Technology in Society 81 (2025) 102810

Contents lists available at ScienceDirect

Technology in Society

journal homepage: www.elsevier.com/locate/techsoc

Assessing the key factors influencing 4G users' intentions to upgrade to 5G networks

Hsiao-Han Lu *, Shi-Fen Huang

Department of Transportation & Communication Management Science, Institute of Telecommunications Management, National Cheng Kung University, Tainan City, Taiwan

ARTICLE INFO

Keywords:
4G network quality
5G promotion
5G perceived cost
5G perceived value
Customer loyalty
Intention to use 5G

ABSTRACT

This research examines how 4G network quality (i.e., speed, coverage, and call and text quality), media reviews, 5G promotion, and 5G perceived cost affect 5G perceived value, customer satisfaction, and corporate image toward a mobile network provider. These factors consequently influence loyalty and intention to use 5G from the perspective of customer-based brand equity. The results show the following key effects. (1) Network coverage and speed of 4G have positive effects on corporate image; (2) Call and text quality of 4G has a significantly positive effect on satisfaction, but a significantly negative effect on 5G perceived value. These findings imply that the high quality of call and text of 4G offered by current providers may reduce the perceived value of 5G, as users may feel that their current 4G service is already good for use. However, 5G technology is still progressing. (3) Media reviews have positive effects on corporate image and 5G perceived value, but significantly negative effects on customer satisfaction. These findings suggest that media reviews enhance corporate image and value perceptions. However, the heightened expectations they create may lead to reduced customer satisfaction; (4) 5G perceived value is the primary driving force of customers' intention to use 5G, and 5G promotion is the strongest predictor among the factors influencing this perceived value; (5) Customer satisfaction with mobile network providers negatively relates to intention to use 5G, but positively relates to loyalty. Customer satisfaction can thus lead to the intention to use 5G through customer loyalty. Lastly, theoretical and practical implications for mobile service providers are discussed.

1. Introduction

The fifth generation of mobile technology (5G) offers faster and more reliable connections for a massive number of connected devices. Following the release of 5G, researchers have investigated user intention to adopt 5G from different perspectives, including the intention-behavior gap of 5G [1], trust and concentration [2], flow and trust [3], attitude toward 5G [4], and perceived value of 5G [5]. These factors have been indicated in recent studies to understand their influence on customer decisions to adopt 5G technology. By the end of 2023, 5G's market penetration was 59 % in North America, while in most other countries, it hovered around 30–40 % [6]. This phenomenon suggests that many 4G users are satisfied with their current mobile service and are not upgrading to 5G. Thus, despite the growing academic interest in 5G, understanding its slow adoption remains limited. Thus, it is worth exploring how 4G users' satisfaction with and loyalty to their current service provider influences their choice to adopt 5G.

Studies on user loyalty in the context of mobile service providers have emphasized the satisfaction-loyalty nexus and found various determinants of the two. Current research has indicated the roles of service or network quality [7–13], corporate image [7,8,14,15] and perceived value [12,14–16] at influencing customer satisfaction and loyalty to a mobile service provider. The above-mentioned predicting factors – perceived quality, corporate image, perceived value – represent the core concepts of customer-based brand equity (CBBE) [17,18]. CBBE has thus attracted attention from both marketing scholars and practitioners, as it reflects a product's position in consumers' minds, thereby creating brand equity and delivering value to the firm [19].

Although the literature has investigated 5G adoption and loyalty to mobile service providers, we know little about how 4G users' experiences with their current mobile service provider relate to their choice for 5G adoption. To be more specific, research has not yet explored how 4G users evaluate their current mobile service providers and how this evaluation relates to their upgrading to 5G. To address these gaps, we

* Corresponding author.
E-mail addresses: hhlu@gs.ncku.edu.tw (H.-H. Lu), shifen189@gmail.com (S.-F. Huang).

https://doi.org/10.1016/j.techsoc.2024.102810
Received 18 October 2023; Received in revised form 15 November 2024; Accepted 29 December 2024
Available online 30 December 2024

propose a research question: How do the relevant factors of 4G and 5G co-exist when determining both customer loyalty and the intention to use 5G? Drawing on the CBBE framework, this study examines how the previous generation (i.e., 4G) of network quality may affect the perceived value of 5G and users' perceptions (i.e., satisfaction and corporate image) towards an individual mobile service provider and in turn their loyalty and intention to use 5G. The CBBE literature has noted that incorporating additional constructs can provide a more comprehensive evaluation of a brand's equity, nicely tailored to specific contexts. Therefore, we incorporate media reviews, as they are important to the performance of telecommunications companies [20] and have been identified as a driver of brand equity [21]. We additionally include 5G-related factors (specifically, perceived 5G cost and 5G promotion) since both are potential influencers of the current delay in adopting 5G, with high expenses being one of the major concerns prior to switching to 5G [22].

By examining the dimensions of CBBE, this study explores the roles of users' 4G network quality, 5G factors (i.e., 5G promotion and 5G perceived cost), and that of media reviews on the effects of corporate image, satisfaction, and perceived value of 5G and consequently loyalty to mobile service providers and users' intention to use 5G. Maeng et al. [22] suggested that delays in using 5G are due to a lack of demand for it, a factor that may also imply that users are already fully satisfied with 4G's performance. Thus, we compare the differences between high and low needs of 5G in our study.

This research contributes to the literature in several ways. First, it extends the current understanding of CBBE to the mobile service context by adding to the studies of CBBE in technology services [23,24]. The results offer a deeper understanding of the factors influencing customer satisfaction, corporate image, 5G perceived value, and subsequently consumer loyalty to the mobile service provided as well as 5G intention within the CBBE framework. Second, we enrich the related literature on how a prior generation of technology may affect the adoption of a newer generation of technology [3,25] by incorporating the different dimensions of 4G network quality (i.e., speed, network coverage, and call and text quality), 5G determinants (i.e., 5G perceived cost and 5G promotion), and media reviews. Third, since a lack of need [22] is one potential reason for delaying 5G adoption, this study investigates the path differences between higher and lower needs for 5G, offering insights into how individual motivation may affect users' loyalty and adoption intention.

2. Theory background and hypotheses

2.1. Review of relevant studies

The literature on telecommunications users has primarily focused on customer satisfaction and loyalty toward mobile service providers and indicated a range of factors that influence these outcomes. Some studies have pointed out the role of overall service quality [7,11,12,14,26] on satisfaction, while other studies have differentiated between the dimensions of service quality and indicated the effect of network quality (e.g., call quality, data quality) [8–10,13] on satisfaction. Dey et al. [16] showed that the various dimensions of network quality (i.e., speed, network coverage, call and text quality) have positive impacts on brand image and service quality, which in turn affect satisfaction through perceived value. Other studies have suggested that perceived value [12, 14–16] and price [8,27] play important roles in influencing customer satisfaction and loyalty toward mobile service providers and the decision to make a change.

The role of corporate image has varying effects on perceived value, satisfaction, and loyalty. While it has a positive effect on perceived value [14,16], its influence on loyalty is insignificant [11,14,26], and its impact on satisfaction is inconsistent. Some studies have highlighted the role of corporate image on satisfaction [8,14,15]. Calvo-Porral et al. [7] suggested that this effect depends on the type of contract. However, Ofori et al. [11] found no significant impact of corporate image on satisfaction.

Studies have also compared the different factors that are influencing telecommunication users in both previous and newer generations of technology. Jung and Kwon [9] examined the various determinants of satisfaction and in turn satisfaction on loyalty in the South Korea mobile telecommunications market and compared the differences between 3G and LTE (4G) users there. Their study reported that the effects of call quality and customer support are stronger on 3G customers than on LTE customers, whereas the effects of data quality and price perception are the opposite, being stronger on LTE than on 3G customers.

The literature has separately explored the driving forces coming from a previous generation of technology that influence the adoption of a newer technology. Tseng et al. [25] noted that perceived value is the most important determinant for 2G (3G) users when deciding to upgrade to 3G (4G). Their study also considered the role of prior satisfaction with 2G (3G), but found no significant effect on the adoption of 3G (4G). Akbari et al. [3] investigated prior satisfaction with 4G, which had a positive impact on flow and in turn the intention to use 5G.

Since the release of 5G, recent studies on telecommunications users have placed more emphasis on investigating the factors that are predicting 5G adoption. Shah et al. [1] pointed out that product market-creating abilities decrease the intention-behavior gap of adopting 5G. Cheng et al. [4] found that the subjective norms, ubiquity, and speed positively relate to attitude toward 5G, while privacy have a negative effect on 5G attitude. Furthermore, they also indicated that users' attitude toward 5G positively influences users' willingness to pay for 5G and to recommend 5G to others in this study.

Shah et al. [5] explored the effects of benefits and sacrifices on 5G's perceived value and in turn the switch intention to 5G through a value-based model. They found that the role of benefits appears, but the effect of sacrifices is not significant for switching to 5G. Perceived usefulness and perceived ease of use have a positive impact on intention to use 5G and is mediated by trust and concentration [2]. In addition to examining the intention to adopt 5G, Maeng et al. [22] explored the factors that are delaying its adoption, indicating both cost and lack of need as key reasons. Table 1 below summarizes several key indicators of loyalty or adoption intention to change a mobile service provider from the studies mentioned above.

