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ACCEPTANCE OF MODERN RETAIL CONSUMERS TOWARDS INTERNET OF THINGS (IOT) TECHNOLOGY WITH TAM APPROACH METHOD

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Abstract

This research aims to investigate consumer acceptance of Internet of Things (IoT) technology in the context of modern retail by applying the Technology Acceptance Model (TAM). TAM is used to analyze consumer perceptions of the usefulness and ease of use of IoT technology, particularly in information systems, smart checkout, and smart displays in the retail environment. The population used in this research consists of modern retail consumers who use IoT devices, with a sample of 300 respondent individuals. Data were collected through a Google Form questionnaire and then subjected to validity and reliability tests to evaluate the fit and reliability of the proposed model. The study also analyzed the relationship between exogenous and endogenous variables and conducted hypothesis testing using PLS-SEM. The research results indicate that all proposed hypotheses have a positive and significant impact. These findings provide in-depth insights into consumer responses and acceptance of IoT technology in modern retail. The implications of these findings can assist stakeholders, including retailers and technology developers, in designing more effective marketing strategies and enhancing the acceptance of IoT technology in the modern retail environment. Thus, this research highlights the significant potential of IoT in transforming the modern retail industry.

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INTRODUCTION

In the increasingly digitally connected era, Internet of Things (IoT) technology has transformed various sectors, including retail industry. IoT has enabled modern retailers to provide a more personalized, efficient, and connected shopping experience for consumers. Internet-connected products, smart shelves, cashierless payment systems, and various other applications have changed how consumers interact with modern stores. However, the crucial question that arises is: how do consumers respond to IoT technology in the retail context, and what factors influence their acceptance of this technology.

The modern retail business typically involves the sale of various goods or services for direct or indirect consumption. In the trading chain, the retail business represents the final stage in the distribution of products or services and interacts directly with consumers. Generally, retailers do not produce their goods and do not sell them to other retailers. Currently, there are many emerging retail formats/modern markets, including but not limited to; 1) Supermarkets 2) Minimarkets 3) Hypermarkets 4) Specialty stores/convenience stores 5) Department Stores (Nurhayati & Yuanita, 2015).

The development of modern retail businesses in Indonesia has led to increased competition in the retail sector. Some common challenges involve long queues of buyers at specific times or days in minimarkets that offer various products. Another issue is related to conventional sales systems, where buyers often our unaware of the availability of stock in the mini market. This can result in buyers purchasing only one or a few items experiencing a waste of time and energy. Therefore, current modern retail players are adopting the Internet of Things (IoT) as a solution to enhance the efficiency of their stores and provide a better shopping experience for consumers. The Internet is a global computer network system that enables devices to communicate globally. The Internet of Things is a concept that facilitates the communication of data and information through the Internet using sensors (Hasiholan et al., 2018).

Acceptance of IoT technology by consumers in modern retail is a critical aspect of business strategy and retail technology development. To understand this phenomenon more deeply, the Technology Acceptance Model (TAM) provides a strong foundation. The TAM model has been widely used to analyze the acceptance of technology by individuals and consumers in various contexts. By applying this approach, we can identify variables that influence consumer acceptance of IoT technology in modern retail, including factors that affect consumer perceptions of the usefulness and ease of use of this technology. And also, identify trust and perceived enjoyment variables as external variables.

This article's goal in this context is to explain the importance of analyzing consumer acceptance of IoT technology in modern retail using the TAM model approach. We will investigate the factors influencing consumer perceptions of IoT technology and how these perceptions affect the intention to adopt this technology. Thus, this article seeks to provide valuable insights for stakeholders in the modern retail industry to design more effective strategies in implementing IoT technology, to enhance the consumer shopping experience, increase profits, and maintain competitiveness in the ever-changing market.

Internet of Things (IoT)

The Internet of Things (IoT) is a key force driving current economic growth and, together with other Internet-based technologies, has a significant impact on organizational productivity (Tohanean et al., 2018). At present, the frequently used term is the Internet of Things, describing a situation where internet connectivity and computing capabilities have expanded to encompass various objects, devices, sensors, and everyday items (Rose et al., 2015).

