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THE IMPACT OF TECHNOLOGY ADVANCEMENTS ON IMPULSE BUYING BEHAVIOR IN ONLINE SHOPPING ON CREDIT AMONG MALAYSIANS

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Abstract: *Impulse buying behavior has become a key area of interest in understanding consumer decision-making processes, particularly in relation to credit usage. Furthermore, impulse buying on credit often leads to overspending and the behavior can result in increasing the risk of default. Additionally with the advancement of technology also significantly influence impulse buying behavior by enhancing accessibility, and engagement in the shopping experience. Thus, this study aims to determine the availability and accessibility of personal smart devices, accessibility of E-commerce websites, internet browsing speed and social networking on impulse buying behavior. Theory of Planned Behavior serve as the basic framework for this study. Using a quantitative approach, convenience sampling was employed in selecting sample size. Data were obtained from 153 consumers who use online shopping on credit. The findings of the study validate a significant effect on availability and accessibility of personal smart devices, accessibility of E-commerce websites, internet browsing speed and social networking on impulse buying behavior. The implications of the findings were discussed, and recommendations related to researcher, marketers and policy makers were made. Future research includes further investigations on the constructs using qualitative approaches plus exploring other variables that can influence impulse buying behavior on credit.*

Keywords: *Technology Advancements, Impulse Buying Behavior, online shopping, Credit, PLS-SEM*

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Introduction

The rapid advancement of technology has significantly transformed consumer behavior, particularly in the case of impulse buying. With the advent of smartphones, high-speed internet, and sophisticated algorithms, consumers are more connected and engaged. These technological innovations have created an environment where impulsive buying decisions are not only facilitated but also actively encouraged (Rani, 2024). According to Suherlan and Okombo (2023), technology plays a vital role in reshaping marketing structure and consumer behaviour. The seamless integration of technology especially on of e-commerce platforms with personalized marketing strategies means that consumers are constantly exposed to products and offers tailored to their preferences (Sudirjo, 2023). This personalized approach significantly increases the likelihood of impulse buying, as consumers are presented with items that meet with their interests and desire. According to the ICT Use and Access by Individuals and Household Survey Report 2023, published by the Department of Statistics Malaysia (DOSM), the top five popular activities of internet usage among Malaysians are as follows, first is participating in social networks, which is remarkably popular, with 99.4% of users engaging in this activity, second downloading pictures, movies, videos, or music, which follows closely at 93.9%, third searching for information about goods and services, utilized by 92.8% of users, fourth downloading software or applications, with 89.6% of internet users involved, fifth using the internet for telecommunication purposes, such as online calls, which accounts for 85.9% of usage. Impulse buying is a phenomenon where consumers make unplanned purchases without prior intention (Chein, Hui and Lee, 2020). Supporting with advance technology has significantly ease the purchasing process, making it easier and convenient to buy products on credit. The integration of e-commerce platforms and user-friendly interfaces has revolutionized the way people shop, and this led to impulse buying particularly on credit.

According to the statistics from Trading Economy (2024) it indicates that consumer spending in Malaysia increased to RM 258,519 million in the third quarter of 2024 from RM 243,029 million in the second quarter of 2024. From 2005 to 2024, consumer spending in Malaysia averaged RM 146,244.37 million, reaching an all-time high of RM 258,519 million in Q3 2024. This data demonstrates that consumer spending has evolved into a significant lifestyle statement, going beyond merely being a leisure activity for many individuals. These figures highlight the considerable impact of consumer spending, which has contributed to an increase in impulse buying. This impulsive purchasing behavior has directly influenced the annual growth and profitability of retailers (Lau et al., 2018).

However, with the advancement of technology and the increase of growth on consumer spending particularly on credit has become an area of growing concern. The concern due to the financial vulnerabilities and limited resources characteristics. (Chein, Hui and Lee, 2020). The consumer, which often faces economic instability and limited financial resources, is particularly affected to these vulnerabilities (Rahman et al. 2021). The availability of credit options, such as buy now, pay later (BNPL) services, exacerbates this issue by providing immediate purchasing power without immediate financial consequences.

Furthermore, from the statistic provided by Sources Consumer Credit Oversight Board Task Force (CCOB), (2024), the data indicated that there were 3.7 million active buys on credit. As of the end of the first quarter of 2024, credit exposure reached RM1.4 billion, marking a 34% increase from RM1.06 billion at the end of 2023, and constituting 0.07% of total household debt as of end-2023. The proportion of account holders with overdue payments decreased from

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5.8% at the end of Q1 2023 to 3.8% at the end of Q1 2024, with the average overdue amount per customer being RM370 million.

Thus, the primary objective of this paper is to explore the factors influencing impulse buying, particularly on credit, within the context of advanced technology among Malaysians. Today's technology landscape is characterized by the accessibility of e-commerce websites, high-speed internet browsing, social networking platforms, and the widespread use of personal tablets, laptops, and smartphones. However, previous studies have offered limited insights into the relationship between these technological factors and impulse buying (Lim & Yazdanifard, 2015; Hasim et al., 2018), impulse purchase behavior on generation Y (Khan et al., 2015) and specific product/industry (Falahat et al., 2017; Lau et al., 2018). While there is a substantial body of literature on impulse buying behavior, there remains a gap in understanding how specific aspects of modern technology influence impulsive purchasing decisions, especially in the context of credit usage. This paper aims to bridge that gap by examining the relationship between modern technological tools and consumer impulse buying behaviors. Additionally, the findings of this study could provide valuable insights for government and policy makers to develop targeted interventions and regulations. These could help mitigate the financial risks associated with impulse buying behavior.