The important roles of service or network quality, corporate image, and perceived value in the context of the mobile service provider represent core dimensions for customer-based brand equity (CBBE). CBBE describes how users' experiences of a service may lead to their satisfaction or behavioral intention toward that service [28]. While studies have explored users' experiences of mobile service providers, the impact of having satisfaction with an earlier generation of technology on the adoption of a newer technology is inconsistent across the findings [3, 25]. However, these studies focused solely on overall satisfaction with a prior generation of technology without differentiating between the potential factors that were contributing to that satisfaction.

Our research thus goes a step further to investigate prior 4G network quality (i.e., network quality, speed, call, and text quality) on users' perceptions of a mobile service provider (i.e., satisfaction and corporate image) and 5G perceived value from the perspective of CBBE. According to CBBE, incorporating more relevant constructs into studies is also

Table 1
Summary of key constructs.

Construct	Relevant Studies
Service quality	7, 11, 12, 14, 26
Network quality	8–10, 13, 16
Perceived value	12, 14–16, 25
Corporate image	7, 8, 11, 14–16, 26
Price/Cost	8, 9, 22, 25, 27
Prior satisfaction	3, 25

encouraged to enrich the understanding of CBBE. Therefore, in addition to 4G-related factors, we also consider specific 5G determinants, such as 5G promotions and perceived costs. Moreover, our study incorporates media reviews, as other research has indicated that social media and word of mouth are important factors in shaping the performance of telecom companies [20]. Similarly, users often rely on media reviews when selecting and comparing technologies, making these a critical factor in the decision-making process and influencing users' choice of a mobile service provider. In sum, this research examines 4G users' intention to use 5G from the perspective of CBBE and explores how loyalty may be one of the important predicators of 5G usage. We discuss these below.

2.2. The effect of customer loyalty to a current mobile service provider on the intention to use 5G

Customer loyalty to a mobile service provider is defined as the customers' favorable attitude toward that same company that leads to the intention to repurchase with a lower price sensitivity [12,15]. In the telecommunications context, loyal customers generally prefer to continue their connections with the current service provider [8]. The effect of customers' loyalty on their intention to continue their relationships with the same company has been found in various contexts. Customer loyalty positively influences continued usage of mobile banking/payment apps [29,30]. In the hotel context, customer loyalty is positively related to customers' intention to stay at the same hotel again [31]. Brand loyalty has been suggested as positively influencing the repurchase of the same smart home brand [32]. Loyalty to retail Facebook pages is positively related to purchase intention from the same apparel retail [33]. In the telecommunications context, we posit that loyalty to mobile service providers means a likelihood to use 5G services from that same service provider. Thus, we propose the first hypothesis.

H1. Customer loyalty to a mobile service provider positively affects 5G use intention.

2.3. Determinants of customer loyalty and intention to use 5G

2.3.1. Customer satisfaction

Customer satisfaction is having positive experiences and content with the service or product provided by a mobile service provider [34]. In the telecommunications context, Calvo-Porral and Lévy-Mangin [15] found that satisfaction positively relates to loyalty and negatively relates to switch intention. Chen et al. [8] suggested that more satisfaction and less dissatisfaction can lead to a higher level of loyalty. Previous studies have shown a positive association between satisfaction and loyalty in a German mobile network operator [27], Korean mobile telecommunication services [10], a Chinese mobile telecommunications company [14], and a Ghana 3G mobile operator [11]. Satisfaction also positively relates to the intention to use a mobile shopping app [35,36]. Customers satisfaction can thus be used to predict future experiences or behaviors toward a company, including loyalty [34] and repurchase intentions [37]. Lin and Hsieh [38] indicated that satisfaction with self-service technology can increase the possibility of using the technology offered by that firm again. Hence, we posit that user satisfaction with a mobile network provider not only relates to loyalty, but also continuation of use for the 5G services or products provided by that company. We propose the following hypothesis.

H2. Customer satisfaction positively affects (a) loyalty and (b) 5G use intention of that mobile service provider.

2.3.2. Customer 5G perceived value

Although satisfaction is considered an important antecedent to loyalty, other determinants also can contribute to the high level of loyalty. Perceived value is often considered as another critical element to predict customer loyalty [14]. Perceived value is defined as "the consumer's overall assessment of the utility of a product based on perceptions of what is received and what is given" [39]. In our context, perceived value of 5G refers to "consumer's overall perception of 5G services based on the considerations of its benefits and sacrifices" [5]. In the telecommunications context, several studies have shown that perceived value positively relates to customer loyalty [14,40]. Moreover, the perceived value of mobile applications is positively related to customer loyalty [41]. Perceived value has been suggested as a factor that impacts various consumer outcomes. For example, perceived value has a positive effect on customers' continued intention to use mobile value-added services [42] and mobile payments [43]. Tseng and Lo [25] reported that the perceived value of 3G positively relates to consumers' intention to upgrade their mobile phones to use 3G. Thus, we propose the following hypothesis.

H3. Customers' 5G perceived value positively affects (a) loyalty and (b) 5G use intention of that mobile service provider.

2.3.3. Corporate image

Corporate image is another driving source of customer loyalty. Corporate image refers to the overall impression formed in the minds of consumers about a company [44]. In the telecommunications context, corporate image is considered one of the determinants that predict loyalty to mobile network providers [11,14,26], although studies have found only positive, but non-significant results. However, Gerpott et al. [27] showed that a competitor's corporate image negatively relates to customer loyalty, suggesting that customers are likely to be attracted by a competitor's positive image. These findings also imply that creating a positive corporate image can play a certain role in fostering loyalty. Despite these mixed findings, we argue that a positive relationship between corporate image and loyalty does exist, as customers are more willing to continue a contractual relationship with a mobile service provider if they hold a good impression of it. The halo effect created by a positive image of a mobile service provider can encourage customers to continue to use other services provided by the company even in the presence of other companies [11].

Corporate image also has a positive impact on other customer behavioral outcomes. Consumers will be more satisfied with a mobile service company when that company is perceived as reliable, trustworthy, and offers wide experience to its users [45]. The positive association between corporate image and satisfaction of mobile network providers has been found in many studies [7,11,14,15]. Similarly, corporate image has a positive effect on perceived value [14,16], which indicates that if a mobile service provider has a positive corporate image, then its users are likely to expect it to provide superior 5G technology and perceived that technology also as a valuable service. Based on these arguments, we posit that corporate image enhances customers' 5G perceived value, customer satisfaction, loyalty, and customer intention to use 5G. Hence, we thus propose the following two hypotheses.

H4. Corporate image positively affects (a) loyalty and (b) 5G use intention of that mobile service provider.

H5. Corporate image positively affects (a) customer satisfaction and (b) 5G perceived value of that mobile service provider.

2.4. Determinants of customer satisfaction, corporate image, and 5G perceived value

2.4.1. Network quality

Network quality is one of the most basic functional attributes [29] in all telecommunications services. A great network quality is evident by strong signal coverage both indoors and outdoors, as well as clear voice transmission free from any disruptions [27]. Previous studies have emphasized network quality as one of the most important driving sources of customers' value perception [13,27]. Mobile network quality,

which refers to the reliability and performance of key mobile technical attributes (i.e., response time and latency), positively influences the perceived value for telecom customers [42]. One study indicated that performance of network quality, including network coverage, speed, and call and text quality, positively influences the corporate image of a mobile network provider [16]. Call quality has been examined as a factor that influences customers' switching behavior [46], revealing that it positively affects customers' satisfaction with the mobile telecommunications service [10]. According to Ofori et al. [11], speed was considered an important element in service quality. In their study, service quality was positively related to corporate image and satisfaction with 3G mobile service providers. Conversely, service becomes meaningless for customers if the mobile network provider has poor network quality, such as prolonged connection times, narrow network coverage, frequent call drops, and low voice quality [29]. Hence, we posit that network coverage, speed, and call and text quality positively influence customers' satisfaction, corporate attitude, and perceived value of the mobile network provider by proposing the next three hypotheses.

H6. Network coverage of 4G positively affects (a) customer satisfaction, (b) corporate image, and (c) 5G perceived value of that mobile service provider.

H7. Speed of 4G positively affects (a) customer satisfaction, (b) corporate image, and (c) 5G perceived value of that mobile service provider.

H8. Call and text quality of 4G positively affects (a) customer satisfaction, (b) corporate image, and (c) 5G perceived value of that mobile service provider.

2.4.2. 5G promotion and 5G perceived cost

Apart from 4G related factors that may affect users' attitude and 5G perceived value of a mobile service provider, monetary promotions were often considered as one of the important marketing tools that stimulates customers' purchase intention [47], continuance intention [48], and satisfaction [49]. Monetary promotion refers to attracting customers by lowering the price, such as using price discounts or coupons [50]. Monetary promotion is more effective than non-monetary promotion [51]. Price promotion has a positive impact on perceived value of an in-store advertising campaign and in turn enhances purchase intention [52]. Sales promotions (e.g., financial reward, price discount) also increases customers' satisfaction with the check-in experience [53,54]. Customers are more satisfied with an online supermarket if they can purchase using a price discount or at a lower price [55]. Hsieh and Lee [56] found that monetary savings provided by mobile promotions can increase the desire to reuse the in-app promotion and subsequently lead to satisfaction with the app. Based on these studies, we posit that 5G promotion likely influences customers' perceived 5G value. In addition, customers' impression and satisfaction with the mobile service provider will be enhanced by the 5G promotion. Thus, we hypothesize the following.