The concept of IoT is not a new technology but rather a broad one (Wortmann & Flüchter, 2015). It involves enhancing objects by incorporating various micro-sensor chips into them. These smart objects are then connected to the internet through wireless networks. As a result, information from these objects can be shared to facilitate interaction between individuals and objects, as well as communication among the objects themselves. This approach enables everyday objects to convey their status autonomously, thereby promoting automatic communication between objects and individuals. The primary goal is to establish communication between real-world objects in the physical realm and the virtual world, achieving a state of "interconnected things."

Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was initially presented by Davis in 1985 and later underwent further development in 1989. TAM is a model of significant importance in predicting the acceptance of a newly implemented information system. Initially, TAM was adopted from the Theory of Reasoned Action (TRA) (Hill et al., 1977) TRA refers to individuals' perceptions of something that influences their attitudes and behaviors toward specific actions. Responses and perceptions regarding the use of information technology will, affect individuals' attitudes and values toward it's use.

TAM is one of the models used to analyze the factors influencing the acceptance of information technology. There are five main factors used in predicting TAM acceptance: perceived ease of use, perceived usefulness, attitude toward using, behavioral intention of use, and actual system usage. Actual system usage refers to the use of information technology by individuals based on the perceived ease and benefits, as observed through the frequency and duration of use (Davis, 1985).

Trust

Trust is a crucial factor in measuring consumer acceptance of IoT technology, as a high level of trust can influence consumers' intentions and behaviors in using this technology for modern retail shopping. In line with the perspectives of drawing on trust theory and research that examines the concept of trust in the interaction between sellers and buyers in the online context, this study interprets trust as described in the existing research by (Pavlou et al., 2007) and (Rousseau et al., 2012) as a user's motivation to accept uncertainty based on their belief that the renovated product will meet their expectations. In other words, trust more reflects perceptions of expectations than fears (Mcallister, 1995). In the study (Tsourela & Nerantzaki, 2020), it is shown that consumer trust in the internet impacts Perceived Ease of Use (PU) and Perceived Usefulness (PEOU). Hence, hypotheses can be formulated:

H1: Trust influences perceived usefulness.

H2. Trust influences perceived ease of use

Perceived Enjoyment

The pleasure experienced as a primary emotional drive has been proven to effectively motivate users to embrace new technology (Bruner & Kumar, 2005). When the use of IoT technology brings joy and satisfaction, users naturally feel motivated to adopt it. (Gao & Bai, 2014) demonstrated that perceived enjoyment positively influences the perceived ease of use of new technology adoption. Another study (Ali et al., 2022) also indicates that perceived enjoyment has an impact on perceived usefulness. Thus, it can be concluded that:

H3: Perceived enjoyment influences perceived usefulness.
H4: Perceived enjoyment influences perceived ease of use.

Perceive Usefulness

In the context of perceived usefulness, perceived usefulness refers to the extent to which an individual believes that the use of a specific system will enhance their job performance (Davis, 1989). Perceived usefulness pertains to how much prospective users believe they can improve their job performance in a given context by using a specific application system (Yuen & Ma, 2008). In a study (Priyono, 2017), it is shown that perceived usefulness influences behavioral intention. Therefore, the hypothesis is formulated as follows:

H5: Perceived usefulness influences behavioral intention to use IoT technologies

Perceived Ease of Use

Perceived ease of use refers to the level of confidence an individual has that using a system will require minimal effort (Davis, 1989). This aligns with the perspective expressed by (Yuen & Ma, 2008) that the perception of ease of use reflects the extent to which prospective users anticipate that the targeted system will require them to exert little effort. In a study (Al-Tall, 2021), it is shown that perceived ease of use influences behavioral intention. (Gao & Bai, 2014) explain that perceived ease of use influences perceived usefulness and behavioral intention. Therefore, based on these previous studies, it can be concluded:

H6: Perceived ease of use influences perceived usefulness.

H7: Perceived ease of use influences behavioral intention

Behavioral intention

Behavioral intention is considered the starting point for the actual use of technology. In the context of TAM, this behavioral intention is the result of perceptions of ease of use and perceptions of usefulness. Behavioral intention refers to the extent to which an individual intends to adopt or use a particular system or technology (Davis, 1989). According to (Yadav & Pathak, 2017), Intention to Use is an indication of how willing an individual is to carry out a specific action. In a study by (Wang et al., 2023), it is shown that behavioral intention influences actual use. Therefore, the hypothesis is formulated as follows:

H8: Behavioral intention influences actual use.