Literature Review

Theoretical Framework

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was proposed by Davis in 1989. TAM outlines a three-stage sequential process for technology adoption. Initially, external elements, notably the system's design characteristics, trigger cognitive reactions in users. These reactions include perceptions of the technology's ease of use and its usefulness. Following this, these cognitive perceptions lead to an emotional reaction, forming attitudes and intentions towards using the technology. Finally, this emotional response impacts the actual behavior of individuals in their use of the technology. Davis initially proposed this model in 1989 and expanded it in 1993.

TAM is a theoretical framework that analyses the relationship between user behaviour and their perceptions of ease of use, usefulness, and intention to engage with specific technology. Perceived usefulness refers to the degree to which a person believes that using the technology will enhance their job performance, while perceived ease of use is the extent to which a person believes that using the technology will be free from effort. (Ru, Kowang, Long, Fong and Fei 2021; Scherer, Siddiq, and Tondeur, 2018). Davis (1989) identifies perceived ease of use and perceived usefulness as two factors that encompass the expectation of positive behavioural outcomes and the belief that participation in the behaviour will not demand excessive effort. A subsequent study indicated that behavioural intention can be effectively substituted by attitude towards behaviour, as proposed by Davis (1993). This attitude reflects an individual's emotional assessment of the possible results of participating in a specific behaviour, as explained by Ajzen (2011). The probability of a behaviour manifesting is positively associated with the strength of the emotional response.

The impact of perceived usefulness on actual use can exhibit a direct relationship, highlighting the significance of this variable in predicting behaviour. While the direct impact of perceived ease of use-on-use behaviour may be limited, it plays a crucial role in shaping the influence of

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perceived usefulness, as highlighted by Davis (1993) and Lee, Rhee and Dunham (2009). According to Yi and Hwang (2003), the model indicates that a user's perception of an application as easy to use enhances its likelihood of being regarded as helpful. This perception of usefulness enhances the acceptance of the technology (Scherer et al., 2018). Recent research on intrinsic motivations and self-efficacy suggests that factors such as enjoyment, goal orientation, and self-efficacy also play important roles in determining technology acceptance behavior. The technology acceptance model posits that the impact of these external variables on behavioral intention is mediated by the two core beliefs of usefulness and ease of use (Yi & Hwang, 2003).

Theory of Planned Behavior

Theory of Planned Behavior (TPB) suggested that intentions to engage in various behaviors can be predicted with high accuracy based on attitudes toward the behavior, subjective norms, and perceived behavioral control. Attitude toward the behavior refers to the extent to which a person evaluates with positive or negative of a behavior. For subjective norm, it refers to the perceived social pressure that reflects one's sense of control over performing the behavior while for perceived behavioral control, it refers to the perceived ease or difficulty of performing a behavior. It is believed to be influenced by past experiences, as well as anticipated barriers and obstacles. The general rule of this theory asserts that the stronger an individual's intention to perform a behavior, the more likely they are to carry it out (Ajzen, 1991).

According to Sutisna & Handra (2022), Theory of Planned Behavior (TPB) has been effective in predicting various types of human behavior. It suggests that an individual's intention is the key factor in determining their actions including on online shopping behavior. Their study showed attitude of a buyer towards e-business and perceived behavioral control have impact on their intention to shop online except for subjective norms. According to their study, there was no impact towards buyers' intention to shop online. However, this result is not in line with theory where the buyers will be affected to have intention to participate or not to participate in online shopping if the environs recommend or did not recommend using e-business.

Supported by Ajzen (1991), the importance of attitude, subjective norm, and perceived behavioral control in predicting intention is likely to vary depending on the behavior and situation. In some cases, attitudes alone may significantly influence intentions, while in others, both attitudes and perceived behavioral control may be enough to account for intentions. In some situations, all three factors might independently contribute to the formation of intentions. Hence, according to the Theory of Planned Behavior (TPB), individuals are more likely to engage in impulse buying if they believe it will lead to desired outcomes and if they feel they have the resources and opportunities to do it. Substantiated by Nguyen (2024), the study found significant occurrence of the main factors that drive impulsive buying behavior by using the Theory of Planned Behavior (TPB) as theoretical frameworks.

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The conceptual framework for this study as follows:

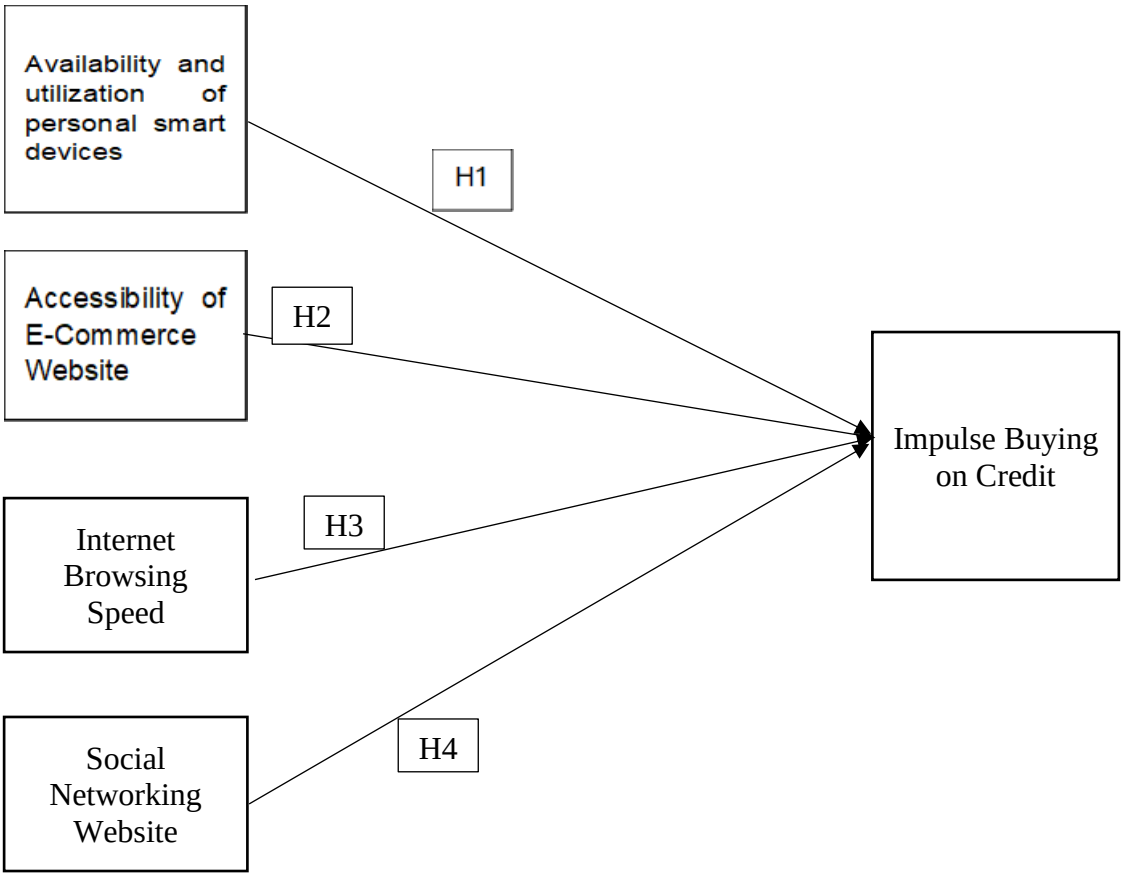

Figure 1: Research Conceptual Framework

Hypotheses Development

Impulse Buying Behavior

According to Burton et al. (2018), impulse purchases are driven by a sudden and intense emotional urge, resulting from reactive behavior characterised by limited cognitive control. Pradhan et al. (2018) further elaborate that this propensity for spontaneous purchasing is largely attributed to the immediate gratification it provides to consumers. Research conducted by Bilal et al. (2022) found that online impulsive buying behavior is predicted by research on online consumers shopping experience however, there is a little empirical evidence to support this claim. Hananto (2022) focuses on the influence of website quality, sales advertising, and fashion consciousness on impulsive purchases in the context of online clothing shopping. Using multiple regression analysis and confirmatory factor analysis, data was collected and analyzed from an online survey of 211 respondents. The results reveal that while fashion consciousness and sales advertising significantly influence impulse buying, website quality does not directly impact such behavior. However, website quality remains important as it complements sales marketing efforts, effectively supporting strategies to encourage impulsive purchases. Balaji and Babu (2017) emphasize the pivotal role of e-commerce websites in facilitating marketers' engagement with consumers, positioning these platforms as the principal medium for real-time interactions between online retailers and their customers. Their study identified a significant positive relationship between the accessibility of e-commerce websites and consumers' impulse purchasing behavior. This study supports that finding, reinforcing the importance of website

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accessibility in driving impulsive buying tendencies. Additionally, Elvina (2022) conducted a study on factors affecting the urge of impulsive buying on E-commerce and found that five major factors visual appeal, product diversity, price, information quality, and parasocial interaction that influence impulsive purchases.

Availability and Utilisation of Personal Smart Devices

In the digital age, the proliferation of personal smart devices, such as smartphones, tablets, laptops, and computers, has significantly transformed the landscape of consumer behavior. According to Tan and Quang (2023) and Kumar and Kaur (2018), the convenience and accessibility of these devices have resulted in a significant increase in online impulse purchasing, a phenomenon that has captivated the attention of both marketers and researchers. The influence of personal smart devices on impulse purchasing behavior has been the subject of numerous studies. The research indicates that the quality and design of e-commerce platforms, the presence of positive emotions during the shopping experience, and the personalisation of advertising can all significantly contribute to the initiation of impulse purchases (Cuong, 2024; Utama, Sawitri, Haryanto, and Wahyudi, 2024).

The ease of accessibility and convenience provided by personal smart devices is another significant factor that influences online impulse purchasing. These devices allow consumers to make purchases at any time and in any location, without the physical limitations of traditional purchasing (Cavazos-Arroyo and Maynez-Guaderrama, 2022). This heightened accessibility may result in a greater propensity for impulse purchases, as consumers are more susceptible to the allure of immediate gratification.

The existing literature suggests that the use of personal smart devices can have a significant impact on impulse buying behavior. Consumers are increasingly accessing e-commerce platforms through applications downloaded on their smartphones or tablets, which can trigger impulse purchases (Tan and Quang, 2023 and Utama et al., 2024). Utama et al., 2024, further clarify that the mobility and ubiquity of these devices, coupled with their ability to provide personalised advertising and recommendations, can contribute to the likelihood of impulse buying. Moreover, Rodrigues, Lopes and Varela, (2021) mention that targeted advertisements that are tailored to the user's preferences and browsing history can create a sense of urgency and desire, leading to impulsive purchasing decisions. It is important to note that impulse buying behavior is not solely driven using personal smart devices. Personal, social, demographic, and situational factors can also influence the likelihood of impulse purchases. The interplay between these various factors can create a complex and dynamic landscape for understanding impulse buying behavior (Liu and Lu, 2017; Utama et al., 2024). Hence, the present study posits the following hypothesis:

H1: Availability and utilisation of personal smart devices has a significant influence on impulse buying on credit

Accessibility of E-commerce Website

Understanding the concept of e-commerce requires clarification that it encompasses various interactions between participants in online buying and selling process. According to Santos et al. (2022), e-commerce is a term that is referring to the businesses that conducted through digital platforms. Due to the expansion of information technologies and growing accessibility of the internet, it has expanded the concept and facilitated the development of large-scale digital marketplaces which enable the seller to advertise their products and make sure the company

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website to be found easily by the customers. Throughout this way, it may provide accessibility of the e-commerce website to the customers from almost anywhere by using their mobile devices (Santos et al., 2022; Chandrasekhar et al, 2024).

