

FACTORS AFFECT THE BEHAVIOR OF USING CASHBACK PROGRAMS: BAYESIAN ALGORITHM

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DOIs: <https://doi.org/10.46242/jstiuh.v64i04.4893>

Abstract. The paper explored factors that affect the behavior of using cashback programs by applying the Bayesian algorithm. The payback model is an international commercial strategy that encourages shopping. The US and the UK are where the "cashback" business model first appeared. It is now used in many other nations, including Vietnam. There are four factors behavior of using cashback programs Ease of Use (EU), Perceived Risk (PR), Using Intention of Cashback (UIC), and Personal Capacity (PC). The paper uses quantitative and qualitative methods. With the qualitative method, we implement the group discussion method to discuss with the group members about the survey questionnaire before launching the official survey. After discussing and discussing, the members kept the questionnaire. Quantitative methods were applied and the design of the study was descriptive and explained for this research model. The data collection method is by questionnaire, a survey designed on Google Form Tool, and sending surveys through social networks Facebook and Zalo. The survey is conducted in Ho Chi Minh City, Vietnam in 2023. Bayesian Algorithm for the Using Behavior of Cashback (UBC) revealed that there is one independent factor. Personal Capacity (PC) has a positive influence on the Using Behavior of Cashback (UBC). Therefore, the implication given to businesses of the cashback program is to put prestige first, implementing policies on customer information security to create a trust for customers. Since this is a financial-related market, reputation is a factor that customers care about, so reputable businesses will attract more customers.

Keywords. Vietnam, BIC algorithm, Online Cashback, consumers.

1 INTRODUCTION

Digital marketing and affiliate methods have benefited from the expansion and increasing popularity of online shopping (Christino et al., 2019). The cashback model is a shopping stimulus solution that applies to many businesses around the world. This model called cashback originated in the US and then in the UK and is now available in several other countries, including Vietnam (Salemall, 2023). In Vietnam, the cashback wave has been introduced since 2016 and putatu.com is the pioneer website in this campaign, helping Vietnamese people catch up with the trend (VTV, 2017). Launched in January 2017, after 2 months of launch, over 2,000 people have made thousands of transactions with a value of up to 12 billion VND via putatu.com. The amount of user savings has reached 500 million (VTV, 2017). Nowadays, cashback is becoming more and more popular, especially when there is the appearance of shopping through e-wallets: MoMo, Moca, ZaloPay, and Shopback. With bill payment via e-wallet or with affiliate applications, customers can get 10% - 20% cashback, even when buying data, phone cards, game cards, restaurant reservations, flight tickets, and movie tickets (Thanhnien, 2020). PVcomBank is one bank that has applied this program to customers and in the first month of opening, the bank estimated to refund customers VND 100 million (PVcombank, 2020). In December 2019, Shopback began its Beta program in Vietnam, drawing almost 800,000 users and over 150 partners. ShopBack Vietnam saw a 1.5-fold increase in monthly sales and orders. To date, more than VND 4 billion has been reimbursed to ShopBack users in Vietnam (Bao Cong thuong, 2020). Cashback applications appeared in Vietnam as a tool to help business partners save costs in marketing and promoting products and services for the online shopping segment and attracting potential customers, potential, increase revenue, and this is a potential form of promotion in the Vietnamese market.

In the e-commerce market, customers benefit from their transactions on linked websites or apps. Combining traditional techniques, such as word of mouth, is critical for the success of this company model because it can increase and strengthen client loyalty (Ballestar et al., 2018). By using this method, both the business and the affiliate gain from the affiliate's e-commerce transactions, resulting in a win-win situation for both the client and the business. Customers' social networks are likewise growing and becoming more active (Ballestar et al., 2016). The research of (Ballestar et al., 2018) showed that the important role of customers in using cashback applications determines customer behavior and activities for e-commerce channels. (Vana et al., 2018) analyzed cashback incentives that increase a consumer's likelihood of purchasing e-commerce sites and increase the size of that transaction, according to dashboard data from a large refund company. Cashback payments increase a consumer's probability of purchasing e-commerce sites and increase the size of that transaction, regardless of impact. The adoption of cashback apps is like other types of online or offline marketing in terms of effectiveness (Christino et al., 2019).

The refund application or website is already present and popular in developed countries such as the US, UK, and Singapore... In Vietnam, this type of payment method was introduced in 2016 by putatu.com, but its level of popularity has only exploded in recent years. Specifically, in 2020, when many website applications are launched such as Shopback, Accumulation, Cashback, and Clingme (Demaitinh, 2020).

The study of Christino et al. (2019) suggests a theoretical model established on the Unified Theory of Acceptance and Use of Technology 2 to identify the elements that influence customers to sign up for cashback programs (UTAUT2). The components of Ease of Use (EU), Personal Capacity (PC), Perceived Risk (PR), and Behavioral Aspects were added to the original ideal.

The cashback program is a strategy that is not too new to countries around the world and there are many studies on this strategy. However, each study gives different results on factors affecting the intention or behavior of customers. Much of the difference is in the geographic, economic, and customer segmentation that researchers choose. In Vietnam, according to the research, the author found that this is a new market, and there are still limited research topics on this issue. So from that, the author formed the idea of researching the refund program. Therefore, the paper explored factors that impact the behavior of using cashback programs by applying the Bayesian algorithm. The following is the order in which this chapter is presented: The first section gives an outline of the study, Section 2 shows a review of the literature on the factor used in this study, and Section 3 presents the method. Results and analysis with some discussion and implications are offered in Section 4. Last, section 5 accomplishes this chapter.