H9. 5G promotion affects (a) customer satisfaction, (b) corporate image, and (c) 5G perceived value of that mobile service provider.

Despite the many factors that are potential driving forces of new technology and service adoption, cost-orientation is considered one of the primary obstacles in the diffusion process [57]. Perceived cost has negative impacts on technology adoption [57,58]. Higher fees appear to negatively relate to the perceived value of mobile payment service [59]. In the GPS navigation app context, perceived cost negatively relates to perceived value [60]. The effect of money worthiness positively relates to satisfaction with a shared-transportation mobile app [61]. The perceived high cost of using m-wallets influences users' negative word of mouth [62]. These factors imply that the perceived cost negatively relates to customers' impression of a company. In the 5G adoption context, the perceived cost of using 5G is one of the primary reasons behind a customer's decision for a delayed purchase [22]. When the perceived cost of 5G is high, the perceived value of 5G is lower, and mobile users may feel dissatisfied and have a negative impression of the mobile service provider. Hence, we propose the next hypothesis.

H10. 5G perceived cost negatively affects (a) customer satisfaction, (b) corporate image, and (c) 5G perceived value of that mobile service provider.

2.4.3. Media reviews

When customers seek to understand or compare the 5G services provided by different mobile service providers, they often search for relevant information on social media. Therefore, media reviews of 5G services of telecommunications companies appear in various channels, such as online news coverage, social media, and online forums. These can be primary marketing channels used by said companies. Online reviews appear to influence users' perception of effectiveness and subsequent satisfaction with online group-buying services [63]. Positive recommendations are likely to enhance the review credibility of customers' perceptions [64], and credibility is one element of a positive corporate image. Positive word of mouth has an even greater impact on satisfaction for search goods [65] and perceived monetary value of a mobile app [66]. In mobile app contexts, online ratings or electronic word of mouth positively influence users' satisfaction with a food ordering app [67] and travel app usage [68]. Chen and Chang [69] indicated that ratings and reviews have positive impacts on perceived value in a sharing economy. Hence, we posit that in the telecommunications context that the more positive that media reviews are, the more likely customers will have a positive corporate image, feel satisfaction, and see perceived value. We then propose the next hypothesis.

H11. Media reviews positively affect (a) customer satisfaction, (b) corporate image, and (c) 5G perceived value of that mobile service provider.

Fig. 1 below illustrates the research model proposed here. It presents the relationships of the study's constructs.

3. Methodology

3.1. Data collection

To test the research model, we gathered responses by using an online questionnaire on SurveyCake, focusing on 4G users in Taiwan. In mid-2023, approximately 25 % of Taiwan's population had adopted 5G, while a significant 75 % still relied on 4G networks. Many 4G users have delayed upgrading to 5G, indicating that they may have specific considerations or concerns about the 5G network. For instance, they might question the value of 5G, have cost concerns, or feel that their current 4G network quality and provider meet their needs. Therefore, exploring the factors that are influencing their willingness to upgrade is valuable, as it can more effectively capture the still unaddressed reasons behind the slow intention to upgrade there. Thus, we selected 4G users as our primary target respondents. We employed the back-translation method to translate the English written survey items into Chinese. Before the formal survey was released, we conducted a pre-test with 41 4G users and modified some of the survey items based on their feedback. We also invited two experts in this field to evaluate the clarity of the survey items to ensure content validity. Hence, we are confident of the consistency and clarity of meaning of the survey items. The first page of the survey included a screening question asking respondents to specify whether they were using 4G or 5G mobile services. We excluded those who had already adopted 5G, as they were likely more interested in new technology or had specific needs for 5G, both of which may not accurately reflect the current slow transition to 5G network. The survey link was then shared online across various social media platforms, forums, and through personal contacts. Data were collected between March 17 and

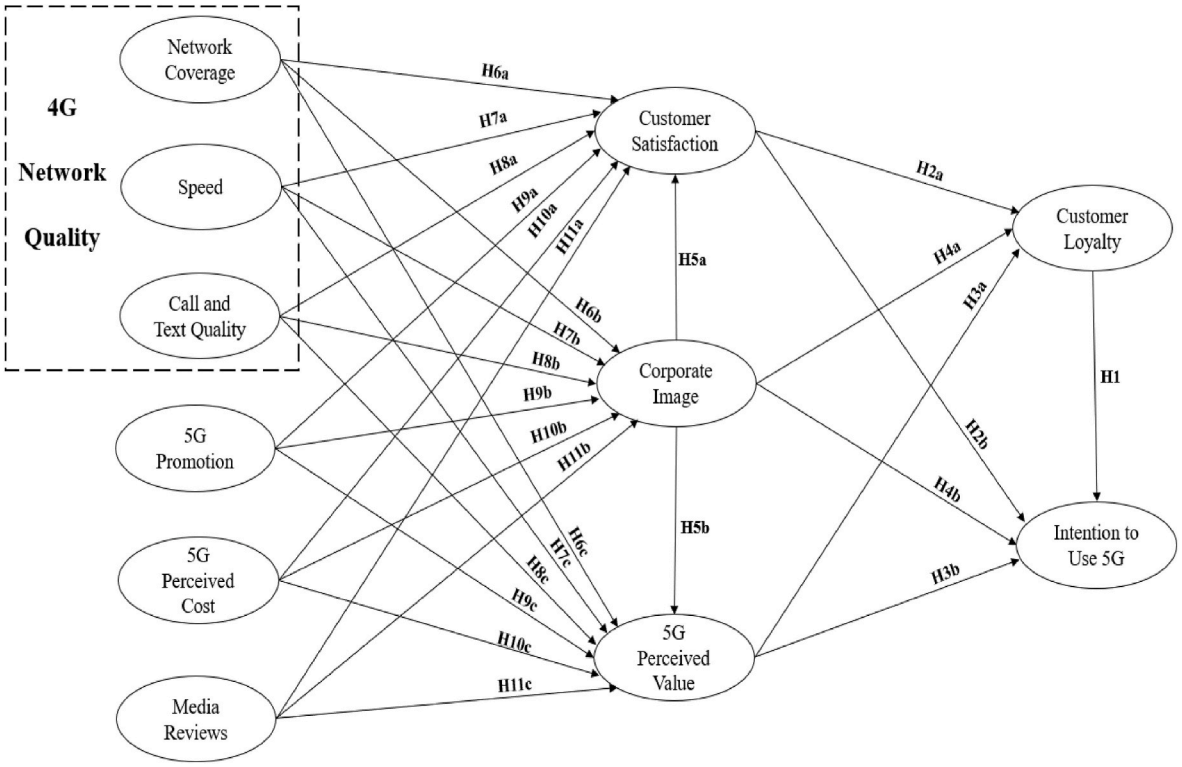

Fig. 1. Research model.

April 6, 2023, and totaled 835 responses. After eliminating inattentive responses, our final sample consisted of 807 responses.

Among these respondents, 57.2 % were female. Most respondents (94.1 %) reported that they have a college degree or above. Respondents' age groups ranged from 21–25 years (35.5 %), 26–30 years (23.7 %), 36 years and above (17.3 %), 31–35 years (15.4 %), to 16–20 years (8.1 %). More than half (53 %) of the respondents indicated having a monthly income of approximately NT$20,000-NT$60,000, less than NT$20,000 (36.4 %), and more than NT$60,000 (10.6 %). Respondents were mostly employees (57.1 %), followed by students (33.8 %), retirees (4.2 %), others (3.7 %), and housekeepers (1.2 %). The majority (90.9 %) of respondents were either employees or students due to their reliance on the Internet for work, study, and socializing, and thus were indeed more likely than others to consider and compare 4G and 5G options. They are also the key target audiences for mobile service providers that are promoting 5G. Therefore, their larger representation in our sample is reasonable.

3.2. Measures

The measurement scales in the proposed framework were adapted from established scales already validated in previous studies (see Appendix). The scale items relating to 4G network quality included 4G network coverage (3 items), 4G speed (3 items), and 4G call and text quality (3 items), adapted from Dey et al. [16]. The scale items relating to 5G included 5G promotion (3 items) modified from Buil et al. [50], 5G perceived cost (4 items) adapted from Nikou [58] and Jang and Park [57], and 5G perceived value (4 items) modified from Hu et al. [70] and de Kervenoael et al. [71]. Media reviews (3 items) were modified from Cheung et al. [64], and corporate image (4 items) was adapted from Dey et al. [16] and Calvo-Porral et al. [7]. Satisfaction (4 items) and loyalty (2 items) came from Calvo-Porral & Lévy-Mangin [15], and intention to use 5G (3 items) was adapted from Lee et al. [72]. We measured all items using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree).

4. Results

4.1. Measurement model

We conducted structural equation modeling (SEM) based on the maximum likelihood method using AMOS 24. According to the two-stage approach [73], we first performed confirmatory factor analysis (CFA) to examine convergent validity and discriminant validity of the measurement model. We then estimated the hypothesized conceptual model by using structural model analysis. To explore further, we employed multigroup analyses to examine the differences between the sub-samples of the current 4G customers (i.e., high vs. low 5G need).

