



Effects of Social Media Marketing Activities on Perceived Values, Online Brand Engagement, and Brand Loyalty

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Abstract

This study aims to validate the model on the effects of social media marketing activities on the perceived values of social media marketing activities and the effects of these perceived values on online brand engagement and, consequently, on brand loyalty. The data used in this study were collected through an online self-administered survey of 501 young social media users in Vietnam. Partial Least Squares Algorithm, Bootstrapping, PLSpredict/CVPAT, and Multi-Group Analysis methods embedded in Smart-PLS software were used to validate the measurement model and test the research hypotheses. The findings confirm that the positive effects of social media marketing activities on brand loyalty are transmitted through the perceived values of these activities and online brand engagement. These effects are more substantial for luxury brands compared to non-luxury brands. Importantly, our study offers a new approach to explaining the impact of social media marketing activities on brand loyalty by focusing on the perceived values of these activities and their effects on online brand engagement. To enhance brand loyalty, businesses should prioritize creating hedonic and utilitarian values through their social media marketing activities and use these values and online brand engagement as key performance indicators for planning and controlling their strategies.

Keywords:

Social Media Marketing Activities;
Hedonic Value;
Utilitarian Value;
Online Brand Engagement;
Brand Loyalty.

Article History:

Received:	23	May	2024
Revised:	25	August	2024
Accepted:	04	September	2024
Published:	01	October	2024

1- Introduction

Despite their significance, the relationships between two critical marketing concepts in today's business world, social media marketing activities (SMMAs) and brand loyalty (BL) have not been adequately examined. Brand loyalty is a term that refers to a strong commitment to consistently repurchase or patronize a preferred product or service in the future, despite potential influences or marketing efforts that may lead to switching behavior [1]. The significance of brand loyalty has been widely recognized in literature for many decades. For instance, it can provide various marketing advantages, such as lower costs, a larger customer base, and increased trade leverage [2]. Brand loyalty can also lead to reduced marketing expenses, lower risk for brand extensions, and a higher return on investment [3]. Studies have shown that higher levels of brand loyalty can result in a greater market share and higher acceptance of prices [4]. Brand loyalty is not new but essential; it has been continuously and extensively investigated for over six decades in the marketing literature [5].

SMMAs refer to using online social media applications and platforms as marketing tools to create entertainment, customization, trendiness, interaction, and word of mouth [6]. Unlike brand loyalty, SMMAs is a relatively new concept developed by Kim & Ko (2010) [7]. However, due to their practical and theoretical importance, SMMAs have gained

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DOI: <http://dx.doi.org/10.28991/ESJ-2024-08-05-017>

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increasing attention in business literature. Social media users have been rapidly increasing, from 3.90 billion in 2020 to 4.89 billion in 2023, and is projected to reach 5.85 billion in 2027 [8]. SMMAAs offer significant advantages over traditional media marketing activities, such as bi-directionality and interoperability [9], making it a powerful marketing tool that has significantly transformed contemporary marketing practices [10, 11]. SMMAAs make it easier for customers to interact, entertain, eWOM, and get the latest information about brands, companies, and markets [12]. They are also considered a cost-effective tool for building brand image [13–15]. As a result, many well-known brands have started prioritizing SMMAAs as their primary marketing communication channels [16]. SMMAAs, however, also give customers more power [17], as they can expose and spread negative information about products or a company's reputation [18], generate fake news [19], and lead to brand switching [19]. Consequently, SMMAAs may also harm brand loyalty and result in ineffective SMMAAs for building and maintaining brand loyalty.

The effects of SMMAAs on Brand Loyalty have not been adequately examined. Only two studies have confirmed the direct positive effects of SMMAAs on BRAND LOYALTY. A meta-analysis revealed that SMMAAs positively affect brand loyalty [11]. Additionally, a study conducted in Saudi Arabia with a sample of 242 usable responses found that the dimensions of SMMAAs directly affect brand loyalty [20]. Seven studies have found indirect positive effects of SMMAAs on brand loyalty. A study with a sample size of 309 customers in the telecommunications service in India indicates that SMMAAs positively affect brand loyalty through brand experiences and continuance use Intention [21]. Another study in India with a sample size of 350 customers in the airline industry showed that SMMAAs affect brand loyalty through brand awareness, brand association, and perceived quality [22]. In addition, a study with a sample of 487 social media users in India found that SMMAAs indirectly positively affect brand loyalty through brand commitment and satisfaction [23]. A study in Qatar with 464 respondents shows that SMMAAs influence brand loyalty through brand community engagement and lovemark [24]. The study surveyed 371 students from a large university in India and revealed that SMMAAs indirectly affect brand loyalty through brand equity [25]. Furthermore, a study in Jordan with a sample of 400 students indicated that SMMAAs indirectly affect brand loyalty through self-expressive brand social and brand love [26].

Five other studies have found that SMMAAs have both direct and indirect positive effects on brand loyalty. One study, which involved 245 social media users, indicated that SMMAAs have direct effects on brand loyalty and indirect effects on brand loyalty through brand community engagement [27]. Another study, which included university students in North Cyprus, found that SMMAAs have direct effects on brand loyalty and indirect effects through brand trust [28]. A study with a sample of 290 Instagram users in Palestine concluded that SMMAAs, directly and indirectly, affect brand loyalty through brand satisfaction, commitment, and trust [29]. Research involving 389 tourists in Northern Cyprus indicated that SMMAAs directly affect brand loyalty and indirect effects through brand trust [11]. A study conducted in Turkey showed that SMMAAs directly and indirectly affect brand loyalty through brand awareness and brand image [30]. A study with data from 346 students in Malaysia found that SMMAAs have direct effects on brand loyalty and indirect effects through values consciousness and brand consciousness [31].

In addition, as discussed above, in most cases, SMMAAs indirectly affect BRAND LOYALTY through product or brand-related constructs such as brand experiences, brand awareness, brand association, brand commitment, brand trust, and brand image. No studies have examined the effects of SMMAAs on brand loyalty through SMMAA-related constructs. Therefore, knowledge of how SMMAA-related constructs affect brand loyalty still needs to be improved. In other words, the literature still needs to adequately explain the effects of SMMAAs on brand loyalty.

To partially close the above research gaps, this study aims to assess the relationship between SMMAAs, perceived values of SMMAAs on one side, and online brand and brand loyalty on the other. To do so, we apply the stimulus-organism-response (SOR) framework [32] to model the effects of SMMAAs on brand loyalty with perceived values of SMMAAs and online brand engagement as mediators. Specifically, we considered SMMAAs to be a stimulus, perceived the values of SMMAAs as an organism, and considered online brand engagement and brand loyalty to be responses. We considered the perceived values of SMMAAs a particular case of perceived values [33] as the consumer's overall assessment of SMMAA utility, making them an organism. Online brand engagement is "the connection, creation, and communication of the brand's story between the firm and consumers, using brand or brand-related language, images, and meanings via the firm's social networking site". While brand loyalty refers to the degree of attachment a customer has to a particular brand [34]. Accordingly, SMMAAs (S) may affect perceived values (O), which in turn affects online brand engagement and brand loyalty (R). Because the perceived values of SMMAAs are more closely related to online brand engagement than brand loyalty, the sequence through which the effects of SMMAAs are transmitted is SMMAAs \Rightarrow perceived values of SMMAAs \Rightarrow online brand engagement \Rightarrow brand loyalty.