2 LITERATURE REVIEW

2.1 The unified theory of acceptance and use of technology

The novel feature of the present study is to extend the traditional UTAUT model to include the constructs of promotional activities, perceived financial/privacy risks as well as psychological/social risks. In what follows, we describe each of the constructs in the extended UTAUT model and the research hypotheses outlining the structural relationships (Wei et al., 2021).

Christino et al. (2019) aimed to identify for the first time the elements that influence consumers to accept and use cashback programs, based on an extended version of the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2). The behavioral model this study is based on is an extension of the unified theory of acceptance and use of technology (UTAUT). The extended UTAUT includes perceived risks and promotional activities as additional determinants of the actual usage of payment (Wei et al., 2021).

The UTAUT model identifies four major determinants of behavioral intention and usage: performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003), while moderated by gender, age, experience, and voluntariness of use. The model was found to achieve a high level of explanatory power of 70% with empirical data (Venkatesh et al., 2003) and, thus, has been applied in a wide range of fields (Venkatesh et al., 2016). Some recent research, for example, (Jose Liebana-Cabanillas et al., 2014; Lee et al., 2019; Wei et al., 2021), concentrated on applying UTAUT in modeling the adoption of mobile payment services. The unified theory of acceptance and use of technology explored factors that affect the behavior of using cashback programs by applying the Bayesian algorithm.

2.2 Cashback

A cashback program is a form of online promotion in which a consumer makes a transaction through a cashback program affiliated with a cashback company, and after a substantial period, the consumer will receive the bonus amount as the transaction from the beginning.

This cashback program increases a consumer's probability of an additional purchase and increases the size of that transaction (Vana et al., 2018). These programs, therefore, act as a tool to attract customers, similar to advertising (Christino et al., 2019). The difference here is that potential customers are identified not from search terms suggestions but from visits to the cashback program (Qiu and Rao, 2020). Consumers visit the websites and applications of the cashback program, not e-commerce sites.

Cashback program transactions are pre-negotiated with merchants in the e-commerce marketplace and linked and posted on websites or apps with the negotiated refund. The cashback program company will receive a commission for each successful transaction and then deposit the payments directly into the consumer's credit account (Vana et al., 2018).

Cashback is a bank's incentive when you shop and pay with a credit card that will be refunded back to the credit card based on the payment value. With today's popular shopping, we often see promotions with direct discounts on products, discount codes, gift vouchers, etc. However, another model of stimulus in shopping is derived from The US and has spread to the UK and other countries, which is cashback (also known as cashback). When making a purchase, you still receive the usual discount promotion and also receive an additional refund from the system, calculated as a % of the product value. When the cashback system was born, it brought a new era of shopping for the consumers themselves. Especially for customers who are thrifty and like to buy goods with a difference from the original price, this must be an attractive program. Cashback Systems have gradually ushered in a new era of online shopping. When linking with many shopping sites on one system, it will help users accumulate cashback from all stores to 1 account. Products purchased at a more reasonable price are still selected from reputable addresses. Some cashback systems have allowed users to link their bank accounts, so withdrawing cashback to their accounts is very easy. They do not force them to use that money to make purchases next time. In Vietnam, the wave of cashback entered 2016, and with the pioneering shot, putatu.com - A smart cashback system has helped Vietnamese people catch up with this trend. With a system of linking over 60 e-commerce sites in many fields such as Retail & Distribution (Lazada, Tiki, FPT shop, Sendo, Zalora...); Services - Tourism, Restaurants, Hotels (MyTour, Atadi, Vntrip, Wefit,...); Education - Online training (Edumall, Kyna.vn, VTC Academy...); Finance - Banking, Credit (Sacombank, Standard Chartered Bank, ANZ...) (Salemall, 2023).

2.3 Using Behavior of Cashback (UBC)

Commerce-related business models that connect companies with customers help them improve their purchasing decisions (Barnes-Vieyra and Claycomb, 2001). Vana et al. (2018) show that cashback payments increase the likelihood of repeat purchases and that customer behavior is significantly different from those without it, as they are not only performing transactions more diversified but also important in the items that need economic investment. Customers benefit from cashback programs because they make the purchasing process easier and provide financial incentives (Ballestar et al., 2016). Consumers are easily seduced by savings, which benefits them because they have the freedom to spend or store the money in any way they see fit (Vana et al., 2018). Consumers often assume they are a customer of that business. Before making a purchase, consumers often search for the products they need to buy on e-commerce channels to see if the product is in stock. Consumers tend to remember cashback programs only when they receive a notification (reminder) from a refund program (Christino et al., 2019; Venkatesh et al., 2012). Thus, the behavior of using the cashback application is the ability to use the cashback application depending on the benefits that the cashback application brings such as helping customers save, and the convenience of using the product.