We first conducted CFA to evaluate the convergent validity of all latent constructs in the measurement model. A good fit was achieved: $\chi 2 = 1454.671$, df = 502, $\chi 2/df = 2.898$, CFI = 0.960, GFI = 0.904, TLI = 0.953, and RMSEA = 0.049 [74]. Table 2 shows that the factor loadings for all items and composite reliability (CR) were above 0.6, supporting the convergent validity of all the constructs. The average variance extracted (AVE) ranged from 0.534 to 0.850, which is greater than the recommended value of 0.5 [75]. In Table 3, the diagonal elements represent the square root of AVEs, and the off-diagonal elements indicate the correlations among the constructs. The square root of AVE for each construct was greater than its correlations with other constructs, confirming discriminant validity [74,75].

4.2. Common method bias

Common method bias can be addressed by examining the phases of survey design and data analysis. To mitigate this issue, we employed procedural methods during the survey design phase and evaluated survey items carefully to enhance the clarity of each construct, thereby reducing the potential for respondent central tendency bias. This introductive language was designed to guarantee respondents' anonymity and confidentiality of the gathered responses. We used statistical control in the analysis phase. Harman's single-factor test [76] revealed

Table 2
Measurement model results.

Construct	Standardized loading	CR	AVE	Mean	S.D.
Network Coverage (NC)		0.918	0.789	3.680	0.821
NC1.	0.895				
NC2.	0.856				
NC3.	0.913				
Speed (SP)		0.926	0.806	3.568	0.844
SP1.	0.899				
SP2.	0.921				
SP3.	0.873				
Call and Text Quality (CTQ)		0.773	0.534	3.668	0.829
CTQ1.	0.814				
CTQ2.	0.688				
CTQ3.	0.682				
5G Promotion (PRO)		0.912	0.778	3.137	0.858
PRO1.	0.918				
PRO2.	0.961				
PRO3.	0.752				
5G Perceived Cost (PC)		0.820	0.606	4.178	0.718
PC1.	0.902				
PC2.	0.723				
PC3.	0.694				
Media Reviews (MR)		0.945	0.850	3.446	0.813
MR1.	0.947				
MR2.	0.935				
MR3.	0.883				
Customer Satisfaction (SAT)		0.932	0.775	3.654	0.802
SAT1.	0.808				
SAT2.	0.937				
SAT3.	0.909				
SAT4.	0.862				
Corporate Image (CI)		0.914	0.727	3.611	0.792
CI1.	0.849				
CI2.	0.843				
CI3.	0.879				
CI4.	0.837				
5G Perceived Value (PV)		0.906	0.709	3.046	0.797
PV1.	0.728				
PV2.	0.791				
PV3.	0.913				
PV4.	0.920				
Customer Loyalty (LTY)		0.852	0.742	3.480	0.976
LTY1.	0.899				
LTY2.	0.822				
Intention to Use 5G (INT)		0.836	0.631	3.374	0.876
INT1.	0.810				
INT2.	0.722				
INT3.	0.846				

that one common factor accounted for just 38.2 % of the variance, confirming that common method bias was not a major concern in the study.

4.3. Structural model and hypothesis testing

We subsequently estimate the hypothesized relationships in the research model. The goodness-of-fit indices of the structural model include $\chi 2 = 1599.635$, df = 571, $\chi 2/df = 2.801$, CFI = 0.957, GFI = 0.900, TLI = 0.950, and RMSEA = 0.047. We controlled for age and gender in our analysis. Our model explains 78.6 % of the variance in corporate image, 45.3 % of the variance in 5G perceived value, 68.5 % of the variance in satisfaction, 53.7 % of the variance in loyalty, and 38.2 % of the variance in intention to use 5G.

Eighteen out of twenty-seven hypotheses in the research model are significant with three hypotheses exhibiting opposite directions of the hypothesized relationship (see Table 4). Loyalty to the mobile network provider ($\beta = 0.212$) has a significantly positive impact on intention to use 5G, and thus H1 is supported. Satisfaction, corporate image, and 5G perceived value are explored as antecedents toward intention to use 5G and loyalty to the mobile network provider. Satisfaction significantly and positively affects loyalty ($\beta = 0.446$) and negatively affects intention to use 5G ($\beta = -0.196$). Therefore, H2a is supported, but H2b is not, because an opposite direction is found.

We find that 5G perceived value has a positive impact on loyalty ($\beta = 0.082$) and intention to use 5G ($\beta = 0.538$). Thus, H3a and H3b are supported, respectively. Corporate image appears to have a positive and significant on loyalty ($\beta = 0.286$), but not on intention to use 5G ($\beta = 0.077$). Thus, H4a is supported, but H4b is not. Corporate image has a significantly positive impact on satisfaction ($\beta = 0.629$) and 5G

Table 4
Model estimates.

Path	Standardized estimate	CR	p value	Result
H1: LYT→INT	0.212	3.710	0.000	Accept
H2a: SAT→LYT	0.446	8.589	0.000	Accept
H2b: SAT→ INT	−0.196	−3.052	0.002	Reject
H3a: PV→ LYT	0.082	2.380	0.017	Accept
H3b: PV→ INT	0.538	11.541	0.000	Accept
H4a: CI → LYT	0.286	5.329	0.000	Accept
H4b: CI → INT	0.077	1.215	0.224	Reject
H5a: CI →SAT	0.629	9.295	0.000	Accept
H5b: CI → PV	0.313	4.082	0.000	Accept
H6a: NC → SAT	−0.010	−0.160	0.873	Reject
H6b: NC → CI	0.242	4.667	0.000	Accept
H6c: NC → PV	0.071	0.951	0.342	Reject
H7a: SP → SAT	0.021	0.356	0.722	Reject
H7b: SP→ CI	0.179	3.610	0.000	Accept
H7c: SP→ PV	0.124	1.754	0.079	Reject
H8a: CTQ →SAT	0.349	5.491	0.000	Accept
H8b: CTQ→ CI	0.073	1.431	0.152	Reject
H8c: CTQ→ PV	−0.152	−2.114	0.035	Reject
H9a: PR →SAT	0.084	3.404	0.000	Accept
H9b: PR → CI	0.032	1.539	0.124	Reject
H9c: PR → PV	0.437	13.02	0.000	Accept
H10a: PC →SAT	−0.036	−1.344	0.179	Reject
H10b: PC → CI	0.074	3.277	0.001	Reject
H10c: PC → PV	−0.113	−3.483	0.000	Accept
H11a: MR→SAT	−0.124	−2.674	0.007	Reject
H11b: MR→ CI	0.509	17.511	0.000	Accept
H11c: MR→ PV	0.145	2.631	0.009	Accept

Table 3
Discriminant validity.

	Construct	1	2	3	4	5	6	7	8	9	10	11
1	4G Network Coverage	**0.888**										
2	4G Speed	0.769**	**0.898**									
3	4G Call and Text Quality	0.641**	0.633**	**0.731**								
4	Media Reviews	0.528**	0.542**	0.414**	**0.922**							
5	5G Promotion	0.023	0.040	0.042	0.053	**0.882**						
6	5G Perceived Cost	0.087*	0.041	0.105**	0.108**	−0.027	**0.778**					
7	Corporate Image	0.678**	0.676**	0.538**	0.753**	0.063	0.142**	**0.853**				
8	Customer Satisfaction	0.633**	0.630**	0.595**	0.528**	0.137**	0.097**	0.695**	**0.880**			
9	5G Perceived Value	0.304**	0.331**	0.206**	0.385**	0.501**	−0.083*	0.409**	0.366**	**0.842**		
10	Customer Loyalty	0.462**	0.447**	0.337**	0.439**	0.161**	0.075*	0.608**	0.619**	0.365**	**0.861**	
11	Intention to Use 5G	0.232**	0.254**	0.151**	0.230**	0.170**	−0.066	0.301**	0.213**	0.506**	0.297**	**0.794**

perceived value (β = 0.313), supporting H5a and H5b.

We next test how the three attributes of 4G network quality (i.e., network coverage, speed, and call and text quality) affect satisfaction, corporate image, and 5G perceived value. Of note is that 4G network coverage significantly and positively affects corporate image (β = 0.242), but not satisfaction (β = −0.01) or 5G perceived value (β = 0.071). Thus, H6b is supported, but H6a and H6c are not. Speed significantly and positively affects corporate image (β = 0.179), but not so for satisfaction (β = 0.021) or 5G perceived value (β = 0.124). Thus, H7b is supported, but H7a and H7c are not. Call and text quality has a significantly positive impact on satisfaction (β = 0.349) and a significantly negative impact on 5G perceived value (β = −0.152), but no significant results are found for corporate image (β = 0.073). Thus, H8a is supported, but not H8b and H8c, where H8c is not positive as we hypothesized.

We include 5G promotion and 5G perceived cost as 5G relevant determinants that predict satisfaction, corporate image, and 5G perceived value. 5G promotion has a significantly positive impact on satisfaction (β = 0.084) and 5G perceived value (β = 0.437), but no significant results are found for corporate image (β = 0.032). Thus, H9a and H9c are supported, but not H9b. 5G perceived cost has a significantly positive impact on corporate image (β = 0.044) and a negative impact on 5G perceived value (β = −0.113); however, no significant results are found for corporate image (β = −0.036). Still, the positive impact on corporate image is contrary to the original hypothesis of a negative effect. Thus, H10c is supported, but not H10a and H10b. Media reviews significantly and positively affect corporate image (β = 0.509) and 5G perceived value (β = 0.145), but significantly and negatively affect satisfaction (β = −0.124). Thus, H11b and H11c are supported, but not H11a where the opposite direction is found.

