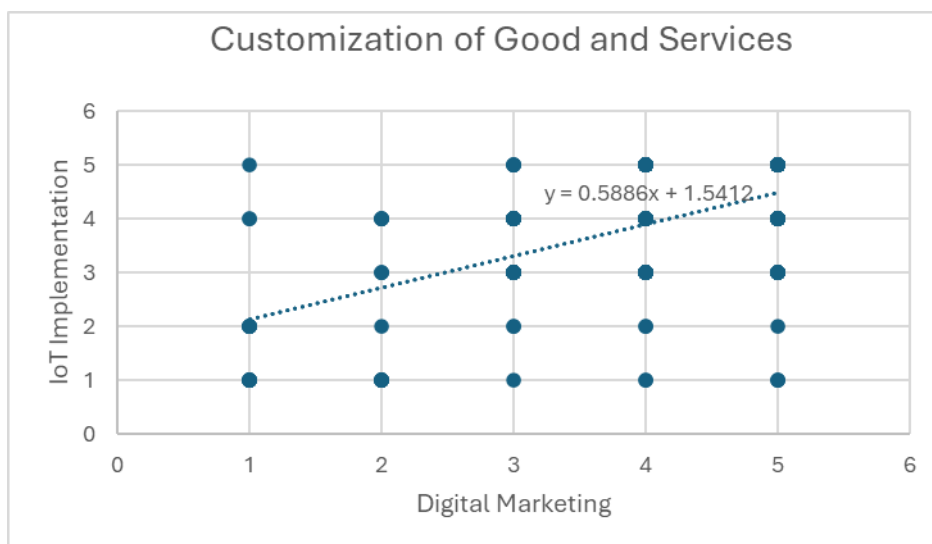
### 4.5.2 Big Data Analytics



**Fig. 2** Big data analytics

The Fig. 2 shows that the level of digital marketing increased with the implementation of IoT. IoT-enabled devices capture more data on customers through various types of sensors than traditional marketing research, and this data appears to be more accurate without human bias. Furthermore, it is estimated that by 2020, around 45 zettabytes of data would be acquired via IoT-enabled devices. As a result, big data provides more specific insights about customers and assists marketers in reducing risk and expanding commercial chances (smstudy.com, 2018).

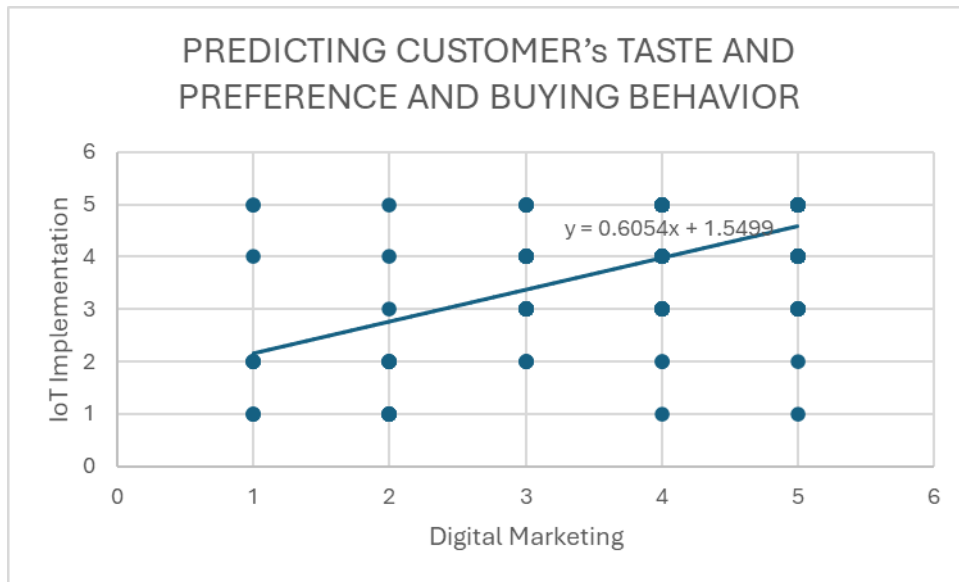
### 4.5.3 Customization of Good and Services



**Fig. 3** Customization of good and services

The Fig. 3 shows that the level of digital marketing increases when the implementation of IoT increases in MSMEs. Customization of goods and services is an effective technique to contact customers and persuade them to purchase a certain brand's goods and services. IoT technology enables marketers to communicate with customers in real time. It also helps marketers to reach out to customers more accurately and increases the efficiency of marketing campaigns. IoT-enabled devices capture a variety of data on customers, assisting in the design of campaigns based on customer capacity. Based on the data acquired, marketers may also build the ideal message at the perfect moment to conclude the customer's purchasing process (Diogo, 2021).