Our study has important theoretical and practical contributions. First, it contributes to the stream of research on the effects of SMMAAs on brand loyalty that has been overlooked. Thus, it provides new evidence to confirm the positive effects of SMMAAs on brand loyalty. Second, it includes the perceived values of SMMAAs and online brand engagement as the mediators between SMMAAs and brand loyalty, thereby offering new explanations for the relationship. None of the studies have included the perceived values of SMMAAs to explain the effect of SMMAAs on brand loyalty. Third,

our study opens a new approach to explain the effects of SMMA on SMMA through SMMA-related constructs instead of the old approach relying on product/brand-related constructs. Fourthly, we found that the impact of SMMA on brand loyalty is greater for luxury brands than for non-luxury brands. This is important because it provides evidence to differentiate the consumer response to luxury vs. non-luxury brands under the effects of SMMA. Fifthly, the SOR model can be extended to connect stimuli and organisms related to one type of object with responses related to other objects, particularly when there are connections between the objects. Practically, our study can provide business firms with specific implications for positioning their SMMA based on the perceived values of SMMA to enhance brand loyalty.

The rest of the paper is organized as follows: In Section 2, we review studies related to SMMA, perceived values, online brand engagement, and brand loyalty and then develop our research hypotheses. Section 3 outlines our research methods. Section 4 presents our findings on the indirect effects of SMMA on brand loyalty. Finally, in Section 5, we draw conclusions, discuss theoretical and practical implications, identify research limitations, and recommend future research directions.

2- Literature Review and Hypothesis Development

2-1- Social Media Marketing Activities

Social media refers to various online applications, platforms, and media facilitating interactions, collaborations, and content sharing [7]. This includes weblogs, social blogs, microblogging, wikis, podcasts, pictures, videos, ratings, and social bookmarking [6]. With its ability to allow users to create content and interact with others, social media presents significant opportunities for marketers to expose consumers to brand messages and engage with them [7]. Social media platforms are used for marketing purposes, known as social media marketing [35]. As social media users continue to rise, social media usage has become one of the most popular online activities [8]. This trend has made social media marketing an increasingly popular and effective communication channel [9, 36].

Consumers perceive social media marketing by firms as consisting of five activities or constructs: entertainment, interaction, trendiness, customization, and word of mouth [6]. In other words, from the customer's perspective, these five activities make up SMMA. Existing studies have defined entertainment as the fun and exciting aspects of social media, interaction as the sharing of information and exchanging of opinions with others, trendiness as the dissemination of the latest and trendiest information, customization as the extent to which social media channels provide personalized information and services, and word of mouth as the sharing of information and content about luxury brands on social media [7, 9, 13, 22]. Some studies have treated these five activities as separate constructs [20, 37], while others have validated them as a second-order construct that reflects five dimensions [7, 9, 22-25, 36, 38-41].

From the perspective of the SOR framework, SMMA can be considered a stimulus because they involve activities carried out by firms. As a result, SMMA can impact various customer perceptions and responses. Specifically, SMMA have been found to positively influence consumer behaviors such as purchase intention, eWOM, brand trust, customer relationship, brand engagement, brand loyalty [6, 31, 35] brand engagement [35, 38], and brand loyalty [10, 24, 42]. Additionally, SMMA can generate excitement and attention for brands, increase brand recognition, and evoke positive emotions in consumers [35, 43]. However, as previously discussed, the existing literature has not sufficiently examined the effects of SMMA on brand loyalty. In most cases of indirect effects, SMMA affect BRAND LOYALTY through product or brand-related constructs. No studies have examined the effects of SMMA through SMMA-related constructs.

Existing research suggests that SMMA can impact brand loyalty through two key factors: perceived values (cognitive and affective) of SMMA and online brand engagement [38, 44-53]. Accordingly, in this study, we adapt the concept of perceived values of SMMA based on a similar concept used for mobile apps [54] and WeChat [55]. Literature also indicated that the stimulus-organism-response (SOR) framework [32] has been widely used to explain the effects of SMMA on customer perceptions and responses [9, 11, 22, 23, 25, 40, 56, 57]. According to this framework, situational cues are perceived as stimuli, which can trigger an individual's internal assessment (organism), leading to positive or negative behaviors (response) towards the stimuli [57]. This literature suggests that the effects of SMMA on brand loyalty can be explained by the perceived values of SMMA and online brand engagement as the mediators.

2-2- Social Media Marketing Activities and Perceived Values

Within the SOR framework, we argue that perceived value is an internal state of customers or organisms. This is because, by definition, perceived value is the consumer's overall assessment of the utility of a product based on their perceptions of what they receive and what they give in return. In other words, value represents a tradeoff of the salient give-and-get component [33]. Therefore, the perceived values of SMMA are affected by SMMA. Additionally, perceived value has been recognized as one of the most significant concepts and a key metric in enterprise marketing [38, 55]. Customer value must be the reason for the firm's existence and success [58].

Previous studies have defined perceived value as a multidimensional construct encompassing various dimensions, such as physical, economic, expressive/social, emotional, and service [33, 59]. Other studies have also identified

additional dimensions such as emotional, social, procedural, functional, emotional, social, utilitarian, and hedonic values [60]. However, in recent social media marketing studies, hedonic and utilitarian values are most commonly studied and utilized [54, 55, 61, 62]. Utilitarian value refers to instrumental, task-related, rational, functional, and cognitive benefits, while hedonic value encompasses non-instrumental, experiential, and affective benefits [63].

Perceived value is derived from a product or service's attributes, functions, and quality. It is determined by customers' perceived benefits from using and the perceived sacrifices they face in purchasing and consuming the product or service [33]. Other authors confirmed that a customer's perceived values come from the interaction between the values produced by each experience and the given customer's personal preferences [64]. Enterprises can utilize customers' experiential values to gain insight into their preferences and make necessary modifications to enhance the product's added value, improve the overall experience, and increase its values [38, 50, 53, 65].

In the context of SMMAAs, in this current study, we define the perceived values of SMMAAs as the values customers receive from their experiences with SMMAAs of brands. Several existing studies support our approach. Meyer & Schwager (2007) [66] expressed that customers can passively receive information about new services from SMMAAs or other customers in their network. In this case, customers can construct potential service experiences and thus assess values from their imagination. Furthermore, some authors introduced similar terms, such as the perceived value of using mobile apps in the purchase process [54] and of experiencing social media marketing in explaining customer intention [38]. Specifically, in this current study, we define hedonic values as the degree to which a user derives pleasure from using SMMAAs of brands. Utilitarian values are the degree to which a person believes that using SMMAAs enhances their experiences with the brands. Accordingly, in this research, we argue that SMMAAs (entertainment, interaction, trendiness, customization, and electronic word-of-mouth) are considered brands' efforts to create both hedonic and utilitarian values for customers.

The components of SMMAAs play a crucial role in clarifying the relationship between SMMAAs and the perceived values associated with them. For instance, by providing entertaining and engaging content, SMMAAs can generate excitement among consumers about the brand, leading them to pay more attention to it and experience positive emotions [43]. This, in turn, contributes to the formation of hedonic values. Additionally, by sharing up-to-date information on social media, SMMAAs can attract the attention of social media users, motivating them to seek out the latest developments and trends related to the brand. This helps to create a positive brand experience in the minds of consumers [43, 67, 68], resulting in the creation of utilitarian values. These arguments are supported by previous studies, which have found that consumers use social media to gain knowledge, share knowledge, and make informed decisions about products and services [69]. Other studies have also shown that SMMAAs allow consumers to express their feelings about brands and facilitate direct interaction with the brand and other consumers [38]. They have also highlighted the role of social media in promoting user interaction and participation, creating an experiential environment that stimulates consumers' feelings of value. Therefore, we propose:

H1: *Social media marketing activities positively affect the perceived hedonic values of Social media marketing activities.*

H2: *Social media marketing activities positively affect the perceived utilitarian values of Social media marketing activities*

2-3- The Perceived Values of SMMAAs and Online Brand Engagement

The concept of brand engagement has become increasingly important in the field of marketing [72]. Customer brand engagement is "the level of an individual customer's motivation, brand-related thoughts, and context-dependent state of mind, characterized by specific levels of cognitive, emotional, and behavioral activity during direct interactions with a brand" [46]. Direct brand interactions refer to customers' physical contact with a brand instead of indirect interactions through mass communication [46]. Another definition of customer brand engagement is "a consumer's positive thoughts, emotions, and actions related to a brand during or after interacting with the brand" [73]. In the context of online social media, online brand engagement can be described as "the connection, creation, and communication of a brand's story between the company and consumers (both current and potential) through the use of brand-related language, images, and meanings on the company's social media platform" [74]. Within the SOR framework, online brand engagement, therefore, is considered a customer response that may be affected by SAMM (as a stimulus).