E-commerce may provide benefits over traditional purchasing methods. According to Santos et al. (2022), there is a positive and significant relationship between the ease of use of online shopping platforms and purchase intentions. Through e-commerce, the customers may have access to the numerous options of products and sellers, accessibility to purchase at anytime and anywhere, possibility to earn cheaper price through offer comparisons and no waiting lines for the product purchases with effective logistic system. Hence, these benefits may encourage the customers to make impulse purchases. Supported by Sai, Lu & Lin (2024), it is more common for the customer to make impulse purchases through online shopping as compared to offline purchases.

User-friendliness, secure transactions and all-encompassing information provision will influence in impulsive buying behavior (Febrilia et al, 2024; Chandrasekhar et al., 2024). This is because, according to Febrilia et al. (2024) the positive inputs may result in the spontaneous decision to purchase based on the emotion of choices that lead to the irrational and impulsive behavior. As stated by Balaji and Babu (2017), e-commerce websites are crucial in aiding marketers' efforts to connect with customers, acting as the main channel for real-time interactions between online retailers and consumers. Their study showed a positive correlation between accessibility of e-commerce website and impulse buying behavior. In order to motivate impulse buying pattern among customers, the seller should focus on the development of information and communication system of their e-commerce website. The study by Chandrasekhar et al. (2024) has indicated that mobile shopping apps leverage their intuitive interfaces, push notifications, personalized shopping experiences and convenience to stimulate impulsive purchasing behaviors and lead to overspending by the customers. Hence, the present study posits the following hypothesis:

H2: Accessibility of E-Commerce Website has a significant influence on impulse buying on credit

Internet browsing speed

Internet plays a significant role in e-commerce by providing a variety tools and technologies (Santos et al., 2022). The emergence of the internet has contributed to the expansion of e-commerce (Gori, Topino, Fioravanti & Casale, 2024) and will be more efficient with the availability of high-speed internet coverage. This is because, as stated by Faisal et al. (2020), enhanced network coverage is a key factor driving the growth in the number of internet users. Supported by Sharma and Madan (2020), the higher data speed will allow the users to do more online transactions in short time and provide higher satisfaction to them.

According to Santos et al. (2022), the rapid speeds of 5G networks, along with the high-resolution screens of 5G-enabled devices, are likely to increase customers' willingness to engage in e-commerce, resulting in more time spent on websites and a higher volume of online purchases. These advancements can enhance the effectiveness of e-commerce strategies, such as online advertising for vendors. As shown by Li et al. (2025), their respondents from the country with better internet accessibility have higher chances to engage in online shopping as opposed to the other country with lesser accessibility to internet. Faster speeds and clearer

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displays also contribute to a more enjoyable e-commerce experience which offering consumers psychological and intangible benefits.

The availability and quality of the network significantly impact impulse buying behavior in online shopping. A stable and accessible network allows for seamless browsing, quick retrieval of product details, and smooth transaction processes. With a stable connection, shoppers feel more confident exploring products, making faster purchase decisions, and giving in to impulsive buying tendencies (Cabansag et al., 2025). Supported by Gori, Topino, Fioravanti and Casale (2024), as the speed of the internet may ease the accessibility and provide convenience to e-commerce any time for the customers, it will simultaneously increase the factors that trigger impulse buying, especially among vulnerable individuals. Supported by Balaji and Babu (2017), they found a strong positive correlation between internet browsing speed and consumer impulse buying behavior. Hence, the present study posits the following hypothesis:

H3: Internet browsing speed has a significant influence on impulse buying on credit

Social Networking Website

Social networking websites have become an integral part of our daily lives, and their influence on consumer behavior has been a subject of increasing research interest. One aspect of consumer behavior that has gained particular attention is impulse buying, which refers to the tendency to make unplanned, spontaneous purchases. (Amos, Holmes, and Keneson 2013; Bhakat and Muruganantham, 2013)

Wahib, (2024) indicates that social interactions and social influence on social networking websites can significantly impact impulse buying behavior. He further explains, marketers have recognised the importance of understanding the factors that drive impulse buying, as it can be a valuable strategy to increase sales and drive revenue. One of the key factors that contribute to impulse buying on social networking websites is the presentation and promotion of products. The diversity of products available and the way they are displayed can create a sense of fulfillment and lead to impulsive purchases. Additionally, the use of enticing promotions and discounts can further stimulate impulse buying behavior (Tan & Quang, 2023; Wahib, 2024).

Utama et al., (2024) emphasize that the quality of the website or app interface has also been identified as a key factor in influencing impulse buying behavior. Factors such as security, convenience, information quality, ease of use, and service quality can shape consumers' perceptions of the website or app, which in turn can trigger positive emotions and lead to impulse purchases. In addition, a significant aspect that contributes to the rise of impulse buying in the digital era is the ability of consumers to visualize products effectively. Product visualisation, combined with strategic emotional triggers, such as limited-time discounts or exclusive promotions, can significantly enhance the likelihood of impulsive purchases. Moreover, the specific preferences and values of the younger generations, particularly the Z generation, have been found to be highly influential in shaping online impulse buying behavior (Tan and Quang, 2023).

