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Utilize Internet of Things (IOTs) on Customer Relationship Marketing (CRM): An Empirical Study

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ABSTRACT

With the rapid development of the Internet and various technological tools, the Internet of Things (IOTs) has become a necessity, a need, also, at the same time an important tool that can be relied upon in all aspects of development. Issues related to data as one of the most important factors contributing to research and development are among the most important factors affected by the rapid development of technology, especially the Internet of Things (IOTs). This study aimed to demonstrate the role played by the Internet of Things (IOTs) in market studies on malls customers through the role of the Internet of Things (IOTs) in collecting, exchanging, analyzing and segmentation of data, in addition to the role of the Internet of Things (IOTs) in consumer communications. The study followed the deductive approach based on a sample of (n=300) individuals working in the field of research and development in malls, where a number of distributed statements were put forward that measure a number of factors, some of which are related to collecting data on consumers and some of which are related to exchanging and analyzing this data and dividing it into categories according to specific criteria's. Also, data related to communication with customers has been taken in consideration. The study concluded that the Internet of Things (IOTs) has a significant role in the process of exchanging, analyzing and data segmentation, in addition to the significant role in communications with customers. The study showed that the Internet of Things did not significantly affect the data collection process, and the Internet of Things (IOTs) played the most prominent role in customer communications and customer communication with each other.

1. INTRODUCTION

Despite the major challenges facing the shift towards technology and business digitization in various sectors, recent decades have witnessed an accelerated shift towards modern technology and the Internet of Things (Mouha, 2021). The Internet-based information environment has facilitated not only the exchange of information but also the exchange of services and even goods (Salazar & Silvestre, 2017), thus the Internet has contributed to radically reshaping human societies through its impact on all aspects of daily life and at all levels "individual or institutional, cities and urban areas...etc (Purwanto et al., 2021). Through our daily lives, it is noted that the Internet has become a companion to the individual at all times, whether at home, work, in the car, on the street, and even during leisure (Khodadadi & Buyya, 2017). Therefore, the reliance on the Internet has become great, especially in meeting daily needs, the most important of which is online shopping, in addition to the widespread use of the Internet in personal relationships. Accordingly, the study aimed to show whether the Internet of Things has an impact on relationships between customers "specially customers of goods" through a survey study on customers of shopping malls, as the impact of the Internet on relationships between customers has also become essential, similar to its role in all other aspects of life.

1.1 What does Internet of Things (IOTs) means?

According to Khodary (2021), the Internet of Things refers to the general idea of things that can be read, recognized, processed, and located based on an information sensing and verification system. Due to the accelerating need for a global infrastructure for communication between people within the framework of globalization, the term Internet of Things (IOTs) has emerged to refer to the evolutionary stage of the Internet, which is sufficient to change all the details and basic aspects of human life, whether at the personal level "health and education" or at the societal level "branches of economy such as agriculture, industry, mining, etc. (Khodary, 2021). The term Internet of Things (IOTs) dates back to the late 20th century when computing devices began to be able to send and receive data on their own (Sharma et al., 2019). The Internet of Things has received a number of definitions, some of which defined it as “an interaction between the physical and digital world using a number of sensors and actuators,” while Patel et al. (2021) described it defined it as “a model in which computing and networking capabilities are embedded in any conceivable type of object. As for Kumar et al. (2019), he defined the Internet of Things as a new model based on high-level technology-based life as an alternative to traditional life through a number of transformations such as smart cities, energy saving, transportation and smart industries. defined the Internet of Things as referring to the communication of physical objects over the Internet through various communication devices and applications in a way that allows the devices to be tracked, controlled and monitored. Patel et al. (2016) defined the Internet of Things as relying on specific protocols to connect to the Internet through information sensors and exchange them to reach smart identification, tracking, monitoring and management. Through the previous definitions, the Internet of Things has a number of criteria identified by Patel et al. (2016) as follows:

- Interconnection: Through the ability to connect things to the global Internet infrastructure.
- ***Services related to things:*** The Internet of Things must be able to provide services within the constraints of the things associated with these services.
- ***Heterogeneity:*** This means the heterogeneity of the devices used in the Internet of Things and the reliance on different platforms and networks that interact with other platforms and networks through the network.
- ***Dynamic changes:*** Any changes in the state of the devices used in the Internet of Things (change in connection status, speed and location), in addition to the dynamic change in the number of devices.
- ***The huge size****:* The devices required to be managed to achieve effective communication between them are larger than the devices connected to the current Internet.
- ***Safety:*** The Internet of Things must provide the safety of personal data in the first place through security programs that are constantly scalable.
- ***Connectivity:*** The Internet of Things must provide two basic points, which are: access to the network and compatibility, thus entering the network with the ability to consume and produce data.

1.2 The study importance – the benefits of using IoT on CRM

The advantages of customer relationship management vary from one company to another, and with the Internet of Things IOTs) becoming an essential part of daily life, it has become an essential tool for exchanging information, which has had a positive impact on the maturity level of customers on the one hand, and on the management of customer relationships with each other on the other hand (Wang & Bayanati, 2023). The Internet of Things is expected to contribute to increasing the ability of companies to meet customer needs with greater accuracy, by increasing the ability to predict customer behavior and desires associated with this behavior. However, most companies are satisfied with a unified “Customers Relationship Management - CRM” system due to the lack of sufficient knowledge and the low level of research - development regarding the software and interfaces necessary to make the most of the Internet of Things in serving customer relations. Therefore, the importance of this study comes from the fact that it sheds light on the benefits of the Internet of Things in serving mall customer relations as a sample of customers of the goods offered by these malls, by clarifying the impact of the Internet of Things on operations related to data related to mall customers, especially collecting this data, exchanging, analyzing and segmenting this data.

1.3 Identified gap

Despite vary previous studies on the Internet of Things (IoT), most have focused on its technical aspects rather than its relationship to market studies and consumer needs. This study aims to fill that gap by analyzing how IoT impacts market research and consumer behavior, particularly among mall consumers. It examines the collection, segmentation, analysis, and communication of customer data to understand the influence of IoT on customer interactions.

1.4 Study questions

As a result of the Internet of Things entering all parts of daily economic and personal life, and in order to analyze the role of the Internet of Things in shopping mall consumers behaviours, the research questions that will be answered can be read as:

1- Does IOTs influence facilitate positively the process of customer data collection?
2- Does IOTs influence facilitate positively the process of customer data exchange?
3- Does IOTs influence facilitate positively the process of customer data analysis?
4- Does IOTs influence facilitate positively the process of customer data segmentation?
5- Does IOTs influence facilitate positively the process of customer communication?

2. LITERATURE REVIEW

2.1 IOTs and customer data collection

The larger the data collected, the more accurate the results obtained. However, as the data volume increases, it becomes more difficult to analyze and process, necessitating new techniques for data collection. (Bojanowska, 2019). The big data provided by the Internet of Things includes important information about customers, including text inputs that enable the management of relationships between customers (Wang & Bayanati, 2023). The Internet of Things enables the collection and integration of data, allowing for the prediction of customer behavior. This helps in satisfying their desires and achieving their needs. Additionally, it aids in developing programs and interfaces that enhance the customer service and relationship management system (CRM) (Ahmed et al., 2017). To analyze the impact of the Internet of Things on mall customers, the following hypothesis was formulated:

H1: IOTs influence facilitate positively the process of customer data collection.

2.2 IOTs and customer data exchange

Data is exchanged through the easy and secure communication feature between electronic devices provided by the Internet of Things, which allows consumers to conduct their transactions without the need for physical presence (Khan & Yuce, 2019; Alshurideh et al., 2023; John, 2023). Data exchange is at the core of defining the Internet of Things as one of the most important features provided by this technology, which paves the way for building high-level marketing strategies, as information exchange provides the ability to build an accurate image of consumers' habits and behaviors, and thus their preferences and needs (Baykal, 2023). The importance of data transfer and its secure environment is increasing in light of security concerns about potential threats and the current capabilities of devices and technologies used in data transfer (Sukiasyan et al., 2022). Internet of Things technologies help in collecting strategic data, which enables the role of physical devices to be dedicated in communicating and exchanging information and data alike, which enables companies to create opportunities that are compatible with the market and its continuous changes (Purwanto et al., 2021). To clarify the role of these technologies in transferring data related to mall consumers, the following hypothesis was formulated:

H2: IOTs influence facilitate positively the process of customer data exchange.