Brand engagement is inherently interactive, highlighting that the relationship between consumers and brands goes beyond a simple transaction and continues even after the purchase process [75]. SMMAAs have proven effective in fostering and nurturing relationships between consumers and brands [31, 76]. When consumers perceive positive values from engaging in SMMAAs, it can have a significant impact on their level of brand engagement. This is because higher perceived values lead to greater satisfaction, which can result in behaviors such as repeat purchases, re-exposure, and even participation in future product support [49]. For instance, an offline study found that perceived values positively influenced behaviors such as collecting brand information, participating in brand marketing activities, and interacting

with others [77]. Furthermore, other studies have shown that when consumers perceive high levels of utilitarian and hedonic values from their consumption experiences, they are more likely to exhibit positive behavioral intentions, such as repeat purchases and continued use [44, 45].

Based on the literature reviewed, the perceived value of engaging with SMMA leads to increased brand engagement in the online environment. This is supported by several studies, such as a recent one by Busalim et al. (2021) [78], who found a positive relationship between the perceived values on s-commerce platforms and customer Engagement behavior. Similarly, Touni et al. (2022) [79] found that customer-perceived values (functional, social, and entertainment) on brand social media pages strengthen customer-brand relationships in commitment, self-connection, and intimacy. More specifically, another study found that perceived utilitarian and hedonic values have been found to have positive effects on users' continued usage intention in a mobile hotel booking environment [80]. Based on the above literature, we argue that:

H3: *The perceived utilitarian values of Social media marketing activities positively affect online brand engagement.*

H4: *The perceived hedonic values of Social media marketing activities positively affect online brand engagement.*

2-4- Online Brand Engagement and Brand Loyalty

Brand loyalty is crucial for companies to understand and utilize to gain a sustainable competitive advantage. Brand loyalty can lead to reduced marketing costs, lower risk for brand extensions, and higher return on investment [3]. Gounaris & Stathakopoulos (2003) [3] define brand loyalty as "a deeply held commitment to consistently rebuy or patronize a preferred product or service in the future, despite potential situational influences and marketing efforts that may encourage switching behavior." Brand loyalty refers to a customer's strong attachment to a specific brand [72]. There are two aspects of brand loyalty: behavioral and attitudinal loyalty [81]. Behavioral loyalty refers to the repeated purchase of a particular brand. In contrast, attitudinal loyalty is a more stable form that reflects a consumer's commitment and preference for a brand based on its unique values [81]. It is important to note that brand loyalty is just one type of customer response and can be indirectly influenced by the perceived values of SMMA through online brand engagement.

As previously discussed, brand engagement is defined as the connection, creation, and communication of a brand's story between the company and current and potential consumers. This is achieved through brand-related language, images, and meanings on the company's social networking site [74]. The ultimate goal of brand engagement is to foster a strong attachment between the customer and the brand, resulting in brand loyalty. This is because when consumers actively focus on and engage with a brand, they are likelier to develop loyalty [46]. Previous studies have shown that when customers engage with a brand, it enhances their overall experience [77]. This is because positive brand experiences are stored in the customer's memory and can ultimately impact their satisfaction and loyalty toward the brand [77, 82].

Recent studies have shown that customer engagement positively affects brand loyalty. For instance, research has found that engaging with a brand through activities such as collecting information, participating in marketing campaigns, and interacting with others on the brand's network can increase brand loyalty [72, 77]. This trend is also evident on social networking sites, where brand engagement positively affects brand loyalty [47]. Additionally, research has shown that the intention to continue using social commerce (similar to online brand engagement) can positively affect brand loyalty [83]. Furthermore, studies have found that consumer engagement behavior through social interaction on Facebook can also contribute to increased brand loyalty [51].

Based on the above literature, we argue that:

H5: Online brand engagement has positive effects on brand loyalty

2-5- The Research Model

As previously discussed, this study utilizes the SOR framework by Russell (1974) [32] as a foundational theory to establish causality between relevant constructs. The framework conceptualizes behavior as occurring within an environment composed of stimuli. These stimuli impact the organism, specifically, the consumer's cognitive and affective processes, leading to behavioral responses [84]. Following the SOR framework, we consider SMMA as stimuli (S), perceived values as customer cognitive states (O), and online brand engagement and brand loyalty as customer responses (R). Based on this framework and the hypotheses above, we have developed the research model depicted in Figure 1. Specifically, we argue that SMMA impact the perceived values of SMMA, which in turn affect online brand engagement and ultimately influence brand loyalty.

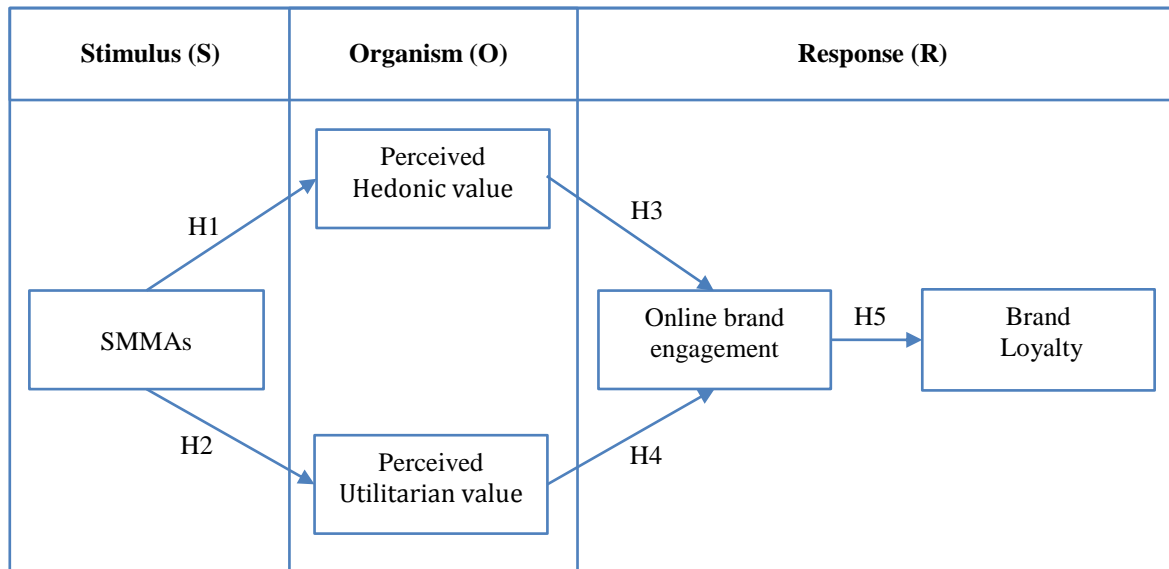


Figure 1. The research framework

3- Methodology

3-1- Research Process

Figure 2 illustrates the research process. The left side represents activities carried out, and the right side represents the outcomes of these activities. These activities and outcomes were discussed in the other sections of the study.