2.4 Ease of Use (EU)

Potential users are more likely to embrace and use innovative technology solutions that are viewed as easy to use and less difficult (Davis, 1989). In the TAM model, according to (Davis, 1989), "perceived ease of use is the degree to which a person believes that using a particular system will be effortless". Perceived ease of use of technology will have an effect or influence on behavior and activities, i.e., the higher the

perceived ease of use of a system, the higher the users' information level (Sayekti and Wijayanti, 2018). Ease of use is implicit as the ease with which users perceive a technology to be used, which is the trust that using a specific organization will be easy (Alalwan et al., 2018). Perceived ease of use helps users have a positive attitude towards the service, thereby enhancing the intention to use (Widyanti and Usman, 2019). Consumers often think that mobile apps, such as cashback programs, are Ease to Use (Arora et al., 2020). According to Bai (2015), websites, and applications with beautiful interfaces will attract more customers. (Davis, 1989) mentioned that consumers find it difficult to remember passwords or technology-related security. Kaur and Jain (2016) argue that customers feel that online payment will be useful for online shopping. Thus, it can be seen that "Ease of use" is an intimate factor in the behavior of using the cashback program. Because consumers in today's technology era feel it is easy and necessary to use applications and programs to serve their online shopping needs. "Ease of Use (EU)" is one of the four factors that Christino et al. (2019) added to their research model to conduct research on the Using Behavior of Cashback of consumers. Putri et al. (2023) shows that the variables perceived usefulness, perceived ease of use, perceived security, and cashback behavioral intention. However ease of use does not lead to product use, it depends on various factors. From the foregoing, it is hypothesized that:

H₁: Ease of Use (EU) has a positive effect on Using Behavior of Cashback (UBC)

2.5 Personal Capacity (PC)

Personal Capacity relates to how confident consumers are that they have the necessary skills or knowledge to effectively participate in and use a particular service area (Walker and Johnson, 2006). A personal capability to estimate consumers' competence to accomplish tasks, is derived from social perception (Alalwan et al., 2016). When it comes to new technology, the easier it is for a person to use a specific program, the better their cognitive-behavioral performance is (Zhang et al., 2017). Capacity is "the ability, subjective or natural condition available to perform a certain activity" such as thinking capacity, and financial capacity. Consumer technology skills are now good. And customers easily adapt to newly launched technology applications. They believe that they can always use a new technology application. More than that, they feel comfortable when many services are connected with technology applications (Christino et al., 2019; Walker and Johnson, 2006). In the era of technology and modernization, consumers always equip themselves with knowledge and updates on the launch of new technologies to serve themselves. As well as shortening the time to perform a certain job just by manipulating applications and technology on mobile devices. Thus, the "personal capacity" of customers always goes hand in hand with user behavior. They feel that they perform well or can perform a certain technology, the higher the behavior of using that technology. Personal competency, which derives from social cognitive theory, is the assessment of someone's capacity to execute activities. When it comes to utilizing new technologies, an individual's cognitive behavioral performance is higher the more easily they can digest a given system (Alalwan et al., 2016). Therefore, the hypothesis is put forward:

H₂: Personal Capacity (PC) has a positive effect on Using Behavior of Cashback (UBC)

2.6 Perceived Risk (PR)

Compared with product risk, consumers' perception of personal information disclosure risk had a greater impact on Internet shopping decisions (Eggert, 2006). Consumers may face risks throughout the purchasing process if they are aware that they have no control over their purchase or that the consequences of making a poor decision could be disastrous (Al Kailani and Kumar, 2011). Perceived risk is another factor affecting personal enjoyment and motivation. The degree to which a consumer perceives the overall negativity of an action is referred to as perceived risk (e.g., purchasing, using, or disposing of a product/service), based on an assessment of the outcomes, negative and the probability of these outcomes (Zhang, 2010). Types of risks act as barriers to conducting transactions on the internet, influence online product purchase behavior, and determine consumers' choice of purchasing channels (Tandon et al., 2016). Perceived risk (PR) is defined as the possibility of a negative outcome as a result of an action (Mohseni et al., 2018). Perceived risk has a direct influence on use and intention to use (Aminu et al., 2019). Consumers' perceived risks will influence consumers' attitudes and interests in online shopping (Ghachem et al., 2019). Customers feel insecure when providing personal information to apply for cashback programs. They worry that when they provide personal information to refund programs, their information will be used for other purposes. Besides, they also feel worried that the refund programs will be faulty (Christino et al., 2019; Walker and Johnson,

2006). According to (Abrar et al., 2017), consumers feel worried when the product is not correct or unsatisfactory (damaged, wrong size, not like the picture, ..) after completing the transactions and making payment entirely online. It can be noticed from there that when performing the activity of using consumers, they will worry about the risks when connecting to applications and technologies. These are all things that can make them hesitate or decide not to use that application or technology. Technology businesses should pay attention to this issue because it is also a way to build trust with customers. And according to previous studies (Mohseni et al., 2018) on the influence of risk perception on usage behavior, the hypothesis given is:

H₃: Perceived Risk (PR) has a positive effect on Using Behavior of Cashback (UBC)

2.7 Using Intention of Cashback (UIC)

According to behavioral theory, Using Intention has a direct influence on performing the behavior. When a customer has an intention toward a certain product or service, the ability to buy and use the product or service is very high (Lee, 2010). Research on consumer intention to use has broader implications than behavior and will often have a positive impact on individual actions. Intention to use is defined as an active decision that reveals an individual's behavior depending on the product (Ross, 2021). According to (Ajzen, 1991), the intention is energizing and shows a person's eagerness to engage in a specific behavior. It is understood as a person's determination to act in a certain way (Ramayah et al., 2010). Using Intention is the consumer behavior of using the app in the future. They will use technology to make online shopping. And when they will use the technology, they will intend to continue using that technology (Christino et al., 2019; Venkatesh et al., 2012). In short, the intention to use represents what the individual wants to use in the future (Mouakket, 2015). And if the intention to use technology is greater in consumers, the higher the probability of performing the user behavior, so the hypothesis should be planned:

H₄: Using Intention of Cashback (UIC) has a positive effect on Using Behavior of Cashback (UBC)

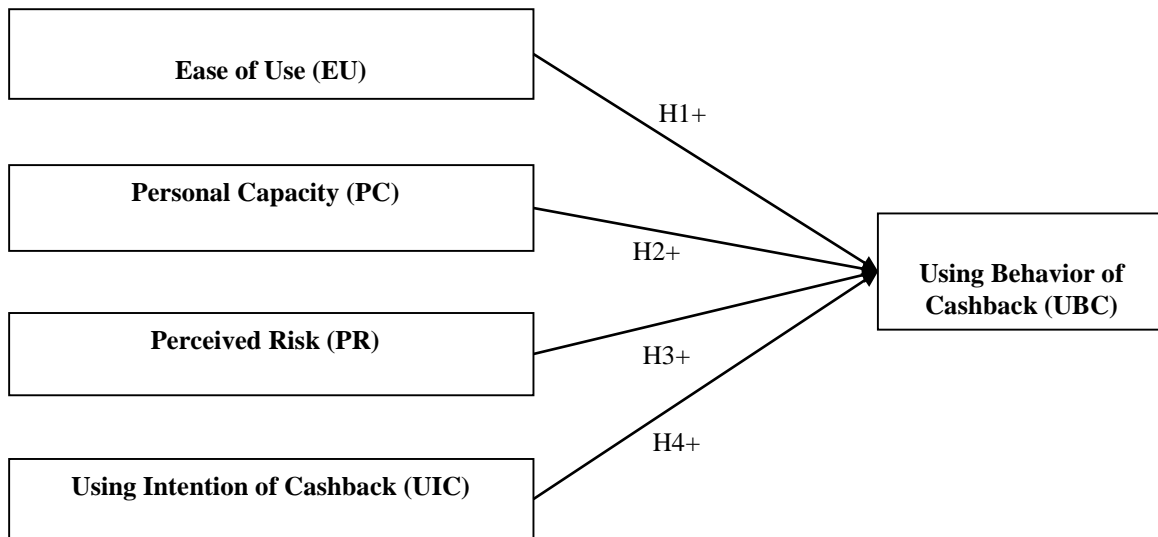


Figure 1 displays all hypotheses and contributing variables.

3 METHODOLOGY

3.1 Research Approach

The research selects an easy (non-probability) sampling approach based on the study's desired sample size and to fit the analysis to the topic's aims. The survey participants are reachable and prepared to respond to the study questionnaire, and In terms of both time and money, it is more affordable to spend gathering the data, which is why the author chose this method (Hair et al., 2006). According to researchers (Hair et al., 2006), the minimum sample size for factor analysis is 50 and the ratio of observations/measured variables is 5:1, i.e. 1 measurement variable requires 5 observed variables. So with 18 observed variables in this study, it is necessary to ensure that the sample size is at least 18 * 5 = 90 (sample). The data collection method is by questionnaire, a survey designed on Google Form Tool, and sending surveys through social

networks Facebook and Zalo. After filtering the data, only 107 answers are people who live and work in Ho Chi Minh City and have used online payment. The survey has been conducted in Ho Chi Minh City in 2022 and 2023. The answers will be updated as soon as the surveyor completes the questionnaire. Table 1 provides data on the sample features.

Table 1: Statistics of Sample

Characteristics		Amount	Percent (%)
Sex	Male	58	54.2
	Female	49	45.8
Age	18-29	104	97.2
	30-44	3	2.8
Monthly Income (VND to USD at https://vi.coinmill.com on 18 January 2023)	Below 298.83 USD	34	31.8
	341.52-426.90 USD	35	32.7
	469.59-640.35 USD	29	27.1
	Over 640.35 USD	9	8.4

Table 1 shows that the results for the sexes of men and women are almost equal. However, there are more men than women, with men accounting for 54.2 percent of the total and women accounting for 45.8%. The age group of 18 to 29 years old accounted for 97.2 percent of the total, while the age group of 30 to 44 years old accounted for 2.8 percent. The remaining age groups did not. This result for the age group of 18 to 29 years old is the most prominent age of exposure and use of online shopping and payment. Research results on the structure of monthly income, we see that out of 107 people surveyed, there are 34 people with income under 298.83 USD, accounting for 31.8%, people with income from 341.52-426.90 USD 35 people account for 32.7%, there are 29 people with incomes from 469.59-640.35 USD, accounting for 27.1%, the rest accounting for 8.4% are people with incomes over 640.35 USD.

3.2 Reliability test

The Cronbach's Alpha test is a technique the author might employ to evaluate the accuracy and dependability of the observed variables for the crucial component. This test analyzes whether the requirements for compatibility and concordance among dependent variables in the same major factor have a tight relationship. With an increase in Cronbach's Alpha coefficient, the factor becomes more reliable. The Cronbach's Alpha value coefficient ranges from 0.6 and higher on the qualified scale to 0.8 to 1 on the highest good scale for utilization. If a variable's Corrected item-total correlation (CITC) value is greater than 0.3, it meets the conditions (Nunnally, 1994). We assess consent for the relevant elements using a 5-point Likert scale. In order to assess the level of permission for all variables that were observed, this paper additionally used a 5-point Likert scale, with 1 denoting disagreement and 5 denoting agreement (see Table 2).