2.3 IOTs and customer data analysis

The Internet of Things (IoT) and data analytics constitute an important and integrated combination that requires companies to have competitive infrastructures capable of analyzing data derived from the Internet of Things (Sestino et al., 2020). "Thus, the Internet of Things provides strategies for analyzing data and information based on the features of data traffic flow across the network. This feature poses a security risk and requires significant effort compared to mobile environments that rely on analyzing information exposure through simulation and automation tools (Ren et al., 2019). In addition to the vast amount of data provided by the Internet of Things, it enables immediate data analysis ('on-the-fly analysis') through the advanced technology provided by cloud computing (Al-Fuqaha et al., 2015). The methods of analyzing data provided by the Internet of Things vary according to the type of data, which can be structured or unstructured, historical or cross-sectional, and in the form of audio, images, texts, or video. Therefore, Internet of Things devices take these types into account when performing computation and analysis to reduce access time, lower costs, and increase quality (Elijah et al., 2018). The following hypothesis was formulated with the aim of testing the role of the Internet of Things in analyzing mall consumer data:

H3: IOTs influence facilitate positively the process of customer data analysis.

2.4 IOTs and customer data segmentation

Data segmentation accuracy increases in terms of activity recognition by relying on the identification of sensor profiles that filter out duplicate and irrelevant actions despite the complexity of this procedure (Al Nadi & Al Zamil, 2019). IoT tools enable data collection and segmentation by sorting encrypted texts, searching for distinct values, and comparing data. The data segmentation process helps protect the privacy of users' data while achieving high

levels of accuracy. Data segmentation based on IoT tools follows a logical sequence. First, the agent collects and segments customer-related data. Then, based on the user's privacy specifications, the agent determines the attributes that may lead to re-identification and separates the data accordingly. The agent also decides the number of storage locations needed to store each set of data securely. Finally, each piece of data is redirected to a cloud service provider (Alotaibi et al., 2021). In this study, the impact of the Internet of Things on the segmentation of consumer data for shopping mall goods was analyzed based on the following hypothesis:

H4: IOTs influence facilitate positively the process of customer data segmentation.

2.5 IOTs and customer communication

As the Internet has rapidly evolved from a network of connected computers to one that connects a wide variety of devices such as vehicles, smartphones, home appliances, and gaming platforms, it has enabled continuous communication and information exchange. This evolution allows for a steady flow of data about consumers and how they use products and goods throughout their production cycles (Marek & Woźniczka, 2017). The Internet of Things has replaced traditional communication methods such as radio and local wired networks. It enables widespread sharing of information, including consumer data, by facilitating communication between devices and with sources of products, goods, and services (Khodary, 2021; Nam et al., 2021; Antouz et al., 2023). It is noted that 'social influence' and 'perceived ease of use' are key factors that developers in the field of the Internet of Things should consider. These psychological factors affect customers' perceptions of products with high utility and ease of use, enabling consumers to access the best products. The impact of the Internet of Things on consumer communications was analyzed using a sample of consumers in shopping malls, based on the following hypothesis:

H5: IOTs influence facilitate positively the process of customer communication.