4.4. Multi-group analysis: high vs. low needs in 5G

Multigroup analyses are utilized to examine the differences in 5G needs in our sample. They are aimed at designing strategies to maximize followers' responses of different target groups. To measure 5G needs, we asked three questions about the primary advantage of 5G over 4G. These questions were: "Comparing to 4G (1) faster speed (e.g., upload or download speed), is what I need, (2) mass connection on many devices for 5G is what I need, and (3) low latency (e.g., loading videos smoothly, web applications respond quicker) in 5G is what I need." To calculate the overall 5G need, we averaged the scores of the three items (using the same scale as indicated in the measures) and then divided the sample by the median value. The z scores with their indication of significance illustrate the differences between the two groups. The comparison of the structural model results between high 5G need and low 5G need is shown in Table 5.

The insignificant results for the overall sample turn out to be significant for specific groups in the two paths between the groups with high and low 5G needs. One difference is that 4G speed-satisfaction path becomes significantly positive for the higher need group, but remains insignificant for the lower need group (p value of 0.047 for 5G high need; p value of 0.092 for lower need; z = −2.601***). The other path is 4G speed- 5G perceived value, which is significantly positive for the 5G high need group, while the effect for the lower need group is not significant (p value of 0.007 for high need; p value of 0.990 for low need; z = −2.336**). A stronger effect on 5G high need than on low need is found in another path, namely, the 5G promotion-5G perceived value path; although both groups are significantly positive (coefficients = 0.356 for high need; coefficients = 0.236 for low need; p value for both 0.000; z = −2.512**). The other four paths are found to be stronger in users with low 5G need than those with high need: 4G call and text quality-satisfaction, 5G perceived value-intention to use 5G, 5G perceived value-loyalty, and satisfaction-intention to use 5G. Two paths are significantly positive for the 5G low need group, but the effect for the high need group is not significant. These are 4G call and text quality-satisfaction (p value of 0.000 for low need; p value of 0.199 for high need; z = 4.314***), and 5G perceived value-loyalty (p value of 0.004 for low need; p value of 0.973 for high need; z = 2.195**). A stronger effect on 5G low need than on high need appears in 5G perceived value-intention to use 5G, although both groups are significantly positive (coefficients = 0.717 for low need; coefficients = 0.371 for high need; p value for both 0.000; z = 2.883***). Interesting results are found in the satisfaction-intention to use 5G path, whereby the negative effect of satisfaction on intention to use 5G is for the low 5G need group (coefficients = −0.308), but it is non-significant for the high 5G group (coefficients = 0.074).

Table 5
Multi-group analysis: users of high 5G need and low 5G need.

Path	High 5G needs N = 397		Low 5G needs N = 410		z-score
	Estimate	p-value	Estimate	p-value	
H1: LYT→INT	0.169	0.007	0.140	0.043	−0.315
H2a: SAT→LYT	0.561	0.000	0.681	0.000	0.816
H2b: SAT→ INT	0.074	0.497	−0.308	0.002	−2.567**
H3a: PV→ LYT	0.002	0.973	0.233	0.004	2.195**
H3b: PV→ INT	0.371	0.000	0.717	0.000	2.883***
H4a: CI → LYT	0.419	0.000	0.292	0.001	−0.920
H4b: CI → INT	0.109	0.264	0.072	0.432	−0.281
H5a: CI →SAT	0.630	0.000	0.455	0.000	−1.351
H5b: CI → PV	0.328	0.000	0.184	0.050	−1.107
H6a: NC → SAT	0.014	0.865	−0.168	0.060	−1.499
H6b: NC → CI	0.261	0.002	0.158	0.015	−0.962
H6c: NC → PV	−0.074	0.475	0.051	0.491	0.981
H7a: SP → SAT	0.168	0.047	−0.121	0.092	−2.601***
H7b: SP→ CI	0.195	0.029	0.110	0.039	−0.818
H7c: SP→ PV	0.292	0.007	0.001	0.990	−2.336**
H8a: CTQ →SAT	0.078	0.199	0.768	0.000	4.314***
H8b: CTQ→ CI	0.038	0.559	0.189	0.045	1.321
H8c: CTQ→ PV	−0.183	0.020	0.007	0.943	1.457
H9a: PR →SAT	0.058	0.017	0.080	0.011	0.561
H9b: PR → CI	−0.001	0.979	0.048	0.048	1.382
H9c: PR → PV	0.356	0.000	0.236	0.000	−2.512**
H10a: PC →SAT	−0.030	0.274	−0.045	0.221	−0.315
H10b: PC → CI	0.073	0.013	0.054	0.056	−0.457
H10c: PC → PV	−0.039	0.268	−0.114	0.001	−1.515
H11a: MR→SAT	−0.120	0.009	−0.008	0.890	1.459
H11b: MR→ CI	0.423	0.000	0.443	0.000	0.381
H11c: MR→ PV	0.102	0.075	0.097	0.088	−0.057

Notes: (1) Customer Loyalty, LYT; Intention to use 5G, INT; Satisfaction, SAT; 5G Perceived Value, PV; Corporate Image, CI; 4G Network Coverage, NC; 4G Speed, SP; 4G Call and Text Quality, CTQ; 5G Promotion, PR; 5G Perceived Cost, PC; Media Review, MR. (2) *p < 0.1, **p < 0.05, and ***p < 0.01.

5. Discussion and implications

5.1. Summary of findings

This study sheds light on the recent phenomenon of the low penetration rate of 5G usage worldwide. To explore the intention to use 5G, we incorporate 4G network quality, 5G related determinants (i.e., 5G promotion, 5G cost, 5G perceived value), and media reviews to investigate how and why 4G users are loyal to mobile network providers and their intentions to use 5G. The results demonstrate several key findings.

The results show that customer loyalty has a positive effect on intention to use 5G (H1). Although studies have suggested the link between loyalty and continuance intention [29,30] or intention to stay at the same hotel again [31], we extend that linkage into the mobile service provider context. For other factors that may be influencing intention to use 5G, we verify 5G perceived value (H3b) as an important factor, whereas corporate image does not play a role in affecting 5G use intention (H4b). The positive impact of perceived value on intention to upgrade is consistent with the research by Tseng et al. [25]. While corporate image does not directly influence the intention to use 5G, the

positive relationships between corporate image and loyalty as well as between loyalty and the intention to use 5G suggest that corporate image indirectly affects 5G usage intention through its impact on loyalty.

In terms of the antecedents of customer loyalty to a mobile service provider, satisfaction and perceived 5G value exhibit positive impacts on customer loyalty to a mobile service provider, which is consistent with other studies that found support for satisfaction [9–11,14,27] and perceived value [14] on loyalty in the mobile service provider context. Despite the conflicting findings of corporate image on loyalty [11,14,26,27], we find a positive impact of corporate image on loyalty in this study. Among these three antecedents, satisfaction (H2a) has the greatest impact on loyalty, followed by corporate image (H4a) and 5G perceived value (H3a).

We surprisingly see that users' satisfaction with mobile network providers has a negative impact on their intention to use 5G (H2b). Our finding differs from other studies that suggest satisfaction with a company can increase the possibilities to reuse its services in the future [12,34,38]. This unexpected finding indicates that satisfaction with existing service providers may reduce the demand for 5G, leading to a negative intention towards adopting 5G. Nonetheless, the positive effect of satisfaction on loyalty does suggest that satisfied customers will try the next generation of technology (5G) if they are loyal to their mobile service provider. Hence, our study provides evidence on the effect of loyalty on intention to use the next generation of mobile network providers and complements Maeng et al. [22] on their findings of the reasons for customer delay in using 5G.

This study confirms that corporate image positively influences customer satisfaction (H5a), which validates the studies on telecom and mobile services [8,14,15]. Additionally, this study strengthens the evidence for the positive effect of corporate image on perceived value (H5b), which is consistent with earlier findings [14,16]. While other studies have examined the role of service quality on corporate image [11,14,16,26] in the context of mobile service provider, our paper is one of the earliest to present various predicting factors for corporate image. Among these factors, media review has the strongest effect (H11b), followed by network coverage of 4G (H6b) and the speed of 4G (H7b).

The strong effect of media reviews may relate to Alshawawreh et al. [20], who showed that social media and electronic word of mouth have positive impacts on the market performance of telecom companies. However, we diverge from their findings by suggesting that there is a positive influence on a different outcome (i.e., corporate image). The effects of call and text quality of 4G (H8b) and 5G promotion (H9b) on corporate image are non-significant. Our findings are in line with Dey et al. [16], who noted the positive effect of speed and network coverage on brand image. However, our results differ in that we find that both call and text quality have a non-significant effect, which contrasts with their study. Contrary to the hypothesized negative relationship, these results reveal that perceived cost has a significantly positive effect on corporate image (H10b). A possible explanation is that higher perceived cost implies higher quality, which positively relates to an enhanced corporate image.