Table 2: Reliability

Unit	Factor and item	Source	CITC	Mean
EU	<i>Ease of Use ($\alpha = 0.626$)</i>			
EU1	Mobile tech apps, such as cashback programs, are simple to practice.	(Christino et al., 2019)	0.491	4.168
EU2	I find apps that have a nice, easy-to-use interface are more appealing to me.	(Nangin et al., 2020)	0.466	4.336
EU3	Passwords, technology-related security issues, and applications such as cashback programs are all difficult for me to remember.	(Christino et al., 2019)	0.334	3.776
EU4	I feel using online payment will be useful for online shopping.	(Kumar et al., 2022)	0.361	4.346

FACTORS AFFECT THE BEHAVIOR OF USING CASHBACK PROGRAMS...

<i>PC</i>	<i>Personal Capacity (α = 0.907)</i>			
PC1	My technology skills are excellent.	(Christino et al., 2019)	0.791	4.206
PC2	I can quickly learn new technology applications, such as online shopping or online payment, and adapt quickly.		0.859	4.196
PC3	I believe I will use freshly released technological applications, such as online shopping and payment apps.		0.799	4.280
PC4	When various services are linked to technology applications, such as online buying or online payment, I feel at ease.		0.721	4.327
<i>PR</i>	<i>Perceived Risk (α = -0.288)</i>			
PR1	When I provide personal information to apply for a cashback program, I feel uneasy (such as bank details, phone number, and address...).	(Christino et al., 2019; Slade et al., 2015)	0.272	2.206
PR2	I am worried that the cashback application will fail (For example: not receiving the money for a much longer time to receive the money than expected...).		0.411	2.056
PR3	I'm concerned that if I take part in the cashback program, my personal information will be used for unknown purposes.		0.224	1.916
PR4	I feel worried when the product is incorrect or unsatisfactory (damaged, wrong size, not like the picture...) after completing online transactions and online payments.	(Abrar et al., 2017)	-0.725	3.935
<i>UIC</i>	<i>Using Intention of Cashback (α = 0.635)</i>			
UIC1	I will use the cashback program in the future.	(Christino et al., 2019; Venkatesh et al., 2012)	0.462	4.280
UIC2	On my purchases, I'll try to use cashback programs.		0.454	4.187
UIC3	I continue to use regular cashback programs.		0.416	4.262
<i>UBC</i>	<i>Using Behavior of Cashback (α = 0.649)</i>			
UBC1	I am a cashback program customer.	(Christino et al., 2019; Venkatesh et al., 2012)	0.435	3.935
UBC2	Before buying, I often search the e-commerce site to see if the product is still available or out of stock.		0.464	4.290
UBC3	I only remember the cashback program when I receive a notification (reminder) from the application or website of these programs.		0.494	3.981

$$\alpha = \frac{k}{k-1} \left[1 - \frac{\sum \sigma^2(x_i)}{\sigma_x^2} \right]$$

Table 2 shows the Cronbach's Alpha measurement of Using Behavior of Cashback (α = 0.649), Ease of Use (α = 0.626), Personal Capacity (α = 0.907), Using Intention of Cashback (α = 0.635) is greater than 0.6, Perceived Risk (α = -0.288) lower than 0.6 is unacceptable. The Cronbach's Alpha test is a technique the author might employ to evaluate the accuracy and dependability of the observed variables for the crucial component. This test analyzes whether the requirements for compatibility and concordance among dependent variables in the same major factor have a tight relationship. With an increase in Cronbach's Alpha coefficient, the factor becomes more reliable. Cronbach's Alpha value coefficients range from 0.6 to 1 for

exceptionally good scales, 0.7 to 0.8 for good usage scales, and 0.8 to 1 for very good scales. If a variable's Corrected item-total correlation (CITC) value is greater than 0.3, it meets the conditions. Table 2 shows that the corrected item-total correlation coefficients for 14 items ranged from 0.334 to 0.859 (EU1, EU2, EU3, EU4, PC1, PC2, PC3, PC4, UIC1, UIC2, UIC3, UBC1, UBC2, UBC3), indicating that the items are appropriate for the construct. This means that the internal consistency values in terms of item-to-item correlation between the variables were above 0.3. Thus, each item on the scale serves the aim of assessing the feature it is designed to measure at a significant level concerning the total scale and is discriminative at the appropriate level.

3.3 Bayes' theorem

Let H be the hypothesis and D denote the actual data got from the collection. Bayes' theorem (Bayes, 1763) states that the probability of H given D occurs, denoted as $P(H|D)$, is:

$$P(H|D) = \frac{P(H) * P(D|H)}{P(D)} \quad (1)$$

The probability of the hypothesis before gathering data is called $P(H)$. $P(D|H)$ is the probability that the data occurs under the right hypothesis H ; $P(D)$ is the distribution of the information in equation 1 (Thang, 2021).