2.6 *The* research model

Based on the previous discussion in the literature part, the study model includes the dependent factor "Internet of Things - IOTs" and five independent factors, so that the relationship of the Internet to each of them is studied. The following figure illustrates the study model:

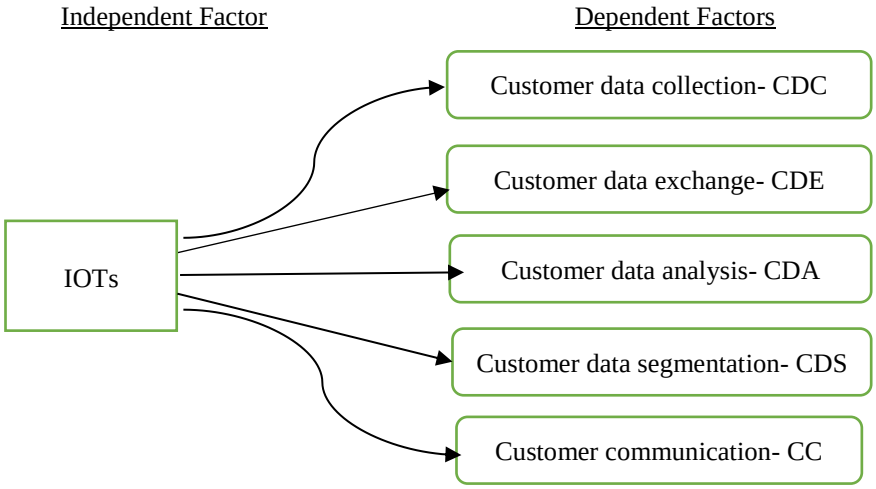

Fig 1. Research Model

3. METHODOLOGY AND DATA ANALYSIS

This study uses "statistical inference" through a sample of 300 individuals representing employees in the marketing, research and development departments in malls, in addition to employees in the departments concerned with information technology and market data analysis in order to analyze opinions about the relationship between the Internet of Things (IOTs) as an independent factor, and each of the collection of data related to consumers, customers data exchange, consumer data analysis, customers data segmentation and Customer communication as Dependent factors. questionnaire was designed to measure the variables included in each of the six factors, and distributed via the Internet to the workers of the shopping malls. Then, the validity and reliability of the study tool (questionnaire) were evaluated, after which the validity and discriminant validity were analyzed, and then the study hypotheses were tested. The Smart PL ESL 4 package was used to complete the statistical analysis, reach the quantitative results, and test the study hypotheses.

3.1 *Convergent Validity*

The statistical study must meet a number of criteria to be considered acceptable for achieving its objectives. These criteria include those related to the loading indicators, the majority of which must be above the average values (50%), in addition to the condition related to the composite reliability (CR), the value of which should preferably exceed 0.8. The extracted average variance index is also considered one of the criteria that are relied upon in testing the quality of the extracted model, such that the value of this index should preferably exceed 0.5, table (1) shows these indicators and tests:

Table (1) Reliability and Validity.

Construct- Factors	Indicators	VIF	Loadings	CR	CA	AVE
Customer data collection	CDC1	1.678	0.256	0.57	0.836	0.27
	CDC2	2.607	0.326			
	CDC3	2.721	0.352			
	CDC4	2.280	0.249			
	CDC5	1.265	0.995			
Customer data exchange	CDE1	2.581	0.736	0.89	0.851	0.63
	CDE2	2.614	0.734			
	CDE3	2.055	0.808			
	CDE4	2.970	0.89			
	CDE5	2.097	0.78			
Customer data analysis	CDA1	3.878	0.89	0.92	0.902	0.67
	CDA2	2.787	0.84			
	CDA3	3.707	0.89			
	CDA4	2.375	0.764			
	CDA5	1.796	0.671			
	CDA6	2.197	0.842			
Customer data segmentation	CDS1	1.855	0.794	0.91	0.865	0.71
	CDS2	2.138	0.851			
	CDS4	1.884	0.821			
	CDS3	2.758	0.904			
Customer communication	CC1	1.791	0.808	0.89	0.834	0.66
	CC2	1.734	0.752			
	CC3	1.820	0.87			
	CC4	1.868	0.818			
IOTs	IOTs1	3.799	0.907	0.84	0.762	0.54
	IOTs2	4.558	0.926			
	IOTs3	2.546	0.861			
	IOTs4	1.831	0.416			
	IOTs5	1.768	0.316			

The previous table 1 shows the loading factors of each variable on the factor to which it belongs, and through these values it appears that all the loading values of these variables are above the recommended limit values, and the composite reliability values (CR) also showed acceptable values as they all exceeded the value of 0.8, indicating that all the used structures show good consistency in the estimated model. Looking at the values of (AVE), they all exceeded the value of 0.5. As a result of the above, it can be said that the estimated model shows good validity and its results can be generalized.