On top of that, previous research conducted by Zhang, Xu, Zhao and Yu, (2018) has also highlighted the role of individual differences in impulsiveness and browsing behavior. Consumers with a higher level of impulsiveness are more likely to engage in impulse buying,

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and the act of browsing on social networking websites can also contribute to this behavior. Hence, the present study posits the following hypothesis:

H4: Social Networking website has a significant influence on impulse buying on credit

Research Design

This study adopts a quantitative research design, utilizing a survey-based methodology to gather data. The primary objective is to examine the impact of technological advancements on impulse buying behavior in the context of online shopping on credit among Malaysians. To achieve this, a structured questionnaire will be employed to measure the relationships between key variables, including the availability and utilization of personal smart devices, the accessibility of e-commerce platforms, internet browsing speed, and the influence of social networking websites on impulse buying behavior facilitated by credit usage. The primary data was selected to capture the impact of technology advancements on impulse buying behavior in online shopping on credit among Malaysians. The items and constructs for the survey instruments was developed by adapted and adopted from verified items from previous studies and assessed using 5-points Likert scale. Prior to the main empirical study, a pilot test was conducted to examine the effectiveness and clarity of the research instruments and procedures. Thirty survey questionnaires were distributed to relevant respondents. Subsequently, the full data collection procedures were carried out using face-to-face invitations and an online survey distributed via Google Forms to the targeted respondents. The GPower 3.1 software package is employed to calculate the required minimum sample size of the respondents (Erdfelder et al., 2009). The input parameters using GPower applied in this analysis was effect size = 0.15, alpha (α) = 0.05, power (1-β) = 0.95 and the number of predictors = 5. Based on the parameters input in the GPower, the optimum sample size for this study is 153 (Hair & Alamer, 2022).

Target Population

The target population for this study is Malaysian consumers who engage in online shopping using credit methods. The appropriate sample size for the study is 153 respondents, specifically focusing on individuals who utilize advanced technology to make credit-based purchases. This calculation is based on a 95% confidence level, a 50% standard deviation, and a 5% margin of error, following the guidelines outlined by Krejcie and Morgan (1970).

Sampling Design

A total of 153 questionnaires were distributed and gathered through Google Forms using convenience sampling techniques. The respondents' age range and demographic backgrounds were random. Convenience sampling was selected due to the unpredictable variety of individuals who engage in online shopping using technology.

Data Analysis

The collected data were then analysed using Statistical Package for Social Science (SPSS) Statistics version 29 and Partial least square structural equation modeling (PLS-SEM). The SPSS is the tool to measure the descriptive analysis of the respondents. Next, PLS-SEM is utilized as preferred method in this study. The objectives of PLS-SEM are to make predictions about relevant constructs (Hair & Alamer, 2022).

Two stages approached in analysing and interpretation embedded in PLS-SEM. The first stage is measurement model, and the second stage is the evaluation of structural model.

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Measurement Model Assessment

The measurement model will be evaluated using indicator loading, internal consistency reliability, and convergent validity. Indicator loadings above 0.70 are generally recommended; items with lower loadings will be removed from the model. Internal consistency reliability will be assessed using Composite Reliability (CR), Cronbach's alpha, and rho_A, where CR values between 0.70 and 0.90 are considered "satisfactory to good" (Hair, Risher, Sarstedt, & Ringle, 2019). Additionally, convergent validity will be assessed using Average Variance Extracted (AVE), and an AVE value above 0.50 is considered acceptable (Hair et al., 2019). Collinearity will be examined using the Variance Inflation Factor (VIF), with values below 3 being recommended (Hair et al., 2019). To assess discriminant validity, The Fornell-Larcker Criterion is a widely used method to assess discriminant validity in PLS-SEM. Discriminant validity ensures that a construct is distinct and measures concepts different from other constructs in the model. Values below 0.85 indicate that discriminant validity is established, ensuring that the latent constructs used to measure causal relationships are distinct from each other (Hair et al., 2017).

Structural Model Assessment

If the measurement model meets the criteria, the structural model assessment will be performed. R^2 values will be calculated for endogenous constructs to assess the explanatory power of the model. According to Hair et al. (2019), R^2 values of 0.25, 0.50, and 0.75 indicate weak, moderate, and substantial contributions, respectively. Additionally, the Q^2 value will be computed using the blindfolding procedure to evaluate the model's predictive relevance. Q^2 values will be interpreted as: > 0 (small), > 0.25 (medium), and > 0.50 (large) (Hair et al., 2019). Lastly, the bootstrapping procedure will be used to obtain path coefficient results, which will help determine whether the direct effects support the hypotheses of this study.

Result Analysis.

Demographic Profiles

This study employed the sample size of 153 respondents with the demographic background characteristics: 66.8% of the respondents are female and 33.2% are males. For the race category, the most respondents are Malay (47.4%), Chinese (31.8%), Indian (14.6%) and others (6.2%). The highest marital status is single (62.8%), married (31.7%) and windowed (5.5%). The majority of the respondent's academic qualification are secondary school/SPM (49.8%) followed by bachelor's degree (30.8%) and the least is doctorate degree/PhD (2.4%). There are four categories of income classifications, 38.7% of them are below RM2,500, 40.1% in the range of RM2,501-RM4,850, 16.7% in the range of RM4,851 – RM7,100 and 4.5% are those with RM7,101 and above. Lastly, state of residence of the respondents. The highest recorded state of residence is Perak (28.5%), followed by Selangor (24.6%), Pulau Pinang (19.7%), Johor (15.8%), Kelantan (8.1%) and Kedah (3.3%).

Regarding the how often the respondents shop online, from the results 55% reported to shop monthly, 23.3% reported weekly and 20% reported as rarely. The are various method for deferred payment options and the most preferred are Shopee Paylater (55.5%), followed by credit card instalment (34.4%).

Assessment of Measurement Model.

Structural Equation Modeling (SEM) utilizing the Smart-PLS 3.0 software, is employed to validate the four (4) proposed hypotheses. Recognized as a second-generation analytical

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technique, SEM is extensively applied in contemporary research due to its capability to address measurement errors among observed variables, effectively addressing the limitations of first-generation methods (Chin, 1998). The data analysis follows a two-stage process, as recommended by Hair et al. (2011): the validation of the measurement model and the evaluation of the structural model. The validation of the measurement model encompasses assessments of convergent validity (as outlined in Table 2) and discriminant validity (as illustrated in Table 3). The evaluation of the structural model focuses on analyzing the proposed hypotheses and estimating the model's predictive efficiency and effect size (as shown in Table 2).