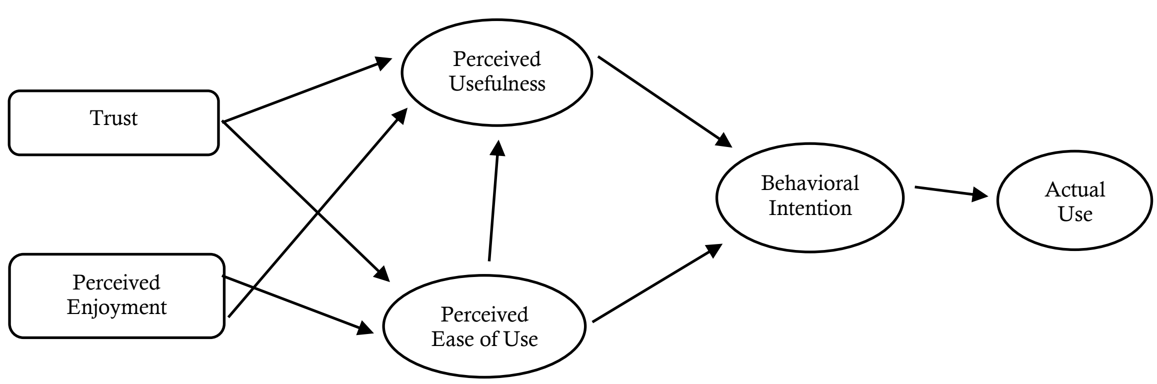

Figure 1. Research Model

METHODS

The research design employed in this study is quantitative research using an online survey design through Google Forms. The data collection technique utilized in my research involves the use of a questionnaire method, wherein statements are presented, and Likert scale measurements are employed with 5 points (1= Strongly Disagree (SD), 2= Disagree (D), 3= Uncertain (U), 4= Agree (A), 5= Strongly Agree (SA)). The respondents in this study are consumers who have previously shopped at modern retailers (minimarkets, supermarkets, and hypermarkets) in Indonesia, including students, university students, civil servants, entrepreneurs, and others, with a total sample size of 300 respondents.

The following table provides a general overview of constructs, items, and references.

Table 1. Research indicators

Construct	Item	Contents	References
Trust (T)	T1 T2 T3 T4	IoT devices/systems in modern retail can be trusted. IoT system devices in modern retail provide reliable information. IoT service providers in modern retail keep their promises and are committed. IoT service providers in modern retail prioritize my best interests	(Gao & Bai, 2014)
Perceived Enjoyment (PE)	PE1 PE2 PE3 PE4	Using IoT devices is truly enjoyable. I enjoy using IoT devices provided by modern retail. Using IoT devices gives me a lot of pleasure. The use of IoT devices in modern retail makes me feel comfortable.	(Felea et al., 2021)
Perceived Usefulness (PU)	PU1 PU2 PU3 PU4 PU5	In my opinion, IoT devices are useful for everyday life. The use of IoT devices in modern retail can enhance my purchasing productivity. Using IoT will improve the efficiency of my shopping. The use of IoT in modern retail helps me easily accomplish many of my tasks. IoT devices provide services and information easily, which is very useful for me.	(Wang et al., 2023)
Perceived Ease of Use (PEOU)	PEOU1 PEOU2 PEOU3 PEOU4	The use of IoT in modern retail is easy for me. I find my interaction with IoT devices clear and easy to understand. In my opinion, learning the use of IoT in modern retail is easy and understandable. The use of IoT in modern retail can make it easier for me to make shopping payments	(Wang et al., 2023)
Behavioral Intention (BI)	BI1 BI2 BI3 BI4	I intend to use modern retail IoT devices in the coming months. I will use IoT devices in modern retail regularly shortly. I will recommend to others the use of Internet of Things devices in modern retail. I will use more IoT devices in modern retail in the future.	(Tsourela & Nerantzaki, 2020)
Actual Use (AU)	AU1 AU2 AU3	Every time I shop at modern retail, I use automatic IoT-connected payments. I make purchase transactions at modern retail on a regular weekly basis. Overall, I am satisfied with the presence of the Internet of Things in modern retail.	(Wang et al., 2023)

RESULTS & DISCUSSION

The research findings are presented in this section. Descriptive data, comprising respondent characteristics, are presented in the first section. The validity and dependability of the suggested model are assessed in the second section. The third section tests hypotheses and examines how the model's exogenous and endogenous variables relate to one another.