3.4 Bayes Inference

The Bayes theorem, according to (Gelman and Shalizi, 2013), enables us to understand that the inference of Bayes contains three separate types of information: practical information (likelihood), prior information we are already aware of, and posterior information we are interested in learning. Information can be thought of as probability or distribution in equation 2. Generalizability of Bayesian inference :

$$\text{Posterior information} = \text{Prior information} \times \text{Likelihood} \quad (2)$$

3.5 Selection of the model by the Bayesian Model Averaging

One often offers only one model (the model combines all the collected variables) for estimating and deduction, as if that model were the best appropriate for the data, to simply build a model for a research problem. So, other models developed using some of the collected variables might be more suitable and can be ignored by the technique. So, it is crucial to analyze and contrast the models of a study problem to decide which model is the most suited for the data (which can also be interpreted as the "best" model) (Raftery, 1995). Using posterior probabilities and the BIC index, the Bayesian mean model approach (BMA), a Bayesian statistical model selection technique, assesses the model (Raftery, 1995). The advantage of the BMA technique is its capability to consider model uncertainty by considering all the study's models.

3.6 Bayesian Information Criteria

Prior knowledge provides the theoretical foundation for Bayesian statistics, and the conclusions reached from it are combined with the facts that have already been viewed (Thach, 2020). The Bayesian method states that probability is information about uncertainty and that probability assesses the degree of uncertainty in the information (Kubsch et al., 2021). Thus, the Bayesian approach is becoming more and more well-liked, especially in the social sciences. With the rapid expansion of data science, big data, and computer computing, Bayesian statistics became a well-liked tool (Kreinovitch et al., 2018). The BIC is an important and useful metric for choosing a full and straightforward model. A model with a lower BIC is chosen based on the BIC information standard. When the minimum BIC value is reached, the best model will be terminated (Kaplan, 2021).

First, the posterior probability $P(\beta_j \neq 0|D)$ given by variable X_j with $(j = 1, 2, \dots, p)$ indicates the possibility that the independent variable affects the occurrence of the event (or a non-zero effect).

$$P(\beta_j \neq 0|D) = \sum_{M_k \in A} P(M_k|D) * I_k(\beta_j \neq 0) \quad (3)$$

where A is a set of models selected in Occam's Window described in Equations 3 and $I_k(\beta_j \neq 0)$ is 1 when β_j in the model M_k and 0 if otherwise. The term $P(M_k|D) * I_k(\beta_j \neq 0)$ in the above equation means the posterior probability of the model M_k not included $X_j = 0$. The rules for explaining this posterior probability are as follows (Raftery, 1995): Less than 50%: evidence against impact; Between 50% and 75%:

weak evidence for impact; Between 75% and 95%: positive evidence; Between 95% and 99%: strong evidence; From 99%: very strong evidence;

Second, an estimate of the Bayes score and standard error is given by the formula

$$E(\beta_j|D) = \sum_{M_k \in A} \hat{\beta}_j P(M_k|D) \quad (4)$$

$$SE(\beta_j|D) = \sqrt{\sum_{M_k \in A} \{[var(\beta_j|D, M_k) + \hat{\beta}_j^2]P(M_k|D)\} - E(\beta_j|D)^2} \quad (5)$$

with $\hat{\beta}_j$ is the posterior mean of β_j in the M_k model. Inference about β_j is inferred from Equations (3), (4), and (5).

Bayesian algorithm is an algorithm commonly used for classification prediction, which is based on Bayesian theory and uses statistics to classify samples in management (Sun and Tan, 2022). The Bayesian network is constructed by statistical data, and samples of unknown categories are classified and predicted according to the Bayesian network. Then, the possibility that samples belong to each classification is predicted and the most probable classification is selected (Moro et al., 2011). Compared with other algorithms, Bayesian has the advantages of less computation and higher accuracy. Even the simplest Naive Bayes algorithm can get an excellent result which is especially suitable for the task of sample classification and prediction.

4 RESULTS

4.1 Bayesian Model Selection

Using BIC, the best model for R software was chosen. BIC has been used for model selection in a theoretical scenario. In a regression model, BIC can estimate one or more dependent variables from one or more independent variables (Raftery et al., 1997). The BIC is an essential and useful metric for choosing a thorough and uncomplicated model. The BIC information standard is followed by a model with a lower BIC. The best model will end when the minimum BIC value is attained (Kaplan, 2021; Raftery, 1995; Raftery et al., 1997). R report displays each stage of the search for the ideal model. BIC chooses model 1 which is best.

Table 3: BIC model selection

UBC	Probability (%)	SD	model 1	model 2	model 3	model 4
Intercept	100.0	0.47909	1.89684	1.32947	2.07496	1.48659
EU	39.4	0.12050	.	0.20583	.	0.20392
PC	100.0	0.08445	0.51071	0.44294	0.51126	0.44404
UIC	9.9	0.02837	.	.	-0.04254	-0.03626

One dependent variable and three independent variables are present. Personal Capacity (PC) is affecting Using Behavior of Cashback (UBC) with a probability of 100%. Ease of use (EU) has a probability of 39.4%.