Table 2: Measurement items and Convergent Validity for the Measurement Model

Variables	Indicator	Items	Factor Loadings	CR	AVE
Impulse Buying Behavior	IB2	I often buy things on credit spontaneously.	0.600	0.876	0.589
	IB3	It is normal to buy things on credit even I have money	0.699		
	IB6	Attractive discounts and promotions lead me to buy on credit.	0.853		
	1B7	Easy payment options (e.g., credit) increase my likelihood of impulse buying	0.852		
	IB8	Social media advertisements influence my impulse buying behavior.	0.802		
Availability and utilization of personal smart devices	PM1	I frequently use my personal mobile device for online shopping on credit.	0.680	0.922	0.665
	PM2	The ease of browsing and shopping on my mobile device encourages me to buy products impulsively on credit.	0.806		
	PM3	I feel more relaxed and less restrained when shopping on my mobile device, which leads me to make impulsive purchases on credit.	0.874		
	PM4	I often make purchases using the credit option when shopping impulsively on my mobile device.	0.889		
	PM5	I am influenced by time-sensitive deals and flash sales on my mobile device, leading to impulsive credit purchases.	0.837		
	PM6	I find it difficult to resist the temptation of online shopping on my mobile device, especially when I can use credit for purchases.	0.791		

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Accessibility of E-Commerce Website	AE1	I am more likely to buy on credit impulsively when the e-commerce website is user-friendly and accessible.	0.850	0.929	0.686
	AE2	If a website has a seamless and fast payment option, I tend to make impulsive purchases on credit without thinking about the cost.	0.860		
	AE3	When an e-commerce website is difficult to use, I am less likely to make impulse purchases.	0.728		
	AE4	The simplicity of an e-commerce website encourages me to buy on credit impulsively.	0.775		
	AE5	The faster I can find a product on an e-commerce website, the more likely I am to make a spontaneous purchase on credit.	0.895		
	AE6	I find that when an e-commerce website offers quick checkout options, I am more likely to complete an impulsive purchase on credit	0.849		
Internet Browing Speed	IS2	I feel more encouraged to buy items impulsively on credit when the online store loads quickly and does not require much waiting time.	0.899	0.962	0.836
	IS3	When the internet speed is fast, I feel more confident in making impulsive purchases on credit.	0.912		
	IS4	A delay in internet speed discourages me from completing impulsive purchases, especially when using credit for payments.	0.908		
	IS5	Fast internet gives me the feeling of efficiency, and I tend to buy products on credit more easily and impulsively.	0.935		
	IS6	A slow internet connection causes frustration and reduces the likelihood of making impulsive purchases on credit	0.916		
Social Networking Website	SN1	I am more likely to impulsively purchase products on credit after seeing product recommendations from influencers on social media	0.812	0.937	0.749
	SN2	Social networking sites frequently showcase sales, or limited time	0.902		

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		offers that prompt me to make purchases on credit impulsively.			
	SN4	The targeted advertisements I see on social media platforms often encourage me to make impulsive purchases using credit.	0.891		
	SN5	I often feel the urge to buy products on credit immediately after seeing them featured in social media posts or stories.	0.885		
	SN6	The social aspect of social media platforms, like seeing others buy products, influences me to make similar impulse purchases on credit.	0.835		

The final three columns of Table 2 present the item loadings, composite reliability (CR), and average variance extracted (AVE). From the results, it shown the AVE and CR of all constructs exceed the 0.50 threshold for AVE (Hair et al. 2013) and 0.70 threshold for CR (Henseler at al. 2009). From the result is has shown that the measurement model is reliable and requisite convergent validity. The item loadings range from 0.600 to 0.935; composite reliability (CR) analysis range from 0.876 to 0.962 and AVE range from 0.589 to 0.836.

Table 3: Discriminant Validity by Fornell-Larcker Criterion

Constructs	AE	IB	IS	PM	SN
AE	**0.828**				
IB	0.720	**0.767**			
IS	0.823	0.662	**0.914**		
PM	0.777	0.826	0.810	**0.816**	
SN	0.709	0.713	0.663	0.734	**0.866**

Bold values indicate the average variance extracted while the other entries represent the squared correlations.
Note: AE= Accessibility of E-Commerce, IB= Impulse Buying, IS= Internet Speed, PM= Personal Smart Devices, SN= Social Network

Discriminant Validity is used to distinguish between measures of a construct. In contrast to Convergent Validity, Discriminant Validity examines whether the items measure anything else unintentionally (Urbach & Ahlemann, 2010). Cross-loading (Chin, 1998b) and Fornell-criterion Larcker's are two often used metrics of discriminant validity in PLS-SEM (Fornell & Larcker, 1981). The Fornell-Larcker (1981) criterion assesses Discriminant Validity by comparing the square root values of each latent construct's AVE to the correlations between the other latent constructs. This criterion means that the AVEs of every latent construct should be bigger than their correlation with any model construct (Hair et al., 2017). Fornell-Larcker (1981) recommends an AVE of 0.50 or above to achieve Discriminant Validity in a model. Table 3 shows that the ranges of the Average Variance Extracted (AVE) are between 0.589 and 0.836, indicating that they are adequate. The comparison of the latent construct's correlation with the square root of the AVE (see; bolded values) in 3 above shows that the AVE had higher values than the correlation among the latent constructs, showing that the Discriminant Validity of this study was achieved.

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Assessment of Structural Model (Inner Model)

A structural model (inner model) evaluated the dependent relationship between the exogenous and endogenous latent constructs in a hypothetical model for this study. In examining the structural model (inner model), PLS-SEM was employed to achieve these objectives. Firstly, before checking into bootstrapping analysis to answer the hypothesis, collinearity of structural model needs to be achieved. Assessing collinearity in a structural model is examined by the variance-inflated factor (VIF). Thus, an exogenous latent variable is evaluated separately for its collinearity in a structural model by determining the variance inflated factor. According to Hair et al. (2011), VIF values above 5 among the exogenous variables in the structural model imply collinearity among the latent variables/constructs. Nonetheless, as indicated in Table 4 below, the VIF values of the exogenous variable indicate that collinearity is not an issue in this study as all latent variable values found were less than threshold values (Hair et al, 2011).