Regarding the predicting factors of satisfaction, both call and text quality of 4G (H8a) and 5G promotion (H9a) have significantly positive impacts on satisfaction. However, speed and network coverage of 4G (H6a and H7a) and 5G perceived cost (H10a) present no significant effects on satisfaction. Our findings align with Kim et al. [10], who indicated there is a positive impact of call quality on customer satisfaction. However, we differ from their study by testing various dimensions of 4G network quality and 5G factors (i.e., 5G perceived cost and 5G promotion) to identify additional factors that may influence satisfaction with mobile service provider. One surprising finding is the negative impact of media review on satisfaction (H11a). Compared to the positive impact of media reviews on corporate image, a possible explanation for this difference is that highly rated media reviews generally provide a good impression of a company for customers; however, positive media reviews may increase the expectations of those users, thereby resulting in a lower level of satisfaction.

Among the predicting factors of 5G perceived value, 5G promotion (H9c) has the strongest effect, followed by corporate image (H5b) and media review (H11c). The findings are consistent with other studies that have shown that promotion [52], corporate image [14], and ratings and reviews [69] can enhance perceived value in various contexts. Two of the three dimensions of network quality (i.e., network coverage and speed of 4G) are non-significant on 5G perceived value, and the third dimension, call and text quality, is significantly negative on 5G perceived value (H8c). This surprising finding implies that users' experiences of network quality do not impact 5G perceived value much and even negatively relates to that perceived value if they believe call and text quality is already great in 4G. We also find that perceived cost negatively relates to 5G perceived value (H10c). This result connects to the other finding that indicates that perceived high cost negatively relates to users' perceived value [59,60].

These multigroup analyses of the need for 5G indicate different patterns. For customers with a lower 5G need, although satisfaction with their current service provider significantly and negatively relates to their intention to use 5G, perceived value still has a strong positive impact on loyalty and intention to use 5G. For customers with a higher 5G need, satisfaction with their current service provider tends to have a positive impact on their intention to use 5G despite it being non-significant. Moreover, although 4G speed does not impact satisfaction or perceived 5G value in the overall sample, a significantly positive effect appears in the higher 5G need group. It relates to the fact that users actually desire 5G due to its high speed.

5.2. Theoretical implications

Our study adds several theoretical contributions to the field of 5G usage intention and loyalty to mobile network providers. Firstly, this research advances the understanding of brand equity and customer loyalty in the context of mobile services, complementing the studies on brand equity in the realm of technology service [23,24]. Other research has shown different antecedents of customer loyalty for intention to use 5G; however, this study expands the existing view by investigating the consequences (i.e., loyalty and intention to use 5G) from the customer-based equity perspective. To the best of our knowledge, this focus is a new angle used to capture users' perceptions of brand equity (i.e., corporate image, satisfaction, 5G perceived value, customer loyalty) based on the customer experiences of 4G network quality, 5G related factors (i.e., 5G promotion and 5G cost), and media reviews. This study is also among the first to provide evidence on the effects of loyalty on intention to use the next generation of mobile network providers.

Secondly, this study extends the literature of how a previous generation of telecommunications influences the next generation. We differ from the other studies that have emphasized the overall satisfaction with a prior generation of technology [3,25] by further investigating what aspect of such a prior generation may influence the perceived value of the next generation of technology, and how that perception can impact corporate image or satisfaction of a mobile network provider. In addition to the factors of a prior technology generation (i.e., 4G), we incorporate 5G factors (i.e., 5G cost, 5G promotion) and media reviews to deepen the understandings of how users' perceptions of such a prior technology generation (i.e., 4G) may impact the newer generation (i.e., 5G). While this study focuses on mobile service providers, we suggest there are potential research opportunities across broader technological domains. Future studies can explore how the co-existence of user perceptions of a previous generation of technology and the key determinants of newer technologies can shape the adoption of the newer ones.

Lastly, this study investigates the differences between higher and lower 5G needs of 4G users, further complementing Maeng et al. [22], who revealed that a lack of need is one of the reasons to postpone using

5G. For 4G customers with a higher need for 5G, 4G speed is an important factor for customer satisfaction and perceived 5G value for mobile network providers. The negative relationship between satisfaction and intention to use 5G remains significant among 4G customers who have a lower need of 5G. However, for those with a higher need of 5G, the relationship turns positive, although not a statistically significant one. Multigroup analysis further reinforces our argument that a lack of need may contribute to the unexpected negative relationship. However, 5G perceived value has the strongest effect on intention to use 5G, not only for the overall sample, but also across different subsamples. Thus, mobile service providers should enhance customers' perception of 5G value in order to raise their intention to use it.

5.3. Managerial implications

The present study helps practitioners better understand how 4G network quality, 5G factors, and media reviews may influence customer perceptions (i.e., satisfaction, corporate image) and perceived 5G value, and thus in turn, their loyalty and intention to use 5G. Therefore, we propose some specific insights for company managers. The positive relationship between loyalty and the intention to use 5G suggests that managers should focus on maintaining customer loyalty, as loyal customers are more likely to adopt the next generation of mobile technology (i.e., 5G). In addition, our findings indicate that satisfaction, corporate image, and perceived 5G value also all play important roles in influencing customer loyalty. Therefore, company managers should enhance customer experiences and impressions to improve the perceptions of their corporate image, satisfaction, and perceived 5G value, thereby fostering greater loyalty and encouraging 5G adoption.

Of these three dimensions, perceived 5G value is the primary driver of the intention to adopt 5G. For users to consider 5G, the low need group emphasizes the 5G perceived value much more than does the higher need group. Mobile service providers are thus encouraged to prove the value of 5G to customers with lower 5G desire. The unexpected finding of a negative relationship between customer satisfaction and the intention to use 5G still persists among customers with lower 5G needs, but becomes positive, although non-significant, among those with higher 5G needs. This finding supports the notion that satisfied 4G users may be less likely to upgrade to 5G due to having a lower need for 5G. Therefore, company managers should create advertisements that highlight the benefits of 5G while downplaying any potential disadvantages, thereby increasing perceived 5G value and fostering a greater demand for that technology.

To increase perceived 5G value, our results suggest that utilizing 5G promotion, improving corporate image, cultivating positive media reviews, and reducing perceived 5G expenses can enhance customer perception of 5G value. Promotion of 5G and corporate image also positively influences customer satisfaction with their current mobile service provider. Company managers are encouraged to provide trials at no charge or at a reduced price for a short period of time, thereby allowing users to personally experience the advantage of 5G before formally purchasing it. This approach, through the use of discounts or lowering perceived cost, can increase customers' perceived value of 5G. Since media reviews can also enhance perceived value and strengthen corporate image, managers should collaborate with tech experts on social media to showcase the benefits of 5G and demonstrate how these benefits can improve users' daily lives. Additionally, corporations can highlight their company's innovation strategies and the reliability of its technology through award-winning achievements. Still, media reviews should be used with caution, as customers may become dissatisfied with the company if their experience does not align fully with the expectations set by those reviews.

Our analysis of the relationship between 4G network quality (i.e., network coverage, speed, call and text quality) and perceived 5G value, satisfaction, and corporate image reveals that 4G network coverage and speed can positively relate to corporate image, but does not impact satisfaction or perceived 5G value. Conversely, 4G call and text quality positively relates to satisfaction, has no effect on corporate image, and does negatively impact perceived 5G value. Therefore, these results imply that customers' reluctance to transition to 5G likely relates to their satisfaction with their current call and text quality, which may even lead to negative perceptions toward switching to 5G. Mobile service providers should focus on improving their infrastructure quality and reassuring customers that they can expect enhanced call and text quality with 5G. Although the role of speed on 5G perceived value is not evident in the overall example, for users with a higher need of 5G, 4G speed is the strongest indicator that is positively affecting all three dimensions. Therefore, for higher need users, emphasizing the speed advantage of 5G and improving the infrastructure to enhance their 5G experience would be more effective.

5.4. Limitations and future research

This study has several limitations that indicate new directions for future research. First, our study targets 4G users to explore their slow intention to upgrade to 5G technology and how customer loyalty to a mobile network provider impacts their adoption of 5G. Future studies are thus encouraged to capture insights from 5G users, as this group largely represents early adopters of new mobile technology. Researchers may also apply our research model to examine other user behaviors (e.g., purchase intention or switching intention) to gain a more comprehensive understanding of these adoption-related intentions. Second, our findings may be biased, as the age and occupation of the participants were concentrated around younger generations (i.e., students or employees). This occupational skewness may have resulted in a sample that does not fully capture the varied economic and social factors that are influencing 5G adoption among different employment statuses. We recommend that future research includes a broader range of age groups and employment statuses to gain a more comprehensive understanding of this phenomenon. Third, our findings used a self-reported survey that may have been influenced by self-selection where respondents who are more conversant with or inclined toward 5G or advanced technologies may have been overemphasized. This implies that further research should include additional constructs (e.g. personal innovativeness or technology readiness) to investigate the differences between a higher or lower level of technology proficiency or consider utilizing alternative methods to ensure sample representativeness. Finally, our study revolves around the context of Taiwanese 4G customers. Thus, caution is also suggested when generalizing these results to a broader spectrum of society.

CRediT authorship contribution statement

Hsiao-Han Lu: Writing – review & editing, Writing – original draft, Methodology, Formal analysis, Conceptualization. **Shi-Fen Huang:** Writing – original draft, Methodology, Investigation, Formal analysis.

Appendix

Network Coverage (NC)

NC1. I have good network coverage everywhere I go with my current 4G mobile service provider.