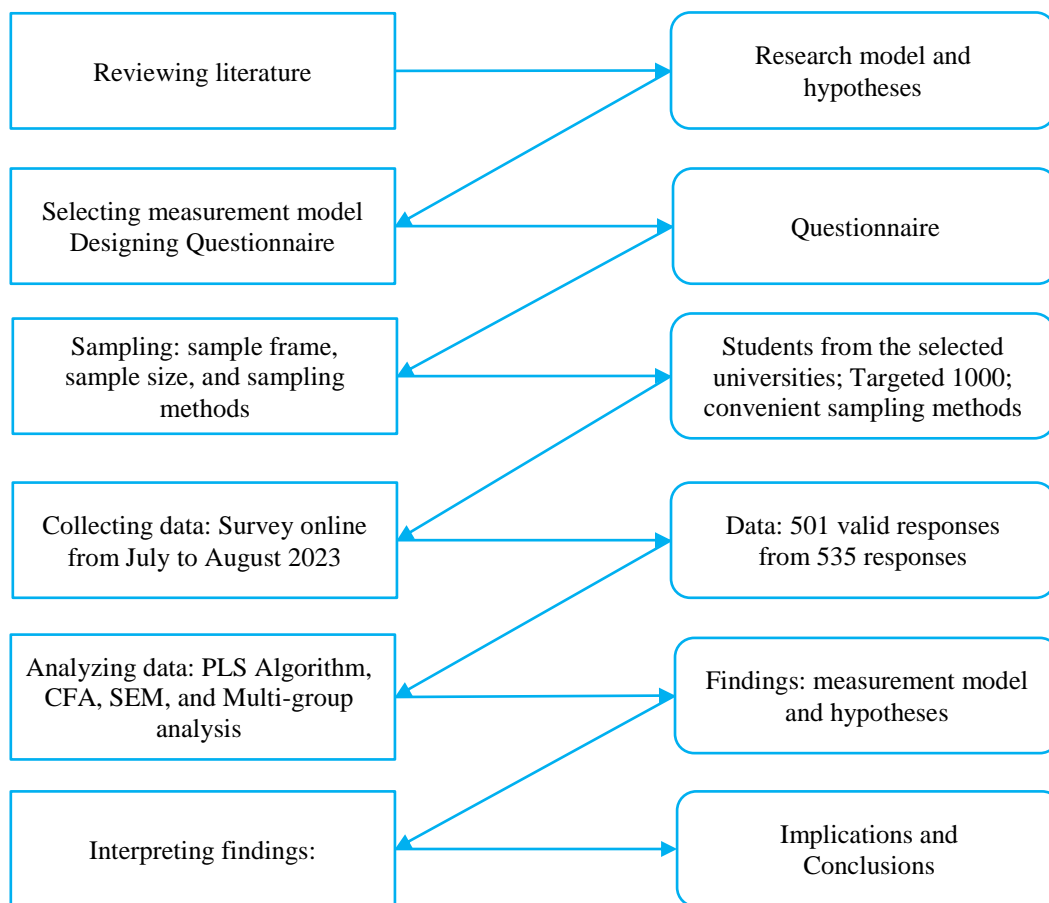


Figure 2. Research process

3-2- Measures and Questionnaire Development

All variables were measured using scales developed by previous researchers. Specifically, a nineteen-item scale from Kim & Ko (2010) [7] was used to measure SMMAs. This scale includes five dimensions of SMM activities:

Entertainment (ENTER) (4 items), Customization (CUSTOM) (5 items), Interaction (INTERACT) (4 items), Electronic Word of Mouth (EWOM) (3 items), and Trendiness (TREND) (3 items). The scales for Hedonic values (HV) and Utilitarian values (UV) were adapted from Hsu & Lin (2016) [54] and Pang (2021) [55], with slight adjustments made to fit the research context. We used a scale of five items developed by Osei-Frimpong & McLean (2018) [74] to measure Online Brand Engagement (OBE). Lastly, the 4-items measuring brand loyalty (BL) are based on Leckie et al. (2016) [34]. All constructs were measured using a five-point Likert scale, with responses ranging from 1 (strongly disagree) to 5 (strongly agree).

In addition to the research introduction and instructions, the questionnaire is divided into two main parts: personal information and a section measuring the constructs in the models. To ensure that the respondents are discussing foreign brands, the questionnaire also includes a screening question about brand origin, brand name, and type of brand.

To ensure the questionnaire's accuracy, we conducted a preliminary survey with six respondents to assess the measurement items' face and content validity. After minor corrections, the final questionnaire was finalized.

3-3-Data

The data is collected via a self-administered questionnaire created and distributed online using Google Forms. In this questionnaire, we stated that we guarantee to keep respondents' personal information confidential and that all data received from the survey will only serve research purposes. The informed consent was collected in written form (on the online form, respondents were asked whether they agreed to participate in the survey. If they chose "Agree," they decided to answer the questionnaire).

The sample was selected using the convenient sampling method. In particular, 1000 students were selected randomly from 20 lists of students provided by faculties in five major universities in Hanoi, Vietnam. These faculties sent questionnaires to these students during July and August 2023. Out of the 1000 students, 535 responded, and after removing outliers using SPSS software, 501 valid responses were used for data analysis. This resulted in a usable rate of 93.64%.

We collect the data, and it belongs to us. In our data, in addition to data about respondent personal information and the type of brand mentioned in the answer, the rest represent social media users' assessments of 35 items to measure the variables SMMAs, hedonic value, utilitarian value, online brand engagement, and brand loyalty in the research model. The specific measurement items and their respective codes were presented in the "Notes on data" file and Table 2 in the Findings section.

3-4-Sample Characteristics

In our sample, 75% (376 respondents) were women, and 25% (125 respondents) were men. As our respondents were students, the average age of the sample was 22, with the majority falling between 18 and 24. Out of the total sample, 379 respondents (75.6%) were only attending school, while the remaining had jobs and income. When asked about the brands mentioned, 56.3% perceived the investigated smartphone brands as luxury brands, while the remaining 43.7% perceived them as non-luxury brands.

A summary of the study's technical specifications is presented in Table 1.

Table 1. Technical specifications of the study

Technical specifications	Value
Sample size	501
Respondents	Young social media users in Vietnam
Sampling method	Convenience sampling
Data collection method	Online survey using Google Forms
Data analysis method	Partial Least Squares Algorithm, Bootstrapping, the PLSpredict / CVPAT and Multi-Group Analysis
Software used	SPSS, SmartPLS 4

3-5-Data analysis

We used SmartPLS 4 software to support data analysis. The techniques of partial least squares algorithm, bootstrapping, the PLSpredict/CVPAT, and multi-group analysis are used to evaluate the scale validity and test the research hypotheses.

First, to evaluate the scale validity in the first-order measurement model and the second-order measurement model, we followed steps in confirmatory composite analysis with reflective measurement models introduced by Hair et al. (2020) [85]. Mainly, we used the techniques Partial Least Squares Algorithm and Bootstrapping with 5000 subsamples in

SmartPLS 4 software to estimate the outer loadings, T-statistics to test the estimate of loadings and significance; then estimated Cronbach's alpha (α) and composite reliability (CR) to test the internal consistency reliability; calculated the Average Variance Extracted (AVE) to assess the convergent validity, and lastly, we applied the heterotrait-monotrait ratio of correlations (HTMT) to interpret discriminant validity. The criteria were used according to Hair et al. (2020) [85].

Then, we also adopted steps in structural model assessment suggested by Hair et al. (2020) [85] and Hair et al. (2021) [86] to test the research hypotheses. First, we evaluate structural model collinearity by VIF value, then examine the size and significance of path coefficients to conclude the significance at the level of 5% for each hypothesis. Besides, we estimated R^2 of Endogenous Variables, f^2 Effect Size, and Predictive Relevance Q^2 to measure the model's predictive power, the magnitude of the effect, and predictive relevance.