Table 4: Collinearity Assessment of the Reflective Constructs (VIF)

Variables	VIF
Accessibility of E-Commerce Websites	3.781
Internet Speed	4.031
Personal Smart Devices	3.780
Social Network	2.425

Following the result of the assessment of collinearity issues among the exogenous constructs, which indicate not an issue in this study, the researcher proceeds to determine the significance of the path coefficient, the level of R-square (R^2) value, assessment of effect-size (f^2), and the predictive relevance Q2 of the structural model.

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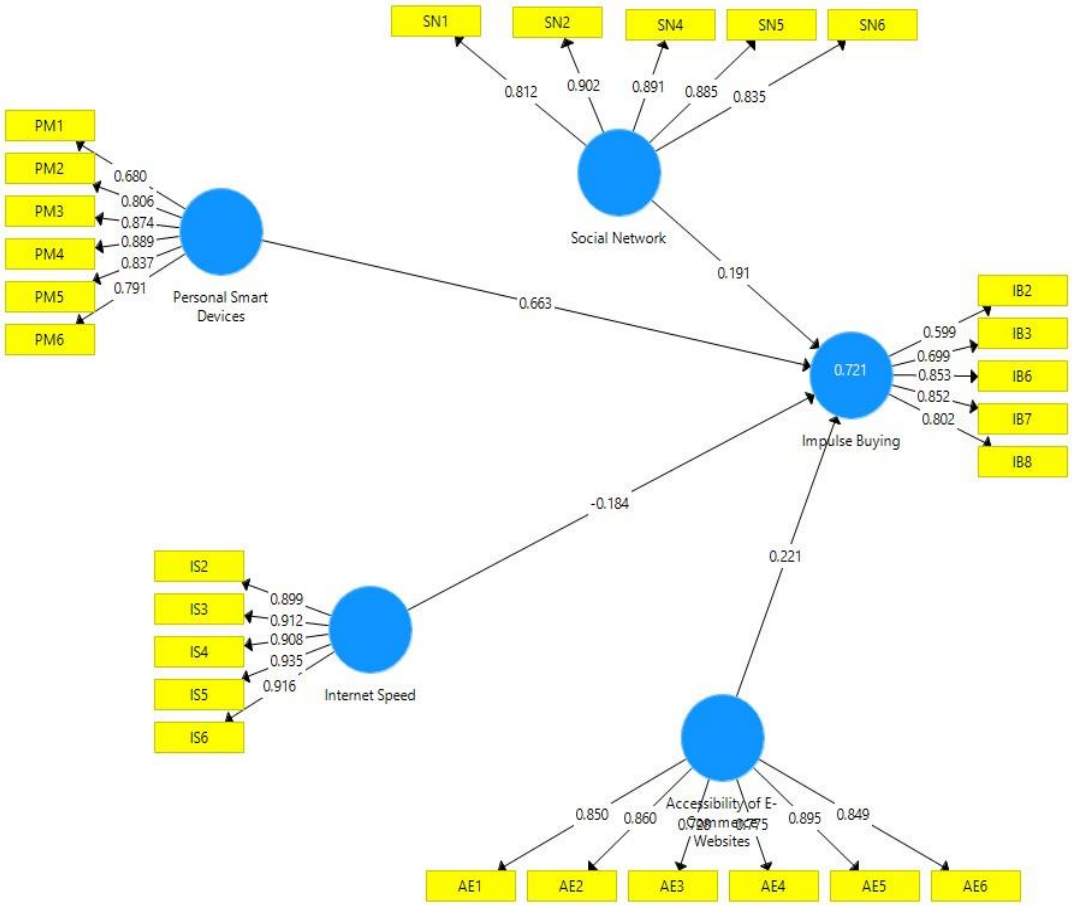

Figure 2: Structural Model Coefficient Value

In PLS-SEM, the structural model evaluation focuses on determining the significance and relevance of path coefficients. This study tested the hypothesized direct association between the exogenous and endogenous latent variables by analyzing the path coefficient analysis with a standard bootstrapping approach. Consistently, Hair et al. (2017) recommend testing the usual bootstrapping procedure, which employs 500 samples for 153 samples to determine the significance of the path coefficient in this study's relationship. The study produced the relationship's beta value, t-statistics, standard error, and statistical significance of the path coefficient.

Table 5: Summary of Structural Model Result

HP	Path	Coefficient	T-statistic	p-value	Results	R-Square	Q2	Effect Size
H1	PM → IB	0.663	6.425	0.000***	Accept	0.714	0.405	0.417
H2	AE → IB	0.221	2.595	0.010*	Accept			0.446
H3	IS → IB	0.184	1.974	0.049**	Accept			0.030
H4	SN → IB	0.191	2.376	0.018*	Accept			0.054

Note: AE= Accessibility of E-Commerce, IB= Impulse Buying, IS= Internet Browsing Speed, PM= Personal Smart Devices, SN= Social Network
p-value = *** p < 0.001, ** p < 0.05, * p < 0.10

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The structural model for this study is illustrated in Figure 1, encompassing four hypotheses developed between the constructs. Using the bootstrapping function in SmartPLS 3.0 with a subsample size of 500, T-statistics were calculated for all hypotheses. As detailed in Table 5, all hypotheses are supported at a 1%, 5% and 10% alpha level.