3.2 Discriminant Validity

Discriminant validity tests the association of items with each other, and assumes that these items are more closely related than they are with other items in hypothetical structures that assume no such association. There are

a number of ways to test discriminant validity, including using the root of extracted mean variance analysis (√AVE). The following table (2) shows the results of the discriminant validity test for the estimated model (Zait & Bertea, 2011).

Table (2) Discriminant Validity.

	CC	CDA	CDC	CDE	CDS	IOTs
CC	0.813					
CDA	0.462	0.820				
CDC	0.136	0.399	0.519			
CDE	0.330	0.823	0.549	0.792		
CDS	0.714	0.410	-0.031	0.278	0.844	
IOTs	0.703	0.610	0.261	0.557	0.572	0.734

Discriminant validity is good when the correlation value between the highest latent variables and the lowest (√AVE) is higher, the model is said to exhibit good discriminant validity. The previous table 2 shows that the study model is good in terms of the correlation values between the highest latent variables. In addition, the external consistency of the proposed model was tested by Fornell and Lickert test, the discriminant validity was verified when the square root of each construct was greater than its highest correlation with any other construct.

3.3 Testing Inner Model

The following structural model in figure number (2) shows the path coefficients and the correlation between each variable and the latent factor saturated on it and between the latent factors with each other (the dependent latent factor and the independent latent factors).

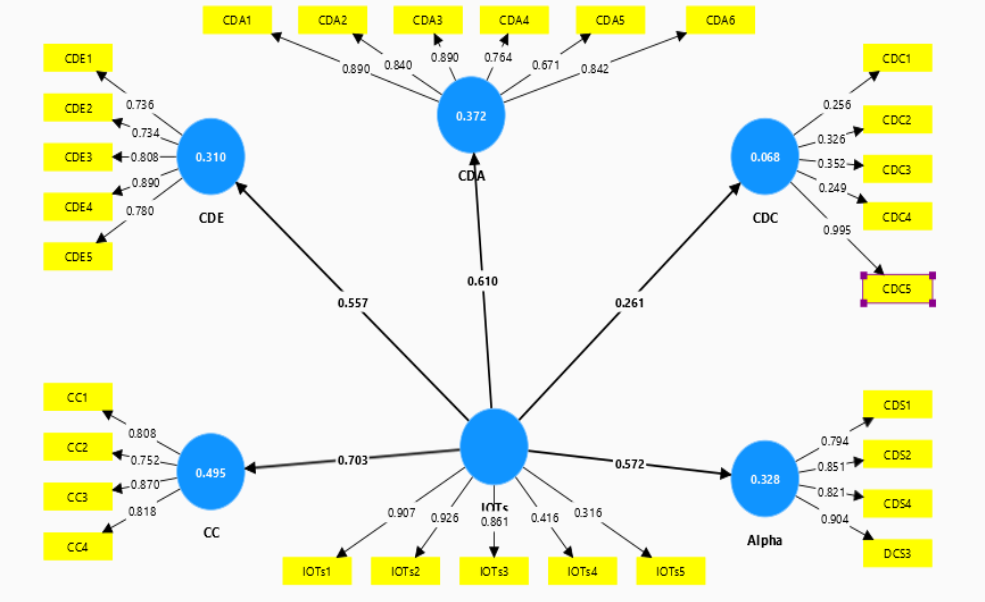

Fig 2. Structured Model.