4- Results and Discussions

4-1- Measurement Model Assessment

We first estimate the first-order measurement model to validate its constructs. The model includes nine constructs: five dimensions of SMMA (customization, entertainment, interaction, trend, and electronic word of mouth), Hedonic value, Utilitarian value, Online Brand Engagement, and Brand Loyalty. Figure 3 and Table 2 exhibited detailed item descriptions and calculation results of confirmatory composite analysis for all constructs.

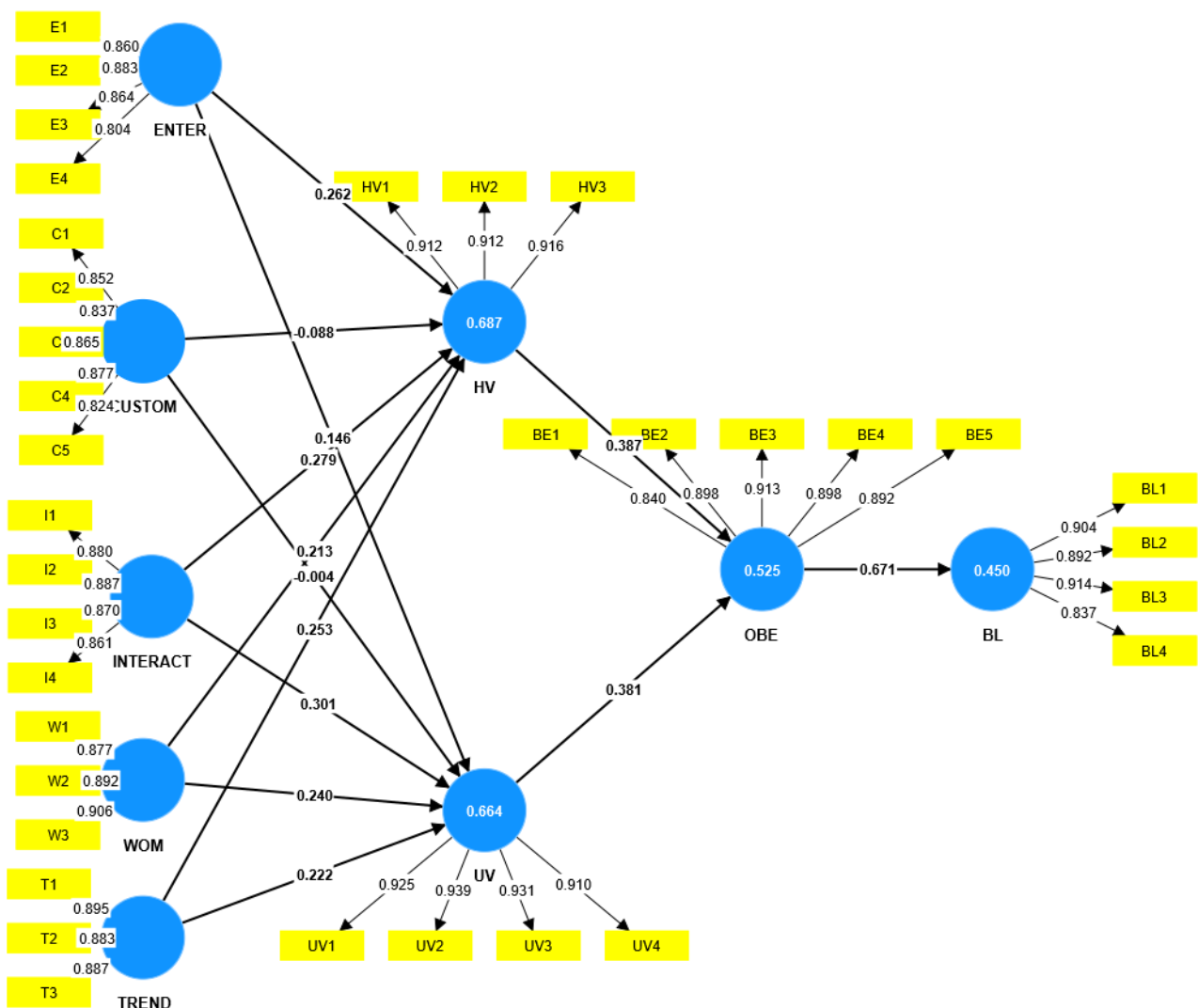


Figure 3. Results with PLS-SEM Algorithm for the first-order measurement model

Calculation results in Table 2 show that all outer loadings of all items in the measurement model are higher than the cut-off of 0.708, ranging from 0.804 to 0.939. In addition, the T-statistic with a two-tailed test at the 5% level for all items is above 1.96 (ranging from 23.780 to 66.101) and is statistically significant ($p_value=0.000$). That expresses the indicator's significance and reliability [85]. Besides, Cronbach's alpha (α) (ranging from 0.866 to 0.944) and composite reliability (CR) (ranging from 0.914 to 0.960) of all constructs are above 0.7. Therefore, the composite reliability of all constructs is also confirmed. The results also indicate that all constructs' average variance extracted (AVE) ranges from 0.724 to 0.795, above 0.5. So, their convergent validity is established.

Table 2. The first-order constructs validity and reliability

Constructs	Item description	Outer Loadings	Outer weights	T Statistics	P Values
Entertainment (ENTER) $\alpha=0.875$; CR=0.914; AVE=0.728	E1. The content found in Brand X's social media seems Interesting	0.860	0.268	28.892	0.000
	E2. It is exciting to use Brand X's social media	0.883	0.305	30.157	0.000
	E3. It is fun to collect information on products through Brand X's social media	0.864	0.302	30.276	0.000
	E4. It is easy to kill time using brand X's social media	0.804	0.297	24.579	0.000
Customization (CUSTOM) $\alpha=0.905$; CR=0.929; AVE=0.724	C1. It is possible to search for customized information on Brand X's social media	0.852	0.224	29.856	0.000
	C2. Brand X's social media provides customized services	0.837	0.242	26.924	0.000
	C3. Brand X's social media provide lively feed information I am interested in	0.865	0.247	32.052	0.000
	C4. It is easy to use brand X's social media	0.877	0.232	32.021	0.000
	C5. Brand X's social media can be used anytime, anywhere	0.824	0.231	25.12	0.000
Interaction (INTERACT) $\alpha=0.897$; CR=0.928; AVE=0.764	I1. It is easy to convey my opinion through Brand X's social media	0.880	0.297	35.03	0.000
	I2. It is easy to convey my opinions or conversations with other users through Brand X's social media	0.887	0.284	34.256	0.000
	I3. It is possible to have two-way interaction through Brand X's social media	0.870	0.274	36.268	0.000
	I4. It is possible to share information with other users through Brand X's social media	0.861	0.288	37.379	0.000
Electronic Word of Mouth (WOM) $\alpha=0.871$; CR=0.921; AVE=0.795	W1. I would like to pass information on brands, products, or services from Brand X's social media to my friends	0.877	0.387	33.527	0.000
	W2. I would like to upload content from Brand X's social media on my Facebook page or my blog	0.892	0.357	37.342	0.000
	W3. I would like to share opinions on brands, items, or services acquired from Brand X's social media with my friends	0.906	0.378	37.731	0.000
Trendiness (TREND) $\alpha=0.866$; CR=0.918; AVE=0.789	T1. Content found on Brand X's social media is up to date	0.895	0.368	42.853	0.000
	TT2. Using Brand X's social media is very trendy	0.883	0.381	40.652	0.000
	T3. The content on Brand X's social media is the newest information	0.887	0.377	37.776	0.000
Hedonic Value (HV) $\alpha=0.901$; CR=0.938; AVE=0.834	HV1. Using Brand X's social media is fun for me.	0.912	0.363	52.009	0.000
	HV2. Using Brand X's social media gives me pleasure	0.912	0.357	52.301	0.000
	HV3. I enjoy using Brand X's social media.	0.916	0.375	46.953	0.000
Utilitarian Value (UV) $\alpha=0.944$; CR=0.960; AVE=0.857	UV1. Using Brand X's social media enables me to accomplish work, learning, communication, and transactions more quickly.	0.925	0.273	59.979	0.000
	UV2. Using Brand X's social media enables me to accomplish work, learning, communication, and transactions more effectively.	0.939	0.270	66.993	0.000
	UV3. Using Brand X's social media enhances my effectiveness in work, learning, communication, and transactions.	0.931	0.265	66.004	0.000
	UV4. Using Brand X's social media improves the quality of my work, learning, communication, and transactions.	0.910	0.271	45.923	0.000
Online Brand Engagement (OBE) $\alpha=0.933$; CR=0.949; AVE=0.790	B51. I follow the brand X and brand Owner of company using social media	0.840	0.230	30.653	0.000
	BE2. I participate in Brand X's engagement activities on social media because I feel better afterward	0.898	0.222	39.668	0.000
	BE3. I participate in the brand X's engagement activities on social media because I am able to share my experiences with others	0.913	0.221	44.123	0.000
	BE4. I participate in Brand X's engagement activities to enable me to reach personal goals	0.898	0.222	39.25	0.000
	BE5. I participate in the brand X's engagement activities on social media because of the emotional attachment I develop for the brand	0.892	0.232	35.415	0.000
Brand Loyalty (BL) $\alpha=0.910$; CR=0.937; AVE=0.787	BL1. In the future, I will be loyal to [Brand X].	0.904	0.316	33.463	0.000
	BL2. I will buy [Brand X] again.	0.892	0.271	28.592	0.000
	BL3. [Brand X] will be my first choice in the future.	0.914	0.271	34.664	0.000
	BL4. I will not buy other brands if [Brand X] is available for sale.	0.837	0.269	23.246	0.000