4.2 Model Evaluation

Table 4: Model Test

Model	nVar	R ²	BIC	post prob
model 1	1	0.307	-34.54979	0.545
model 2	2	0.331	-33.69566	0.356
model 3	2	0.309	-30.15211	0.061
model 4	3	0.332	-29.22941	0.038

$$\text{BIC} = -2 * \text{LL} + \log(\text{N}) * k$$

According to the results from Table 4, BIC shows model 1 is the optimal selection because of BIC (-34.54979). Personal Capacity (PC) is affecting Using Behavior of Cashback (UBC) is 30.7% ($R^2=0.307$) in Table 4. Model 1 is created by BIC to be the best decision, and a variable has a probability of 54.5% (post-prob=0.547). According to the analysis above, equation 6's Bayesian regression is statistically significant.

$$\text{UBC} = 1.89684 + 0.51071 \text{ PC} \quad (6)$$

4.3 Discussion

The results of the BIC second choice for Using Behavior of Cashback (UBC) showed that an independent variable Personal Capacity (PC) has a positive impact on Using Behavior of Cashback (UBC). Thus, hypothesis H_2 is accepted at the 95% confidence level. Cashback program is a strategy that is not too new to countries around the world and there are many studies on this strategy. However, each study gives different results on factors affecting the intention or behavior of customers. Much of the difference is in the geographic, economic, and customer segmentation that researchers choose. In Vietnam, according to the research, the author found that this is a new market, and there are still limited research topics on this issue. Therefore, the paper has explored the Personal Capacity affecting the intention to use the cashback application and proposed the implications of improving the quality in the Vietnamese market.

The study builds on previous studies: The study by (Christino et al., 2019) shows that the factors affecting cashback application such as habit, social influence, and other behavioral aspects, research This study is based on the UTAUT2 research model, which has successfully shown that customer behavior is closely related to technology. (Ballestar et al., 2016) found that customer engagement in cashback programs has a positive impact on customer loyalty and profitability for both customers and businesses. (Ballestar et al. (2018) apply the concepts of loyalty, social networks, customer growth, and interaction to find that the role of customers depends on the customer's position in the social network. This study also shows that the more customers trust, the more engaged, the more transactional, and the level of engagement with the cashback program is also related to the multi-transaction of the program. Finally, research by (Vana et al. (2018) has proven that it is useful for businesses and companies to cooperate with cashback programs. This study found that the effectiveness of cashback programs was like that of previously established online and offline promotions. The studies have been successful in developed countries, but for Vietnam, the refund program is still new. With the author's research, one factor "personal capacity" is the impact. Strongly to the "behavior of using" cashback program of customers in Ho Chi Minh City.

5 CONCLUSION

Bayesian data mining technology has been applied in the customer management system, which can make enterprises better understand customers and make better business strategies, thus improving the quality of marketing decisions. In this paper, the technology of data mining in marketing strategy is combined, and data processing methods are provided. In addition, customer classification, customer acquisition, and

customer retention are realized in the data mining module. The Bayesian algorithm of the best customer strategy can calculate the node that brings the highest net profit to the company (Sun and Tan, 2022). This study was conducted to find out the factors affecting the behavior of consumers using cashback programs in Ho Chi Minh City. The research process includes preliminary research and formal research. Preliminary research conducted group discussion and found that there are 4 factors affecting the behavior of consumers using cashback programs: Ease of Use (EU), Personal Capacity (PC), Perceived Risk (PR), and Using Intention of Cashback (UIC). From there, conduct formal research by submitting the survey by a convenient method (the questionnaire is sent directly by google drive and sent through the social networking application Zalo, Facebook and sharing the form online continued on a personal Facebook page), the total survey sent was 124 samples and collected 107 suitable samples. Use R software to analyze the data and get the following results:

Among the factors, 3 factors Ease of Use (EU), Perceived Risk (PR), and Using Intention of Cashback (UIC) were excluded because of inappropriate results. The remaining 1 factor is "Personal capacity". Besides, this study also shows that male and female consumers have almost the same decision to use cashback programs, with only an 8.4% difference in 107 surveyed people, which proves that In the 4.0 era, the need to buy goods and use online applications in particular for men and women is almost equal. Prominent in 2 age groups from 18 to 29 years old and 30 to 44 years old, those aged 18 to 29 are still more popular, showing that this age group has a higher demand for online shopping and has experience in using transactions online. The results on income levels are not too different, specifically, from 341.52-426.90 USD accounted for the highest part 32.7%, then briefly below income level below 298.83 USD (31.8%), from 469.59-640.35 USD accounts for 27.1% and finally over 640.35 USD accounts for 8.4, so it is possible that regardless of income level, online shopping still attracts consumers. With marital status, single people are better than the rest of marital status, accounting for 97.27% out of 107 surveyed votes.

Research significance

In theory: this study contributes to understanding more definitions, the most recent theory developed from the research of Christino et al. (2019) on consumer purchasing behavior based on Kotler's theory. and Lavy (1969) in the case of the cashback program market in Ho Chi Minh City.

In practice: the results of the study will contribute to helping companies in the cashback program market know how the factors affect the usage behavior of consumers. From there, give implications to improve advertising strategies and Marketing tactics for the cashback program.

Implication for Personal Capacity

Bayesian regression results show that "Personal competence" has a positive impact on the behavior of consumers using cashback programs in Ho Chi Minh City (Beta = 0.51071). This is the second most influential factor in the variable "user behavior".

The observed variable with the lowest mean value is PC2 (4.1963) "Easy to adapt to newly launched technology applications". This level shows that customers agree with this statement, so in the era of industrialization and modernization, consumers are always ready to equip themselves with the knowledge and skills needed to use technology. It also means that consumers are always ready and excited about new technology features. Therefore, businesses need to invest in designing their programs to be eye-catching and convenient, creating more skills so that consumers do not feel bored when using the cashback program. Next is the PC1 variable "Good technology skills" with an average rating of 4.2056. Similar to PC2, PC1 also shows confidence in equipping knowledge to use technology. This seems to show that the more consumers use good technology, the more eager they are for programs and applications that mention new services. Cashback program businesses should improve the quality of their websites and applications, as well as mention other related services, so that consumers can enjoy, discover, and attract customers.