Notably, internet speed (β = -0.184) has a negative influence on impulse buying behavior, while the predictors such as personal smart devices (β = 0.663), accessibility of e-commerce (β = 0.221), and social network (β = 0.1991), exhibit a positive influence on impulse buying behavior. Furthermore, the R^2 value of 0.714 surpassing the threshold of 0.66, signifies a substantial model (Chin, 1998), indicating that 71.4% of the variance in impulse buying behavior can be explained by this structural model. Effect sizes, as defined by Cohen (1988), are categorized as follows: 0.02 represents a small effect, 0.15 a medium effect, and 0.35 a large effect. Referring to Table 5, personal smart devices ($f^2 = 0.417$) and accessibility of e-commerce ($f^2 = 0.446$) exhibit large effects in contributing to the R^2 value for impulse buying behavior, while the other two constructs demonstrate medium but statistically significant effects.

Additionally, the blindfolding procedure is applied to assess the model's predictive relevance. A Q^2 value greater than zero indicates that the model possesses predictive relevance for a specific endogenous construct. According to the guidelines provided by Hair et al. (2013), Q^2 values of 0.02, 0.15, and 0.35 signify small, medium, and large predictive relevance, respectively. For this study, the Q^2 value for impulse buying behavior is 0.405, which is not only greater than zero but also surpasses 0.35, confirming the model's substantial predictive relevance.

Discussion

The first variable personal smart device such as smartphones and tablets have a positive and influence on impulse behavior when using credit. These devices provide seamless access to online shopping platforms, enhancing convenience and immediacy. Features like personalized notifications, discounts and one-click purchasing often appeal to consumer emotions and reduce the perceived effort by making a purchase. In addition, the integration of credit options, lowers the psychological barriers associated with spending. This fosters a sense of financial flexibility, which can increase impulsive purchasing tendencies. This can be supported by Tan and Quang (2023) and Kumar and Kaur (2018), the convenience and accessibility of these devices have resulted in a significant increase in online impulse purchasing, a phenomenon that has captivated the attention of both marketers and researchers.

The second variable is accessibility of e-commerce has a positive and significant influence on impulse buying behavior, particularly when it involves credit usage. E-commerce platforms offer unparalleled convenience, enabling consumers to shop anytime and anywhere through personal devices. Features like user-friendly interfaces, tailored recommendations, and extensive payment options make it easy for consumers to make unplanned purchases. Additionally, the availability of credit facilities or credit card integration lowers the impact financial impact of transactions which can encourage impulsive spending. Hence, it can be supported by Santos et al, 2022, Chandrasekhar et al, 2024) there is a positive and significant relationship between the ease of use of online shopping platforms and purchase intentions. Through e-commerce, the customers may have access to the numerous options of products and sellers, accessibility to purchase at anytime and anywhere, possibility to earn cheaper price through offer comparisons and no waiting lines for the product purchases with effective logistic system.

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The third variable implies that positive and significant influence on internet browsing speed and impulse buying behavior on credit. The result can be consistent with Gori, Topino, Fioravanti and Casale (2024), as the speed of the internet may ease the accessibility and provide convenience to e-commerce any time for the customers, it will simultaneously increase the factors that trigger impulse buying, especially among vulnerable individuals. Balaji and Babu (2017), they found a strong positive correlation between internet browsing speed and consumer impulse buying behavior. Faster browsing speed enhance convenience of the online shopping experience, allowing consumers to browse products, make decisions and complete transaction quickly.

Last variable also indicates positive and significance influence on social network and impulse buying behavior specifically on credit. Social networking websites have become an essential part of daily life, garnering significant research interest for their impact on consumer behavior. A notable area of focus is impulse buying, which is defined as the tendency to make unplanned and spontaneous purchases (Amos, Holmes, and Keneson, 2013; Bhakat and Muruganantham, 2013). Moreover, Wahib (2024), social interactions and influences within social networking platforms play a crucial role in shaping impulse buying behavior. The study emphasizes that marketers have increasingly recognized the importance of identifying and understanding the factors driving impulse purchases, as this knowledge serves as a valuable strategy for boosting sales and generating revenue.

Conclusions and Future Recommendations.

This study aimed to investigate the impact of technology advancements on impulse buying behavior in online shopping on credit among Malaysians. The technology was segmented into availability and accessibility of personal smart devices, accessibility of E-Commerce, internet browsing speed and social network. To achieve these objectives, this study formulated a total of four hypotheses. Based on theory of planned behavior, Technological advancements, such as e-commerce platforms, mobile apps, and personalized recommendations, influence the attitudes, subjective norms, and perceived behavioral control of consumers. These elements collectively shape their intention to make impulse purchases.

The findings of this study reveal that technological advancements, including the availability of personal smart devices, accessibility to e-commerce platforms, high-speed internet, and the influence of social networking websites, significantly contribute to impulse buying behavior in the context of online shopping on credit among Malaysians. These factors collectively create a seamless, personalized, and engaging shopping experience that stimulates spontaneous purchase decisions. The findings highlight how credit accessibility amplifies this behavior by reducing immediate financial barriers, thereby increasing consumers' susceptibility to unplanned purchases. This underscores the transformative role of technology in reshaping consumer behavior, with important implications for marketers aiming to optimize these factors for business growth and policymakers seeking to mitigate potential financial risks associated with impulse buying behavior.

The current study employs convenience sampling, though utilising convenience sampling is prone to bias, limits generalizability, and may lead to inaccurate results, as it relies on easily accessible participants rather than a random, representative selection. Despite its limitations, convenience sampling can be a valid method in empirical research which is useful for gathering preliminary insights, testing hypotheses, or identifying trends without aiming for broad

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generalizations. If the sample characteristics and research context are clearly defined, the findings can still be relevant and applicable.

Furthermore, future research could increase the sample size, clearly define the populations to improve representativeness and further explore on psychological mechanisms where could delve deeper into emotional triggers, cognitive biases and decisions fatigue that underpin impulse purchases facilitated by credit.

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