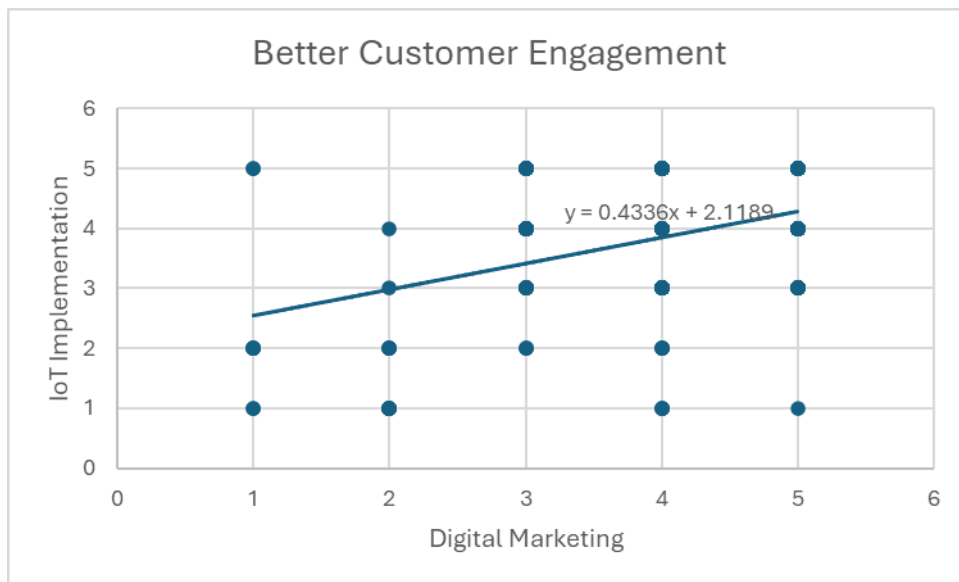
#### 4.5.4 Predicting Customer’s Taste and Preference and Buying Behavior



**Fig. 4** Predicting customer’s taste and preference and buying behavior

The Fig. 4 explains that the level digital marketing increases when the implementation of IoT increases in MSMEs. IoT-enabled gadgets enable marketers to understand clients’ tastes, interests, and purchasing intentions from start to finish, establishing a clear picture of the customers and their purchasing journey. IoT technology also aids in the evaluation of consumers’ requirements and desires, their purchasing habits, how market changes impact customer purchasing patterns, and the areas in which marketers must adjust goods and services accordingly. As a result, IoT-enabled devices provide more detailed information on consumers’ interests and preferences (Letterbug, 2016).

#### 4.5.5 Better Customers Engagement



**Fig. 5** Better customer engagement

The above diagram demonstrates the relationship between digital marketing and IoT implementation. The implementation of IoT significantly helps MSMEs for better customer engagement. Through real-time engagement, marketers may better understand their clients’ needs and desires and provide them accordingly (Michael, 2020). Thus, IoT is a disruptive technology that has altered how firms manufacture and transport items, market their products, and offer customer support. IoT devices could help enterprises while also providing several commercial opportunities.

## 5. Conclusion

### 5.1 Overall Summary

In this research, the target respondents are the owners, managers, administrative and staff of MSMEs in Selangor. The actual sample size was 384 respondents, however, there were only 340 respondents answered the questionnaire for research. There are about 174 respondents out of 340 respondents are female, whereas the rest are male. Most respondents in this study are 22 to 26 years old and the most race is Malay with 40.6% respondents. Many of the respondents are working in MSMEs with a percentage of 97.9% respondents. According to the results, most of the respondents are at a degree education level. Finally, most of the workers work in MSME for 1-3years.

Based on Table 6, the IoT implementations are helpful for new product design development, big data analytics, customization of goods and services, predicting customers taste, preference and buying behavior, and better customer engagement. This involved assessing the use of IoT devices, sensors, and connectivity solutions to enhance business processes, improve efficiency, and enable smarter decision-making.

The findings of the research provide valuable insights into the technological landscape of MSMEs in Selangor, shedding light on the extent to which these enterprises have embraced IoT solutions. The identified levels of implementation offer a foundation for understanding the role of IoT in enhancing operational capabilities within the MSME sector in the region. This information is crucial for policymakers, business owners, and technology providers seeking to support and further promote the integration of IoT in small and medium-sized enterprises.

The results indicated the average mean of each dimension for the questionnaire. The results showed that predicting customers taste and preference and buying behavior obtained the highest mean which is 3.97. However, the lowest mean value of 3.91 is scored by the big data analytics and digital marketing in MSMEs. From the result, we know that the main criteria that affect the digital marketing in MSMEs is predicting customers taste and preference and buying behavior. Hence, the second highest mean value is scored by customization of goods and services. Moreover, the better customer engagement had a mean value of 3.94.

In this research, the questionnaire is used to determine the level of digital marketing among MSME's in Selangor. MSMEs are increasingly recognizing the transformative power of digital marketing in reaching a broader audience, building brand awareness, and driving sales. The adoption of social media platforms like Facebook, Instagram, and Twitter has become commonplace among MSMEs, providing cost-effective avenues for targeted advertising and customer engagement.