NC2. I have good indoor network coverage with my current 4G mobile service provider.

NC3. I have reliable network coverage with my current 4G mobile service provider.

Speed (SP)

SP1. I have fast Internet browsing speeds (e.g., loading web pages)

with my current 4G mobile service provider.

SP2. I have fast Internet download speeds (e.g., streaming videos or music) with my current 4G mobile service provider.

SP3. I have fast Internet upload speeds (e.g., how fast can I upload files to the cloud) with my current 4G mobile service provider.

Call and Text Quality (CTQ)

CTQ1. I have good call quality with my current 4G mobile service provider.

CTQ2. I do not experience dropped calls (i.e., calls that unexpectedly hang up) with my current 4G mobile service provider.

CTQ3. I do not experience problems sending and receiving text messages with my current 4G mobile service provider.

5G Promotion (PRO)

PRO1. My current 4G mobile service provider frequently offers price discounts.

PRO2. My current 4G mobile service provider often uses price discounts.

PRO3. My current 4G mobile service provider uses price discounts more frequently than other mobile service providers.

5G Perceived Cost (PC)

PC1. I fear that the cost of 5G is going to be way over my budget.

PC2. I consider cost carefully before I use 5G.

PC3. I think that the economic aspects of using 5G are a burden to me.

Media Reviews (MR)

MR1. Based on media reviews, reviews of my current 4G mobile service provider are found to be favorable by other audiences.

MR2. Based on media reviews, reviews of my current 4G mobile service provider are highly rated by other audiences.

MR3. Based on media reviews, reviews of my current 4G mobile service provider are good.

Customer Satisfaction (SAT)

SAT1. The decision to contract with my current 4G mobile service provider was wise.

SAT2. I am very satisfied with my current 4G mobile service provider.

SAT3. My current 4G mobile service provider gives me what I expect from a mobile service provider.

SAT4. My current 4G mobile service provider has so far satisfied my expectations.

Corporate Image (CI)

CI1. I have a good image about my current 4G mobile service provider.

CI2. My current 4G mobile service provider has a good image among consumers.

CI3. My current 4G mobile service provider is reliable and trustworthy.

CI4. My current 4G mobile service provider has a good image versus other mobile service providers.

5G Perceived Value (PV)

PV1. There are greater benefits than disadvantages of using 5G.

PV2. Considering the cost, risk, and benefits, I think it is valuable to use 5G.

PV3. The use of 5G delivers a satisfactory experience.

PV4. Overall, the use of 5G provides me with good value.

Customer Loyalty (LTY)

LTY1. If I had to contract again, I would choose my current 4G mobile service provider.

LTY2. I consider myself loyal to my current 4G mobile service provider.

Intention to Use 5G (INT)

INT1. I plan to use 5G from my current 4G mobile service provider in the future.

INT2. I will purchase 5G from my current 4G mobile service provider in the future.

INT3. I will use 5G from my current 4G mobile service provider in the future.

Data availability

Data will be made available on request.

References

[1] S.K. Shah, T. Zhongjun, Elaborating on the consumer's intention–behavior gap regarding 5G technology: the moderating role of the product market-creation ability, Technol. Soc. 66 (2021) 101657.
[2] M. Akbari, A. Rezvani, E. Shahriari, M.A. Zuniga, H. Pouladian, Acceptance of 5G technology: mediation role of trust and concentration, J. Eng. Technol. Manag. 57 (2020) 101585.
[3] M. Akbari, A. Rezvani, M.A. Zuniga, E. Shahriari, How the theory of planned behaviour and flow theory contribute to the acceptance of 5G technology, Eur. J. Int. Manag. 18 (4) (2022) 518–545.
[4] L.-K. Cheng, H.-L. Huang, S.-Y. Yang, Attitude toward 5G: the moderating effect of regulatory focus, Technol. Soc. 67 (2021) 101795.
[5] S.K. Shah, Z.J. Tang, A. Sattar, X.H. Zhou, Consumer's intention to purchase 5G: do environmental awareness, environmental knowledge and health consciousness attitude matter? Technol. Soc. 65 (2021) 101563.
[6] Ericsson Mobility Report, 5G mobile subscriptions to reach close to 5.6 billion in 2029. https://www.ericsson.com/en/reports-and-papers/mobility-report/dataforecasts/mobile-subscriptions-outlook, 2024.
[7] C. Calvo-Porral, A. Faina-Medin, M. Nieto-Mengotti, Satisfaction and switching intention in mobile services: comparing lock-in and free contracts in the Spanish market, Telematics Inf. 34 (5) (2017) 717–729.
[8] A.H. Chen, Y.B. Lu, S. Gupta, X.L. Qi, Can customer satisfaction and dissatisfaction coexist? An issue of telecommunication service in China, J. Inf. Technol. 29 (3) (2014) 237–252.
[9] W. Jung, Y. Kwon, Differences between LTE and 3G service customers: business and policy implications, Telematics Inf. 32 (4) (2015) 667–680.
[10] M.K. Kim, M.C. Park, D.H. Jeong, The effects of customer satisfaction and switching barrier on customer loyalty in Korean mobile telecommunication services, Telecommun. Pol. 28 (2) (2004) 145–159.
[11] K.S. Ofori, K. Boakye, B. Narteh, Factors influencing consumer loyalty towards 3G mobile data service providers: evidence from Ghana, Total Qual. Manag. Bus. Excel. 29 (5–6) (2018) 580–598.
[12] O. Turel, A. Serenko, Satisfaction with mobile services in Canada: an empirical investigation, Telecommun. Pol. 30 (5–6) (2006) 314–331.
[13] Y. Wang, H.-P. Lo, Y. Yang, An integrated framework for service quality, customer value, satisfaction: evidence from China's telecommunication industry, Inf. Syst. Front 6 (2004) 325–340.
[14] F.J. Lai, M. Griffin, B.J. Babin, How quality, value, image, and satisfaction create loyalty at a Chinese telecom, J. Bus. Res. 62 (10) (2009) 980–986.
[15] C. Calvo-Porral, J.-P. Lévy-Mangin, Switching behavior and customer satisfaction in mobile services: analyzing virtual and traditional operators, Comput. Hum. Behav. 49 (2015) 532–540.
[16] B.L. Dey, W. Al-Karaghouli, S. Minov, M.M. Babu, A. Ayios, S.S. Mahammad, B. Binsardi, The role of speed on customer satisfaction and switching intention: a study of the UK mobile telecom market, Inf. Syst. Manag. 37 (1) (2020) 2–15.
[17] D.A. Aaker, Measuring brand equity across products and markets, Calif. Manag. Rev. 38 (3) (1996) 102–120.
[18] K.L. Keller, Conceptualizing, measuring, and managing customer-based brand equity, J. Market. 57 (1) (1993) 1–22.
[19] M.I. El-Adly, A.A. Elsamen, Guest-based hotel equity: scale development and validation, J. Prod. Brand Manag. 27 (6) (2018) 615–633.