Descriptive statistic

The overall quantity of participants in my study is 300 individuals. The age range of the responders from 15 to 50 years old and include students, university students, civil servants, entrepreneurs, and other workers residing in Sumatra, Java, Kalimantan, Sulawesi, and Papua. More detailed information can be found in Table 2.

Table 2. Respondent Characteristics

Characteristics	Respondents (n=300)	Percent
Gender		
- Man	107	35.7 %
- Woman	193	64.3 %
Age		
- <18 years	22	7.3 %
- 18 – 25 years	240	80 %
- 26 – 35 years	34	11.3 %
- 36 – 50 years	4	1.3 %
Domicile		
- Sumatra	242	80.7 %
- Java	43	14.3 %
- Kalimantan	8	2.7 %
- Sulawesi	5	1.7 %
- Papua	2	0.7 %
Work		
- Student	19	6.3 %
- University Student	193	64.3 %
- Civil servants	6	2 %
- Entrepreneur	47	15.7 %
- Other	35	11. 6 %
The monthly income/revenue		
- < IDR 500.000	138	46%
- IDR 500.000 – IDR1.500.000	79	26.3%
- IDR1.500.000 – IDR 3.000.000	30	10%
- IDR 3.000.000 – IDR 5.000.000	33	11%
- IDR 5.000.000 – IDR 10.000.000	17	5.7%
- >IDR 10.000.000	3	1%

Reliability and Validity

In this study, Smart Partial Least Square (SPLS) analysis is used to gauge the suggested model. Cronbach's alpha and Composite are utilized to assess the level of internal consistency of constructs. A measurement is considered reliable if the Cronbach's alpha value is > 0.6 and the composite reliability value is > 0.7 (Hair et al., 2019). To gauge the convergent validity of constructs, the average variance extracted (AVE) is used with an acceptable threshold of 0.50. Table No. 3 illustrates the values of Cronbach's alpha, composite reliability, and average variance.

Table 3. Construct Reliability and Validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
AU	0.766	0.774	0.864	0.680
BI	0.841	0.843	0.894	0.678
PE	0.850	0.856	0.899	0.689
PEOU	0.835	0.836	0.890	0.669
PU	0.843	0.847	0.888	0.614
T	0.811	0.812	0.868	0.569

The six variables mentioned above possess composite reliability scores greater than 0.7 and Cronbach's alpha values greater than 0.6, indicating that this study can be considered reliable. The Average Variance Extracted (AVE) values also exceed 0.5, confirming the validity of this research.

We must compare the square root of the Average Variance Extracted (AVE) for each construct with the correlations between these constructs in order to evaluate discriminant validity. In this case, the square root of the AVE for each construct should exceed the correlations between these constructs to meet the requirements of discriminant validity, as explained (Fornell & Larcker, 1981). The results listed in Table No. 4 indicate that all square root values of AVE on the diagonal exceed the correlations between constructs, demonstrating that the discriminant measurement used meets the standards and is considered adequate.

Table 4. Discriminant Validity Result

	Actual use	Behavioral Intention	Perceived enjoyment	Perceived Ease of Use	Perceived usefulness	Trust
Actual Use	0.825					
Behavioral Intention	0.739	0.823				
Perceived Enjoyment	0.495	0.638	0.830			
Perceived Ease of Use	0.586	0.730	0.664	0.818		
Perceived Usefulness	0.638	0.714	0.668	0.647	0.784	
Trust	0.624	0.712	0.732	0.678	0.750	0.754

Structural Models

The Partial Least Square (PLS) path modeling is a highly valued approach in analyzing cause-and-effect relationships among latent variables in social science research. It is often considered a very flexible and effective method applicable in various research situations (Hair et al., 2011).