From the research the level of digital marketing in the MSMEs enhances a firm's competitive advantage and digital marketing saves money and generates sales. The mean of 3.91. Digital marketing promotes the ability of business firms to attract and retain customers where it will help the firm to increase its competitive advancement.

Based on the graph shows, it indicates that when the implementation of IoT increases, the level of digital marketing also increases in MSME's in Selangor. This is because they manage to solve whatever issue or challenge that they face. They manage to implement IoT in digital marketing successfully. Besides that, they also proven that the IoT implementation has successfully brought positive outcome in digital marketing among MSME's in Selangor.

The research objective aimed at elucidating the connection between the implementation of Internet of Things (IoT) technologies and the landscape of digital marketing within Micro, Small, and Medium Enterprises (MSMEs) in Selangor. Through a comprehensive study, the research successfully identified and delineated the intricate relationship between these two facets. The findings not only affirmed the presence of a symbiotic association but also delved into specific instances where IoT integration positively impacted digital marketing strategies among MSMEs in the region.

By examining the practices and trends within Selangor's business community, the research contributes significantly to the understanding of how MSMEs leverage IoT to enhance their digital marketing endeavors. This insight holds practical implications for businesses and policymakers alike, offering a nuanced understanding of the dynamics at play in the intersection of IoT implementation and digital marketing strategies. The achieved research objective thereby provides a valuable foundation for future endeavors aiming to optimize technological integration for improved marketing outcomes among MSMEs in the given context.

### 5.2 Limitation Research

In general, when doing the research for this study, there were certain constraints. To begin with, the researcher faced problems during collecting the data. It was tough for the researcher to gather the questionnaire from the respondents. Because some respondents were unwilling to complete the questionnaire or believed it just waste of time. The study collected only 340 questionnaires out of a total of 384. Furthermore, because of time and

financial constraints, the investigation is limited to Selangor. Furthermore, the research is restricted to Selangor state. As a result, constraints should be considered in future research.

## 5.3 Recommendation

### 5.3.1 Recommendation for Government

Government plays an important role in sustaining and improving the business sector. The research findings highlighting the relationship between IoT implementation and digital marketing among MSMEs in Selangor present valuable insights for governmental considerations. To capitalize on the identified relationship, the government should embark on initiatives to enhance IoT awareness and adoption among businesses through workshops and training programs. Financial incentives, such as tax breaks or subsidies, could alleviate the financial constraints associated with IoT integration, encouraging more MSMEs to embrace these technologies. Concurrently, the development of tailored digital literacy programs would empower entrepreneurs to effectively leverage IoT in tandem with digital marketing strategies. Establishing collaboration platforms for knowledge exchange among businesses could further amplify the collective impact, fostering innovation and competitiveness. By implementing these recommendations, the government can catalyze a tech-savvy and digitally competitive landscape for MSMEs in Selangor.

### 5.3.2 Recommendation for Future Researchers

Future researchers in this domain should consider exploring the specific mechanisms and best practices identified in the correlation between IoT implementation and digital marketing among MSMEs in Selangor. Further investigation into the causal factors that drive the observed relationship could provide deeper insights into how businesses can strategically adopt and optimize IoT technologies for more effective digital marketing campaigns. Additionally, examining the challenges and barriers faced by MSMEs in implementing IoT in the context of digital marketing could offer practical recommendations for overcoming obstacles.

Moreover, as technology evolves, it would be beneficial for researchers to stay abreast of emerging IoT trends and their implications for digital marketing strategies in MSMEs. This could involve investigating new applications of IoT, potential synergies with other technologies, and the evolving consumer landscape. Finally, conducting longitudinal studies to track the sustained impact of IoT on digital marketing effectiveness over time would contribute to a more comprehensive understanding of the dynamic nature of this relationship within the MSME sector in Selangor.

## 5.4 Conclusion

In conclusion, this research has been conducted to determine the correlation between the level of IoT implementation among MSMEs in Selangor and the level of digital marketing among MSMEs in Selangor.

In this research, quantitative methods have been used to conduct the study. The questionnaires were distributed to 384 target respondents who were the owners, managers, administrative and staff of MSMEs in Selangor. As a result, there were only 340 questionnaires obtained to analyze the result of the research. The research was not successfully achieving the objectives. Based on the findings, the level of digital marketing in MSMEs is based on the level of IoT implementation in MSMEs.

Finally, the results obtained have been analyzed and discussed in a further way. The results are reliable and valid. Hence, suggestions for future studies have been proposed to improve the reliability and validity of the collected data.

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## 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:** K.B, and R.C; **data collection:** K.B; **analysis and interpretation of results:** K.B, and R.C; **draft manuscript preparation:** K.B, and R.C. All authors reviewed the results and approved the final version of the manuscript.*

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