[20] A.R. Alshawawreh, F. Liebana-Cabanillas, F.J. Blanco-Encomienda, Impact of big data analytics on telecom companies' competitive advantage, Technol. Soc. 76 (2024) 102459.
[21] U. Chakraborty, The impact of source credible online reviews on purchase intention: the mediating roles of brand equity dimensions, J. Res. Indian Med. 13 (2) (2019) 142–161.
[22] K. Maeng, J. Kim, J. Shin, Demand forecasting for the 5G service market considering consumer preference and purchase delay behavior, Telematics Inf. 47 (12) (2020) 101327.
[23] M. Šeric, I. Gil-Saura, A. Mollá-Descals, Can advanced technology affect customer-based brand equity in service firms? An empirical study in upscale hotels, Journal of Service theory and Practice 26 (1) (2016) 2–27.
[24] X. Xu, J.Y.L. Thong, V. Venkatesh, Effects of ICT service innovation and complementary strategies on brand equity and customer loyalty in a consumer technology market, Inf. Syst. Res. 25 (4) (2014) 710–729.
[25] F.M. Tseng, H.Y. Lo, Antecedents of consumers' intentions to upgrade their mobile phones, Telecommun. Pol. 35 (1) (2011) 74–86.
[26] S. Aydin, G. Özer, The analysis of antecedents of customer loyalty in the Turkish mobile telecommunication market, Eur. J. Market. 39 (7–6) (2005) 910–925.
[27] T.J. Gerpott, W. Rams, A. Schindler, Customer retention, loyalty, and satisfaction in the German mobile cellular telecommunications market, Telecommun. Pol. 25 (4) (2001) 249–269.
[28] J.J. Cambra-Fierro, M. Fuentes-Blasco, R. Huerta-Alvarez, A. Olavarría, Customer-based brand equity and customer engagement in experiential services: insights from an emerging economy, Service Business 15 (3) (2021) 467–491.
[29] R. Ramadan, J. Aita, A model of mobile payment usage among Arab consumers, Int. J. Bank Market. 36 (7) (2018) 1213–1234.
[30] S. Shahid, J. Ul Islam, S. Malik, U. Hasan, Examining consumer experience in using m-banking apps: a study of its antecedents and outcomes, J. Retailing Consum. Serv. 65 (2022) 102870.
[31] U. Ramanathan, R. Ramanathan, Investigating the impact of resource capabilities on customer loyalty: a structural equation approach for the UK hotels using online ratings, J. Serv. Market. 27 (5) (2013) 404–415.
[32] R. Filieri, W.S. Chen, B.L. Dey, The importance of enhancing, maintaining and saving face in smartphone repurchase intentions of Chinese early adopters: an exploratory study, Inf. Technol. People 30 (3) (2017) 629–652.
[33] K.C. Anderson, D.K. Knight, S. Pookulangara, B. Josiam, Influence of hedonic and utilitarian motivations on retailer loyalty and purchase intention: a Facebook perspective, J. Retailing Consum. Serv. 21 (5) (2014) 773–779.
[34] C.T. Liu, Y.M. Guo, C.H. Lee, The effects of relationship quality and switching barriers on customer loyalty, Int. J. Inf. Manag. 31 (1) (2011) 71–79.
[35] T. Natarajan, S.A. Balasubramanian, D.L. Kasilingam, Understanding the intention to use mobile shopping applications and its influence on price sensitivity, J. Retailing Consum. Serv. 37 (2017) 8–22.
[36] T. Natarajan, S.A. Balasubramanian, D.L. Kasilingam, The moderating role of device type and age of users on the intention to use mobile shopping applications, Technol. Soc. 53 (2018) 79–90.
[37] A.S. Al-Adwan, M.M. Al-Debei, Y.K. Dwivedi, E-commerce in high uncertainty avoidance cultures: the driving forces of repurchase and word-of-mouth intentions, Technol. Soc. 71 (2022) 102083.
[38] J.-S.C. Lin, P.-L. Hsieh, The influence of technology readiness on satisfaction and behavioral intentions toward self-service technologies, Comput. Hum. Behav. 23 (3) (2007) 1597–1615.
[39] V.A. Zeithaml, Consumer perceptions of price, quality, and value: a means-end model and synthesis of evidence, J. Market. 52 (3) (1988) 2–22.
[40] C.F. Chen, L.T. Cheng, A study on mobile phone service loyalty in Taiwan, Total Qual. Manag. Bus. Excel. 23 (7–8) (2012) 807–819.
[41] C.C. Chang, Exploring mobile application customer loyalty: the moderating effect of use contexts, Telecommun. Pol. 39 (8) (2015) 678–690.
[42] M.M. Al-Debei, Y.K. Dwivedi, O. Hujran, Why would telecom customers continue to use mobile value-added services? Journal of Innovation & Knowledge 7 (4) (2022) 100242.
[43] J.W. Lian, J. Li, The dimensions of trust: an investigation of mobile payment services in Taiwan, Technol. Soc. 67 (2021) 101753.
[44] H. Barich, P. Kotler, A framework for marketing image management, MIT Sloan Manag. Rev. 32 (2) (1991) 94–104.
[45] Z.H. Deng, Y.B. Lu, K.K. Wei, J.L. Zhang, Understanding customer satisfaction and loyalty: an empirical study of mobile instant messages in China, Int. J. Inf. Manag. 30 (4) (2010) 289–300.
[46] Y.F. Chuang, Pull-and-suck effects in Taiwan mobile phone subscribers switching intentions, Telecommun. Pol. 35 (2) (2011) 128–140.
[47] S.S. Srinivasan, R.E. Anderson, Concepts and strategy guidelines for designing value enhancing sales promotions, J. Prod. Brand Manag. 7 (5) (1998) 410–420.
[48] X.J. Lim, J.H. Cheah, S.I. Ng, N.K. Basha, G. Soutar, The effects of anthropomorphism presence and the marketing mix have on retail app continuance use intention, Technol. Forecast. Soc. Change 168 (2021) 120763.
[49] C.M. Chen, H.M. Liu, The moderating effect of competitive status on the relationship between customer satisfaction and retention, Total Qual. Manag. Bus. Excel. 30 (7–8) (2019) 721–744.
[50] I. Buil, L. De Chernatony, E. Martínez, Examining the role of advertising and sales promotions in brand equity creation, J. Bus. Res. 66 (1) (2013) 115–122.
[51] B. Alvarez Alvarez, R. Vázquez Casielles, Consumer evaluations of sales promotion: the effect on brand choice, Eur. J. Market. 39 (1/2) (2005) 54–70.
[52] M. Bues, M. Steiner, M. Stafflage, M. Krafft, How mobile in-store advertising influences purchase intention: value drivers and mediating effects from a consumer perspective, Psychol. Market. 34 (2) (2017) 157–174.
[53] J.K. Hsieh, The effects of transforming mobile services into mobile promotions, J. Bus. Res. 121 (2020) 195–208.
[54] C.C. Yin, Y.C. Tang, Y.C. Hsieh, H.C. Chiu, S.J. Jhu, Find me here: share store information through check-in, J. Res. Indian Med. 16 (2) (2022) 259–276.
[55] E. Moriuchi, I. Takahashi, An empirical investigation of the factors motivating Japanese repeat consumers to review their shopping experiences, J. Bus. Res. 82 (2018) 381–390.
[56] S.H. Hsieh, C.T. Lee, Values that drive desire: examining determinants of mobile promotion satisfaction, Int. J. Retail Distrib. Manag. 50 (12) (2022) 1458–1474.
[57] Y. Jang, E. Park, An adoption model for virtual reality games: the roles of presence and enjoyment, Telematics Inf. 42 (2019) 101239.
[58] S. Nikou, Factors driving the adoption of smart home technology: an empirical assessment, Telematics Inf. 45 (12) (2019) 101283.
[59] K.Y. Lin, Y.T. Wang, T.K. Huang, Exploring the antecedents of mobile payment service usage: perspectives based on cost-benefit theory, perceived value, and social influences, Online Inf. Rev. 44 (1) (2020) 299–318.
[60] Y.Y. Wang, H.H. Lin, Y.S. Wang, Y.W. Shih, S.T. Wang, What drives users' intentions to purchase a GPS Navigation app the moderating role of perceived availability of free substitutes, Internet Res. 28 (1) (2018) 251–274.
[61] J. Park, H. Le, A shared-transportation mobile app continuance model: the moderating effects of brand awareness, J. Consum. Behav. 22 (2) (2023) 496–510.
[62] M. Talwar, S. Talwar, P. Kaur, A. Islam, A. Dhir, Positive and negative word of mouth (WOM) are not necessarily opposites: a reappraisal using the dual factor theory, J. Retailing Consum. Serv. 63 (2021) 102396.
[63] X.P. Shi, Z.Q. Liao, Online consumer review and group-buying participation: the mediating effects of consumer beliefs, Telematics Inf. 34 (5) (2017) 605–617.
[64] M.Y. Cheung, C. Luo, C.L. Sia, H. Chen, Credibility of electronic word-of-mouth: informational and normative determinants of on-line consumer recommendations, Int. J. Electron. Commer. 13 (4) (2009) 9–38.
[65] W.H. Shi, L.S. Tang, X.H. Zhang, Y. Gao, Y.M. Zhu, How does word of mouth affect customer satisfaction? J. Bus. Ind. Market. 31 (3) (2016) 393–403.
[66] H.W. Kim, A. Kankanhalli, H.L. Lee, Investigating decision factors in mobile application purchase: a mixed-methods approach, Inf. Manag. 53 (6) (2016) 727–739.
[67] A.A. Alalwan, Mobile food ordering apps: an empirical study of the factors affecting customer e-satisfaction and continued intention to reuse, Int. J. Inf. Manag. 50 (2020) 28–44.
[68] A.L. Coves-Martinez, C.M. Sabiote-Ortiz, D.M. Frias-Jamilena, How to improve travel-app use continuance: the moderating role of culture, Tourism Manag. Perspect. 45 (2023) 101070.
[69] C.-C. Chen, Y.-C. Chang, What drives purchase intention on Airbnb? Perspectives of consumer reviews, information quality, and media richness, Telematics Inf. 35 (5) (2018) 1512–1523.
[70] B. Hu, Y.-l. Liu, W. Yan, Should I scan my face? The influence of perceived value and trust on Chinese users' intention to use facial recognition payment, Telematics Inf. 78 (2023) 101951.
[71] R. de Kervenoael, R. Hasan, A. Schwob, E. Goh, Leveraging human-robot interaction in hospitality services: incorporating the role of perceived value, empathy, and information sharing into visitors' intentions to use social robots, Tourism Manag. 78 (2020) 104042.
[72] J. Lee, J. Kim, J.Y. Choi, The adoption of virtual reality devices: the technology acceptance model integrating enjoyment, social interaction, and strength of the social ties, Telematics Inf. 39 (2019) 37–48.
[73] J.C. Anderson, D.W. Gerbing, Structural equation modeling in practice: a review and recommended two-step approach, Psychol. Bull. 103 (3) (1988) 411–423.
[74] J.F. Hair, W.C. Black, A. Babin, R.E. Anderson, Multivariate Data Analysis, Global Edition (seventh ed., Pearson Education, 2010.
[75] C. Fornell, D.F. Larcker, Evaluating structural equation models with unobservable variables and measurement error, J. Market. Res. 18 (1) (1981) 39–50.
[76] P.M. Podsakoff, S.B. MacKenzie, J.Y. Lee, N.P. Podsakoff, Common method biases in behavioral research: a critical review of the literature and recommended remedies, J. Appl. Psychol. 88 (5) (2003) 879–903.