Furthermore, we applied the HTMT value to assess the discriminant validity of the constructs. We found that all the HTMT values between constructs are below the considered level of 0.9 (shown in Table 3), so these results display acceptable discriminant validity [85]. In short, all the above results indicated that all first-order constructs' validity is documented.

Table 3. Discriminant validity assessment using the HTMT criterion

	BL	CUSTOM	ENTER	HV	INTERACT	OBE	TREND	UV
CUSTOM	0.649							
ENTER	0.692	0.893						
HV	0.735	0.765	0.827					
INTERACT	0.637	0.883	0.856	0.847				
OBE	0.724	0.631	0.718	0.747	0.687			
TREND	0.696	0.886	0.827	0.836	0.865	0.662		
UV	0.661	0.751	0.767	0.846	0.825	0.727	0.802	
WOM	0.737	0.792	0.801	0.822	0.859	0.795	0.828	0.801

Next, we validated the second-order constructs by assessing the second-order measurement model. The model includes five constructs: SMMAAs, Hedonic value, Utilitarian value, Online Brand Engagement, and Brand Loyalty. We followed the same procedure and criterion for validating the second-order constructs.

The results in Table 4 also show that all second-order constructs display good reliability and validity. Specifically, the outer loadings of all items range from 0.837 to 0.938; the T-value ranges from 23.245 to 73.614 with P value for all items of 0.000.

Table 4. The indicators' significance and reliability in the second-order measurement model

	Outer loadings	Outer weights	T statistics	P values
CUSTOM ← SMMAAs	0.911	0.213	47.548	0.000
ENTER ← SMMAAs	0.888	0.221	45.742	0.000
INTERACT ← SMMAAs	0.914	0.234	44.755	0.000
TREND ← SMMAAs	0.891	0.225	37.392	0.000
WOM ← SMMAAs	0.870	0.224	41.720	0.000
HV1 ← HV	0.911	0.359	52.398	0.000
HV2 ← HV	0.914	0.364	53.280	0.000
HV3 ← HV	0.915	0.371	50.648	0.000
UV1 ← UV	0.923	0.268	65.142	0.000
UV2 ← UV	0.938	0.269	73.614	0.000
UV3 ← UV	0.931	0.267	69.909	0.000
UV4 ← UV	0.911	0.277	52.761	0.000
BE1 ← OBE	0.840	0.230	30.689	0.000
BE2 ← OBE	0.898	0.222	39.705	0.000
BE3 ← OBE	0.913	0.221	44.140	0.000
BE4 ← OBE	0.898	0.222	39.299	0.000
BE5 ← OBE	0.892	0.232	35.440	0.000
BL1 ← BL	0.904	0.316	33.463	0.000
BL2 ← BL	0.892	0.271	28.592	0.000
BL3 ← BL	0.914	0.271	34.664	0.000
BL4 ← BL	0.837	0.269	23.245	0.000

Besides, as shown in Table 5, Cronbach's Alpha, CR, and AVE of the second-order constructs are all within a cut-off score, and the HTMT value between pairs of constructs ranges from 0.661 to 0.889. These calculation results indicate good indicator significance, composite reliability, convergent validity, and acceptable discriminant validity.

Table 5. Cronbach's Alpha, CR, AVE, and the HTMT value of the second-order constructs

	Cronbach's alpha	CR	AVE	BL	HV	OBE	SMMAs
BL	0.910	0.937	0.787				
HV	0.901	0.938	0.834	0.735			
OBE	0.933	0.949	0.790	0.724	0.747		
SMMAs	0.938	0.953	0.801	0.741	0.889	0.758	
UV	0.944	0.960	0.857	0.661	0.846	0.727	0.857

Consequently, all constructs in the model are ready to test the research hypotheses.

4-2- Hypotheses Testing

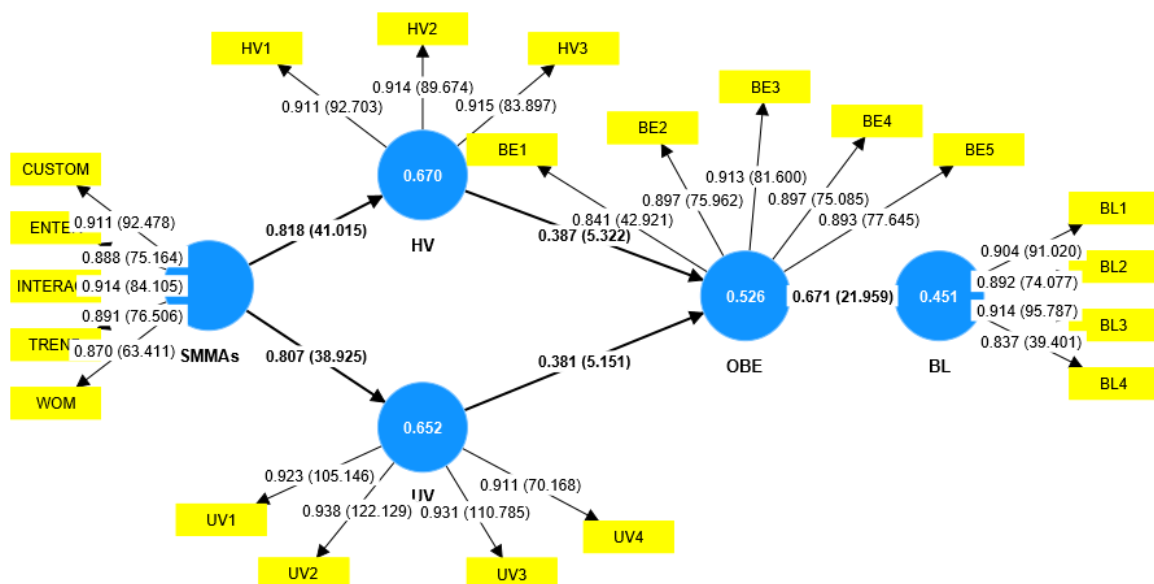
To begin with structural model assessment for hypotheses testing, we assessed structural model for collinearity issues by estimating the VIF values among the predictor constructs. The max VIF value among them is 2.563, below the tolerance values at 3 (see Table 6). Therefore, collinearity is not a problem in this structural model [85].