For the PC3 variable "Capable of using newly released technology applications, ", the average rating is 4.2804. With a fairly high average rating. This proves that before a new technology is released, consumers will learn in advance the features, usage, as well as desire to experience. Therefore, before launching a new program or feature of the cashback program, businesses need to have a trial version for customers to experience and give their own opinions so that businesses can complete the refund program to improve the program and the product's features.

Finally, PC4 "Feels comfortable when many services are connected with technology applications" with the highest average rating of 4.3271. According to the author, businesses need to create more new and more

creative features for the program so that customers feel more convenient when using the business's cashback program. In order to improve competition because customers always choose for themselves utility programs and applications to serve their own needs.

In summary, the factor of "personal capacity" refers to the fact that consumers in the current era are always updating their knowledge and skills about technology to use new technologies. The more the service is linked with technology, the more convenient it is and it shortens the usage time of consumers. Besides, it increases discoverability. Businesses should invest as well as regularly updating new features to keep customers as well as attract potential customers.

Limitations

First, this study was carried out in a relatively short time of only five months, the time constraint more or less affected choosing the research model and building the most suitable scale, the time of collecting the survey collection also affects the results of the study of factors.

Secondly, in the process of carrying out the research, the author also encountered certain difficulties such as having difficulty accessing leading experts, limited meeting time as well as not being able to fully comprehend all the relevant topics, opinions and certain knowledge. The process of collecting secondary data also faces many difficulties because some agencies in Vietnam have not disclosed data transparently and clearly.

Third, the number of 107 samples studied by the author is not large enough. This number of samples only represents a small part of the population, not the general population of the entire population of consumers living in HCMC. And because the epidemic is quite serious, it is also limited in the direct survey process. Surveys only used on social networks are also a limitation. Therefore, the number of consumers invited to respond to the survey cannot fully assess consumer behavior in using the cashback program in Ho Chi Minh City.

In order to complete the research model and achieve better results, the next research topic on the behavior of using the consumer cashback program is: Conduct research with a larger sample to achieve a higher level of satisfaction with better overall representation; Research on a larger scale in Ho Chi Minh City, with many types of consumers to increase the diversity of survey subjects; It is possible to focus on researching each separate consumer object to devise a specific strategy for each different consumer group.

Acknowledgment

This research is supported by the Industrial University of Ho Chi Minh City (Code: 22/1QTKD01).

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FACTORS AFFECT THE BEHAVIOR OF USING CASHBACK PROGRAMS...

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CÁC YẾU TỐ ẢNH HƯỞNG ĐẾN HÀNH VI SỬ DỤNG CHƯƠNG TRÌNH HOÀN TIỀN: ỨNG DỤNG THUẬT TOÁN BAYES

BÙI HUY KHÔI, NGUYỄN THỊ NGÂN

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Tóm tắt. Bài báo khám phá các yếu tố ảnh hưởng đến hành vi sử dụng chương trình hoàn tiền bằng ứng dụng thuật toán Bayes. Mô hình hoàn tiền là một chiến lược thương mại quốc tế khuyến khích mua sắm. Mỹ và Anh là nơi mô hình kinh doanh hoàn tiền xuất hiện đầu tiên. Nó hiện được sử dụng ở nhiều quốc gia khác nhau bao gồm cả Việt Nam. Có bốn yếu tố hành vi sử dụng chương trình hoàn tiền đó là tính dễ sử dụng (EU), Nhận thức rủi ro (PR), Ý định sử dụng hoàn tiền (UIC) và Năng lực cá nhân (PC). Bài viết sử dụng kết hợp phương pháp định lượng và định tính. Với phương pháp định tính, chúng tôi thực hiện phương pháp thảo luận nhóm để các thành viên trong nhóm thảo luận về bảng câu hỏi khảo sát trước khi tiến hành khảo sát chính thức. Sau khi trao đổi, thảo luận, các thành viên giữ nguyên bảng câu hỏi. Phương pháp định lượng được áp dụng và thiết kế nghiên cứu mô tả, giải thích cho mô hình nghiên cứu này. Phương pháp thu thập dữ liệu bằng bảng câu hỏi, khảo sát được thiết kế trên công cụ Google Form và gửi khảo sát qua mạng xã hội Facebook, Zalo. Cuộc khảo sát được thực hiện tại Thành phố Hồ Chí Minh, Việt Nam vào năm 2023. Thuật toán Bayes cho hành vi sử dụng hoàn tiền (UBC) tiết lộ rằng có một yếu tố độc lập. Năng lực cá nhân (PC) có ảnh hưởng tích cực đến Hành vi sử dụng chương trình hoàn tiền (UBC). Vì vậy, hàm ý mà chương trình hoàn tiền đưa ra cho các doanh nghiệp là đặt uy tín lên hàng đầu, thực hiện chính sách bảo mật thông tin khách hàng để tạo niềm tin cho khách hàng. Vì đây là thị trường liên quan đến tài chính nên uy tín là yếu tố khách hàng quan tâm, vì vậy doanh nghiệp uy tín sẽ thu hút được nhiều khách hàng hơn.

Từ khóa. Vietnam, BIC algorithm, Online Cashback, consumers.

Received on: 18/03/2023

Accepted on: 04/07/2023