The proposed structural model has been analyzed using the SmartPLS software, which gives PLS-SEM analysis a graphical user interface. A total of 5000 bootstrap subsamples were used in the complete bootstrap procedure to assess the importance of the proposed correlations between the variables. The path coefficients from the structural model and the R-square values for the endogenous latent variables are shown in Figure No. 2

If the t-statistic is greater than 1.96 at a significance level of 0.05, path coefficients are deemed statistically significant. (Cohen, 2013) states that values greater than 0.35 are considered a strong indication, while values above 0.15 and 0.02 are considered moderate and weak indications, respectively.

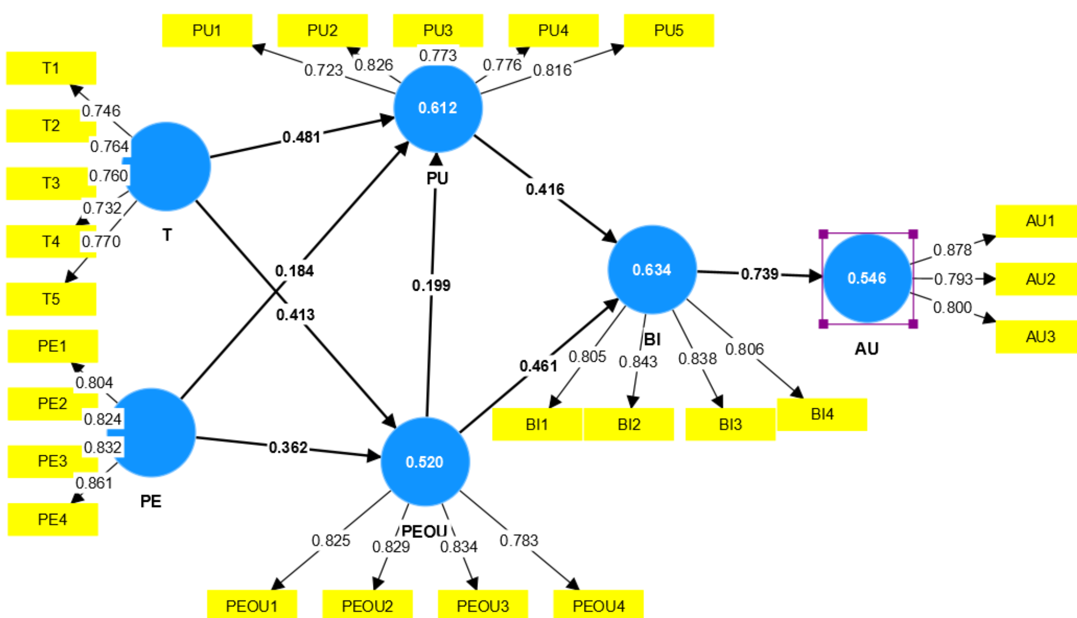

Figure 2. Inner Model

The preliminary results indicate that Trust is positively related to perceived usefulness (β = 0.481, t=6.102, p<.001) and perceived ease of use (β = 0.413, t= 4.755, p<.001), thus supporting H1 and H2. Both perceived enjoyment are positively related to perceived usefulness (β = 0.184, t= 2.294, p<.001) and perceived ease of use (β = 0.362, t= 4.331, p<.001); therefore, hypotheses H3 and H4 are supported. Thirdly, perceived usefulness has a positive influence on behavioral intention (β= 0.416, t= 8.763, p<.001), thus supporting H5.

Fourthly, perceived ease of use has a positive impact on perceived usefulness (β = 0.199, t= 2.195, p<.001) and behavioral intention (β = 0.461, t=8.780, p<.001), supporting H6 and H7. Fifthly, behavioral intention has a positive impact on actual use (β = 0.739, t=23.660, p<.001), supporting H8. The results of hypothesis testing can be seen in Table No. 5.

Table 5. Summary of hypothesis

	Hypothesis	Coefficients β	t Values	p Values	Result
H1	T → PU	0.481	6.102	0.000	Supported
H2	T → PEOU	0.413	4.755	0.000	Supported
H3	PE → PU	0.184	2.294	0.022	Supported
H4	PE → PEOU	0.362	4.331	0.000	Supported
H5	PU → BI	0.416	8.763	0.000	Supported
H6	PEOU → PU	0.199	2.195	0.028	Supported
H7	PEOU → BI	0.461	8.780	0.000	Supported
H8	BI → AU	0.739	23.660	0.000	Supported

The coefficient of determination, or R-squared, is a metric used to quantify how much the exogenous factors can account for the variation of the observed endogenous variable. R-square serves as an indicator to measure the overall impact of the structural model. The research findings indicate that 54.6% of the variance in the actual use variable and 63.4% of the variance in the behavioral intention variable can be explained. The results of R-Square test can be seen in Table 6 below.