Table 6. Summary of the results of hypotheses testing

Hypotheses	VIF	Original sample	T statistics	P values	f-square	Conclusion
H1: SMMAs → HV	1.000	0.818	41.015	0.000	2.026	Yes
H2: SMMAs → UV	1.000	0.807	38.925	0.000	1.871	Yes
H3: UV → OBE	2.563	0.381	5.151	0.000	0.120	Yes
H4: HV → OBE	2.563	0.387	5.322	0.000	0.124	Yes
H5: OBE → BL	1.000	0.671	21.959	0.000	0.820	Yes

Calculation results for estimating the size and significance of the path coefficients provide support for all paths in the structural model. A summary of the testing of hypotheses is detailed and presented in Table 5. Accordingly, the results of PLS-SEM indicated that all hypotheses in the study were supported at a 5% significance level by the data. Specifically, SMMAs generate a direct positive effect on perceived hedonic and utilitarian values, with a path estimate of 0.818 and 0.807, effect size f^2 of 2.026 and 1.871, and a significance level of $p=0.000$ and 0.000 , respectively. Thus, the results provide support for H1 and H2. Besides, the analysis also displays that perceived hedonic and utilitarian values have a substantial effect size f^2 of 0.12 and 0.124 on Online brand engagement, with the paths estimate of 0.381 and 0.387 at p -value= 0.000 and 0.000 , respectively. As a result, the hypotheses H3 and H4 are supported. In addition, the data reveals a large effect size of 0.82 and significance of the path estimate of 0.671 at p -value= 0.000 between Online brand engagement and Brand loyalty.

The findings also exhibit the value of R^2 for constructs in the model (Figure 4). The R^2 value of perceived hedonic values is 0.67, perceived utilitarian values are 0.652, online brand engagement is 0.526, and brand loyalty is 0.451. These results mean about 67% variance in perceived hedonic values and 65.2% variance in perceived utilitarian values are explained by SMMAs; 52.6% variance in online brand engagement is explained by SMMAs and perceived hedonic and utilitarian values; and lastly, 45.1% variance in Brand loyalty is explained by four remaining variables in the model.



Note: (displaying outer loadings and T-value for the outer model, path coefficients and T-value for the inner model, R-square in the constructs).

Figure 4. Results of bootstrapping analysis with five thousand subsamples

The data analysis continued with the PLSpredict/CVPAT analysis to predict the predictive relevance of Q2. The Q2 value for the endogenous variables in the model is over 0 (0.668 for perceived hedonic value, 0.650 for perceived utilitarian value, 0.495 for online brand engagement, and 0.397 for brand loyalty), so the predictive relevance is established. These results mean that the model is moderately effective in predicting brand loyalty.

Moreover, for the extra findings, we run bootstrapping to test the mediating role of variables in the model. The results prove that all perceived hedonic values, utilitarian values, and online brand engagement mediate the effects of SMMAAs on brand loyalty (detailed results in Table 7).

Table 7. The results of specific indirect effects analysis

Paths	Original Sample	T Statistics	P Values
HV → OBE → BL	0.260	5.462	0.000
SMMAAs → UV → OBE → BL	0.207	4.871	0.000
SMMAAs → HV → OBE → BL	0.213	5.356	0.000
SMMAAs → HV → OBE	0.317	5.547	0.000
SMMAAs → UV → OBE	0.308	5.206	0.000
UV → OBE → BL	0.256	5.040	0.000

We also run a Multi-Group Analysis (MGA) to discover whether brand types (luxury and nonluxury brands) affect these relationships in the model. The luxury brands include 282 cases, and the nonluxury brands include 219 cases. We applied the measurement invariance of composite models (MICOM) procedure to assess the measurement invariance. The results of Step 2 (Table 8) show that the permutation's p-values, which were more significant than 0.05, supported partial measurement invariance [86, 87].

Table 8. Results of MICOM-Step 2

	Original correlation	Correlation permutation mean	5.00%	Permutation p-value
BL	1.000	1.000	0.999	0.441
HV	1.000	1.000	1.000	0.790
OBE	1.000	1.000	1.000	0.930
SMMAAs	1.000	1.000	1.000	0.538
UV	1.000	1.000	1.000	0.802

Calculation results for Step 3 (see Table 9) exhibit equal variances across two groups for all constructs (Permutation p-value ranges from 0.304 to 0.969, above 0.5). However, there is a significant difference in composite mean for most constructs, but SMMAAs. Consequently, the Step 3 results concluded that only partial measurement invariance was supported.

Table 9. Results of MICOM-Step 3a+3b

	Mean			Variance		
	Original difference	Permutation mean difference	Permutation p-value	Original difference	Permutation mean difference	Permutation p-value
BL	0.303	0.002	0.001	-0.059	-0.001	0.635
HV	0.197	0.003	0.030	-0.091	0.004	0.446
OBE	0.244	0.002	0.010	-0.128	0.001	0.304
SMMAAs	0.179	0.001	0.051	-0.004	0.004	0.969
UV	0.206	0.003	0.020	-0.060	0.004	0.613

The bootstrap MGA indicates significant differences in some relationships in the model across brand types (see Table 10).

Table 10. Results of path coefficients – bootstrap MGA

	Difference (Luxury - Non-Luxury)	1-tailed (Luxury vs Non-Luxury) p-value	2-tailed (Luxury vs Non-Luxury) p-value
HV → OBE	0.066	0.317	0.633
OBE → BL	0.050	0.219	0.439
SMMAAs → HV	0.102	0.004	0.009
SMMAAs → UV	0.081	0.024	0.049
UV → OBE	0.040	0.384	0.767

In all relationships in the model, brand type moderates the effect of SMMA on perceived hedonic and utilitarian values. To be more precise, SMMA has a more substantial impact on perceived hedonic values for luxury brands than nonluxury brands, with Path Coefficients-diff of 0.102 (path coefficients estimate in this path for luxury brands is 0.863, and for nonluxury brands is 0.761), and the p-value is 0.009. Likewise, the analysis also reveals the moderating role of brand type in the relationship between SMMA and perceived utilitarian values, with a Path Coefficients-diff of 0.081 and a p-value of 0.049. Accordingly, SMMA has a more substantial effect on perceived utilitarian values for luxury brands (path coefficient is 0.842) than nonluxury brands (path coefficient is 0.761).

5- Discussions of Findings

5-1- Summary of the Findings

Built on the Stimulus-Organism-Response (SOR) framework, our research model and hypotheses were developed to explore the effects of social media marketing activities (SMMA) on brand loyalty. Our results demonstrated that the effects of SMMA are transmitted through the perceived values of SMMA and online brand engagement. Specifically, our findings confirmed all proposed hypotheses: (i) Social media marketing activities positively affect the perceived hedonic values of Social media marketing activities; (ii) Social media marketing activities positively affect the perceived utilitarian values of Social media marketing activities; (iii) The perceived utilitarian values of Social media marketing activities positively affect online brand engagement; (iv) The perceived hedonic values of SMMA positively affect online brand engagement; (v) Online brand engagement has positive effects on brand loyalty. Furthermore, our findings indicated that the effects of SMMA on mediating and dependent variables are stronger in the case of luxury brands than in non-luxury brands. These results signify that superior SMMA lead to higher perceived values of SMMA, resulting in stronger online brand engagement and, ultimately, greater brand loyalty. Additionally, compared to non-luxury brands, better SMMA lead to higher brand loyalty for luxury brands.