3.4 *Goodness of Fit*

The coefficient of determination R^2 indicates the explanatory power of the model as it expresses the amount of variance in the dependent latent factor that can be explained by the variance in the extracted variance, and it also indicates the goodness of fit of the model (GoF) which takes into account the value of both the coefficient of determination and the value of the average variance extracted (AVE), so that the model is evaluated based on three threshold values (0.1 for small, 0.25 for medium, and 0.36 for large). Table (3) shows the coefficients of determination corresponding to each of the five relationships (IOTs) as a dependent factor and the five factors associated with consumer data as independent factors.

Table (3) Hypothesis Results

Relationship	Beta	R^2	Standard Deviation	t-value	p-value	Decision
IOTs→CC	0.703	0.495	0.049	14.281	0.000	Supported
IOTs →CDA	0.610	0.372	0.068	8.980	0.000	Supported
IOTs → CDC	0.261	0.068	0.232	1.125	0.261	Not supported
IOTs → CDE	0.557	0.310	0.069	8.061	0.000	Supported
IOTs → CDS	0.572	0.328	0.077	7.436	0.000	Supported

4. RESULTS AND DISCUSSION

From the previous table 3, it appears that the coefficients of determination showed acceptable values that reached 0.495 against relationship between (IOTs &C). For the coefficient of determination corresponding to the factor (CDC customer data collection), the value of the coefficient of determination did not exceed (0.068) and in relation to the values of the average variance extracted, the hypothesis related to this factor was rejected, which means that there is no relationship between it and the Internet of Things (IOTs). The previous table shows the values of the regression coefficients (path) between the dependent factor and the independent factors as well, in addition to the test (t-student) corresponding to each of these factors. As it appears from the values of (P- value), all of these coefficients are considered significant except for the coefficient corresponding to (CDC) whose value was greater than (0.05) respectively, so the hypothesis between this factor and the Internet of Things (IOTs) was not significant (rejected). Based on the previous analysis, the hypotheses related to all factors are supported except for the factor indicated (CDC).

This study reached empirical results that can be added to the new body of knowledge related to the Internet of Things and its connection to market studies, especially in the segment of consumers in malls. These results were reinforced by the experimental study that was built depending on data obtained using a questionnaire designed to achieve the desired objectives of the study, which is to analyze the relationship between the Internet of Things (IOTs) and factors related to consumer data in shopping malls and communication between these consumers through the five main factors which are : Customer data collection- CDC, Customer data exchange- CDE, Customer data analysis- CDA, Customer data segmentation- CDS, Customer communication- CC.

The study concluded that the Internet of Things has a positive and essential role in all four factors (CC, CDA, CDE. CDS), but it did not have a significant impact on (CDC). The study showed that the factor most affected by the Internet of Things is (Customer communication- CC) where the value of the impact parameter reached (0.703), followed by the factor (CDA) when the value of the impact parameter reached (0.610), then the factor (CDS) versus the effect of (0.572), and finally the factor (CDE) versus the value of the impact parameter reached (0.557).

5. CONCLUSION

Analyzing the relationship between the Internet of Things (IOTs) and market studies is important, especially with regard to consumer data and data related to consumer communication with each other on the one hand, and between them and their market on the other hand. The Internet of Things (IOTs) plays an important role in creating an important database about consumers in a specific sector that helps in identifying their needs, desires, and preferences, thus making decisions that contribute to building their loyalty to the product, brand, or market in general, which is positively reflected in the business results that contribute to developing the market and thus the entire economy.

Communication between customers, and between them and the market with all its channels is considered the factor most affected by the Internet of Things, and this may be from the researcher's point of view as a result of the ability that the Internet of Things (IOTs) provides to build a huge database about these customers and their renewed and increasing desires and preferences. There should be more focus on collecting data so that there are software's and applications that contain tabs that are compatible with the basic goals of the mall, which are aimed at understanding issues related to the mall's customers in the form of segments and categories, so that Internet of Things technologies are invested more effectively, which increases the optimal use and optimal utilization of the benefits provided by the Internet of Things for a deeper understanding of the market and thus building detailed decisions that contribute to developing the volume of business and thus developing this sector more based on empirical scientific foundations.

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