Table 6. R-Square test

Variable	R-square
Actual Use	0.546
Behavioral Intention	0.634
Perceive Ease Of Use	0.520
Perceive Usefulness	0.612

The study reveals that trust has a positive and significant influence on perceived usefulness, aligning with previous research (Tsourela & Nerantzaki, 2020), and also on perceived ease of use. Additionally, the research finds that perceived enjoyment has a positive and significant impact on perceived usefulness, supporting previous studies (Gao & Bai, 2014), and perceived enjoyment also has a positive and significant impact on perceived ease of use, supporting earlier research (Ali et al., 2022)

Furthermore, the study supports the findings (Priyono, 2017) that perceived usefulness significantly influences behavioral intention to use IoT technologies. It also reveals that perceived ease of use positively and significantly influences perceived usefulness and behavioral intention, supporting previous research (Gao & Bai, 2014). The impact of behavioral intention on actual use, supported in this study, is consistent with previous research (Wang et al., 2023).

CONCLUSION AND RECOMMENDATION

This research aims to measure and understand the extent to which consumers in modern retail accept and are willing to adopt Internet of Things (IoT) technology in the context of shopping. The results confirm the effectiveness of the TAM (Technology Acceptance Model), explaining consumer behavior in accepting IoT technology. To achieve this objective, the study introduces a structural model that utilizes the Technology Acceptance Model (TAM) as a foundation, with the addition of two external variables: Trust and Perceived Enjoyment.

The conceptual model proposed was tested through an initial online survey, collecting responses from modern retail consumers in Indonesia. In order to assess the validity and dependability of the suggested model, partial least squares (PLS) analysis was performed in the second stage. PLS-SEM was then used to examine the connections between the variables and evaluate the hypotheses. Findings from this research indicate that all hypotheses proposed in the study are supported.

Practically, this research explores the significance of the Internet of Things (IoT) as an innovative technology in daily life and emphasizes its impact on the workplace and the market, particularly in modern retail. For professionals and practitioners, this study presents several guidelines that they can apply to enhance their goods and services to draw in and gain more consumers. The study highlights that in the use of IoT, consumers not only desire functionality and ease of use in IoT technology but also seek enjoyment and satisfaction in their shopping experiences. Therefore, IoT service providers are advised to integrate useful features with entertainment elements in their services. In terms of usability, practitioners are expected to ensure that the interfaces and IoT platforms they offer are well-designed for users, making them efficient and reliable. Thus, this research emphasizes that IoT has significant potential to transform the modern retail industry. With a better understanding of consumer acceptance of this technology, retail companies can improve their competitiveness and provide better services to their customers.

The findings of this research can serve as a foundation for further studies in the field of consumer acceptance of IoT technology in modern retail. Future studies could involve more variables or different contexts to understand more in-depth factors influencing consumer acceptance. There are limitations to this research. Firstly, it solely employs the Technology Acceptance Model for analysis and does not consider other acceptance models, such as the ECM model used in previous research by (Shang & Wu, 2017). Secondly, this study only adds additional variables like "Trust" and "Perceived Enjoyment" in TAM analysis, while there may be other factors not included that could influence consumer acceptance of IoT. Thirdly, the primary focus is on consumer acceptance of IoT technology, and the research does not explore the perspectives or acceptance of other stakeholders, such as manufacturers, suppliers, or retail workers.

Future research could compare other acceptance models, such as ECM and UTAUT (Unified Theory of Acceptance and Use of Technology), or the Technology Readiness Index model, to better understand the elements affecting IoT adoption among consumers in contemporary retail. This would aid in identifying the most effective model in this context. Additionally, research could delve into external factors influencing consumer acceptance, such as retail promotions, service quality, and shopping experiences, providing further insights into the contributions of these external factors. Lastly, future research could also explore the perspectives of manufacturers, not just consumers, to deepen the understanding of IoT technology adoption in supporting the better development of IoT technology in the retail industry.

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