5-2- Theoretical Implications

Our research has significantly contributed to the current literature on the impact of SMMA on brand loyalty. Firstly, our study is the first to explain the effects of SMMA on brand loyalty, specifically through the perceived values of SMMA and online brand engagement as mediating variables. Our findings provide new insights into the impact of SMMA on brand loyalty. These findings further support the belief that SMMA positively influence brand loyalty and that various customer cognitions and responses mediate this influence. For instance, previous studies have shown that SMMA indirectly affect brand loyalty through factors such as brand love [26], brand equity [25], love mark [24], brand awareness and brand image [30], value consciousness, and brand consciousness [88], and brand experience (similar to perceived values) [40]. Therefore, our findings add to the limited research on the effects of SMMA on brand loyalty and also shed light on the mechanisms through which these effects are transmitted.

Secondly, our study introduces a novel approach, the perceived values of the SMMA approach, to explain the impact of SMMA on brand loyalty. This is achieved by examining the effects of SMMA and perceived values of SMMA on online brand engagement and brand loyalty. This approach differs from the traditional approach, which studies the impact of perceived values of products/brands on brand loyalty [24, 25, 40]. Our innovative approach offers researchers a new perspective on studying the effects of SMMA, specifically by examining the mediating roles of perceived values of SMMA. Additionally, our study contributes to future research on the perceived values of SMMA, which previous studies have yet to explore extensively. In conclusion, our study opens up new avenues for understanding consumer behavior in the context of SMMA.

Thirdly, our study confirms the moderating effects of brand luxury on the relationship between SMMA and the perceived values of SMMA. Specifically, we found that the impact of SMMA on perceived values is more significant for luxury brands than non-luxury brands. This can be attributed to the association of luxury with pleasantness, superficiality, and ostentation. Luxury brands often prioritize image over objective physical attributes [7, 89, 90]. With the rise of social media, customers now have more power to shape the market [17]. As a result, the influence of SMMA on perceived values is more substantial when purchasing luxury brands.

Finally, our research has revealed new possibilities for applying the SOR model to consumer behaviors and social media marketing activities (SMMA). Our findings suggest that the SOR model may be particularly effective in examining the impact of stimuli on organisms and responses in the context of luxury products and brands with high social value. Furthermore, the SOR model can be applied not only to a single type of object (such as a product or brand) but also to connect stimuli and organisms related to one type of object with responses related to other objects, especially when there are connections between them. Specifically, our study has linked SMMA to brand loyalty within the same business firms.

5-3- Practical Implications

Our research indicates that businesses can establish brand loyalty using SMMA. Some practical implications of this include:

Firstly, businesses should consider investing more in SMMA rather than allocating excessive funds toward other marketing communication activities to cultivate brand loyalty, particularly for luxury products and brands. This argument is supported by our research findings, the cost-effectiveness of SMMA [13-15], and 4.89 billion social media users worldwide [8]. To accurately allocate a budget for SMMA, firms should analyze the impact of their social media marketing budget on brand loyalty and compare it to the impact of their budget for other marketing communication activities. Based on this analysis, budget allocations should be made to maximize the effects on brand loyalty.

Secondly, to effectively build brand loyalty through SMMA, firms should focus on creating perceived values for customers, particularly luxury brands. This can be achieved by designing SMMA solutions that support customer engagement. Our findings demonstrate that this approach can significantly improve the impact of SMMA on brand loyalty. To accomplish this, firms should optimize the attributes, functions, and quality of their social media sites/platforms [33], align the values produced by experiences with the preferences of their target market [64], enhance the outcomes of SMMA [38, 50, 53, 65], and incorporate entertainment, interaction, trendiness, customization, and word of mouth aspects into their SMMA [6].

Thirdly, firms should use the perceived values of SMMA and online brand engagement as key performance indicators in planning and controlling their SMMA. This will ensure that their efforts are on track and consistently contribute to brand loyalty. By doing so, firms can improve the effectiveness and efficiency of their SMMA. Specific steps in this process may include adopting or developing specific scales or metrics to measure SMMA efforts, perceived values of SMMA, online brand engagement, and brand loyalty. Additionally, firms should build inference statistical models or econometrics models to monitor and determine the effects of SMMA's efforts on the perceived values of SMMA, online brand engagement, and brand loyalty. It is essential for firms to periodically collect and update data and check the effects of their SMMA. Based on the analysis results, appropriate modifications should be made to the new plans for SMMA efforts.

Lastly, SMMA are user-generating content activities and affect perceived values, online consumer engagement, and brand loyalty; therefore, business firms should pay more attention to influencing content in SMMA by providing social media users with sufficient information about the firms, brands, and products. Entertainment, customization, trendiness, interaction, and word-of-mouth activities on social media marketing should focus on creating hedonic and utilitarian value, involving customers in online brand communities. The firm should also select social media sites/platforms with substantial customization and interaction capacities.

6- Conclusions

This study adds to our understanding of social media marketing activities (SMMA), perceived values of SMMA, online brand engagement, and brand loyalty. Firstly, our research is the first to explore how SMMA influence brand loyalty by focusing on the perceived values of SMMA rather than the traditional approach of focusing on the perceived values of brands or products. We found that SMMA impact online brand engagement and brand loyalty through the perceived values of SMMA. Secondly, our study confirms the moderating effects of brand luxury on the relationship between SMMA and the perceived values of SMMA. Specifically, we found that the impact of SMMA on brand loyalty is greater for luxury brands than for non-luxury brands. Furthermore, our findings indicate that the Stimulus-Organism-Response (SOR) model can be applied not only to a single type of object, such as a product or brand, but also to connect stimuli and organisms related to one type of object with responses related to other objects, especially when there are connections between them. This study's contribution to the academic landscape is significant not only because it adds to the limited research on the effects of SMMA on brand loyalty but also because it uncovers new mechanisms through which these effects are transmitted and offers new approaches to applying the SOR framework. In addition, our findings have practical implications for firms. Firstly, firms should invest in SMMA to build loyalty, particularly for luxury products and brands. Secondly, to effectively build brand loyalty through SMMA, firms should focus on creating perceived values of SMMA for customers, particularly in the case of luxury brands. Thirdly, firms should use the perceived values of SMMA and online brand engagement as key performance indicators in planning and controlling their SMMA.

The current research has some limitations. First, our study has limitations in generalizability. We conducted this research based on samples from an emerging Southeast Asian country. Thus, the results cannot be generalized to developed countries or countries in other regions of the world. Second, there may be potential moderators in the relationship between variables in our models, such as generation (X, Y, Z generation) or social media platforms (Twitter vs. Facebook). Therefore, future research should examine the moderating effect of nationality, generation, and social media platforms on the relationships in our research model. Additionally, as we discussed previously, future research could apply the perceived values of the SMMA approach to explain the effects of SMMA on brand loyalty, and it could also help explain conflicting findings in the existing literature.

7- Declarations

7-1- Author Contributions

Conceptualization, N.M.N. and N.T.H.; methodology, N.T.H.; software, N.T.H.; validation, N.M.N., N.T.H., and C.A.T.; formal analysis, N.M.N.; investigation, C.A.T.; resources, N.M.N.; data curation, C.A.T.; writing—original draft preparation, N.M.N.; writing—review and editing, N.M.N.; visualization, C.A.T.; supervision, N.T.H.; project administration, N.T.H.; funding acquisition, N.T.H. All authors have read and agreed to the published version of the manuscript.

7-2- Data Availability Statement

The data presented in this study are available on request from the corresponding author.

7-3- Funding

This study received funding from the National Foundation for Science & Technology Development of Vietnam under Grant Number 316/HD-502.02-2020.

7-4- Institutional Review Board Statement

Not applicable.

7-5- Informed Consent Statement

The informed consent was collected in written form (online form, respondents were asked whether they agreed to participate in the survey. If they chose "Agree," they decided to answer the questionnaire).

7-6- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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