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A two-phase confirmatory factor analysis and structural equation modelling for customer-based brand equity framework in the smartphone industry

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ABSTRACT

The emergence of smartphones has brought a transformative change in the smartphone industry in terms of technological innovations and business decision-making dynamics. Smartphones have appeared in the market as the standard configuration and currently represent the fastest-growing market segment in the telecommunications industry. It is considered a highly involved product that is relevant and important to the buyer due to its daily use and multiple functionalities. With this growth in smartphone use, the market has been more competitive with the emergence of new brands leading to a wide range of brand selection opportunities for customers. Therefore, there is a need for smartphone companies to understand customers' brand equity before implementing strategic decision-making to promote their brands. This paper introduces a conceptual framework based on the theoretical framework of Keller and Aakar's Customer-Based Brand Equity (CBBE) models. This conceptual framework consists of nine constructs organised into three layers: marketing programs, brand equity dimensions, and brand equity. The framework has been validated using a quantitative survey of Nepalese smartphone users in two phases. In the first phase, Exploratory Factor Analysis (EFA) has been performed to measure the reliability of the constructs and the Factor Loading (FL) of the scales under each construct of the proposed framework. In the second phase, the survey questionnaire has been revised based on the analytical results of the first phase, and the full-phase survey has been conducted. The full-scale survey data has been analysed using Confirmatory Factor Analysis (CFA). Hence, the relationship between the constructs has been measured using Structural Equation Modelling (SEM) for the proposed framework. This proposed framework has focused on different strategic decision-making constraints of smartphone marketing, which decision-makers can utilise to develop market policies and other business decisions. The results have indicated that the Product Features (PF) have an important role in creating positive Perceived Quality (PQ) if the promotion has been made to create Brand Awareness (BA). Positive PQ helps in enhancing Brand Image (BI). Marketers need to focus on creating positive Brand Preference (BP), as BI is not sufficient in creating Brand Loyalty (BL) and Brand Repurchase (BR).

1. Introduction

The smartphone industry has shown tremendous growth and development in the last three decades. In recent years, the popularity of smartphones has had exceptional growth due to their multiple functionalities and applications [1]. The smartphone market has become more competitive with innovative technologies, constant product introduction, short product life cycles, aggressive pricing, and highly price-sensitive consumers [2]. The increased competition entails major advantages for the customer: increased choice, greater value for the money, and augmented levels of service [3]. On the other hand, in the competitive and shifting market environment with an abundance of new brands, smartphone makers have to redefine and reinforce their brand equity in order to enable customers to distinguish their smartphones from their competitors. Hence, the strong competitiveness of the brand has been more important and the need for effective marketing strategies is evident. In this context, a well-defined brand equity framework in the smartphone business is an essential prerequisite to thrive and survive in a rapidly growing global market. The importance of brand equity in various industries in terms of marketing and business management has been addressed by both academics and practitioners. But, the role of brand equity in the smartphone industry is still sparse and requires more attention from business decision-making. This will contribute to assess critical factors [4] and aggregate information in the smartphones industry [5].

In order to understand how consumers evaluate brands, decision-makers, and policymakers need a comprehensive understanding of

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brand equity. Hence, this study proposes to acquire a better knowledge of brand equity in the smartphones industry. The main objective of this study is to develop a better understanding of the formation of brand equity in smartphones. This study explores Customer-Based Brand Equity (CBBE) in the smartphone industry and conceptualise the brand equity model in smartphones based on models proposed by [6–8]. Although several studies have identified the important components of brand equity in other industries, however a comprehensive understanding of brand equity formation in the smartphone industry is rare. In this study, we have made contributions in the following areas. First, a conceptual framework has been proposed based on the product and promotion component of the marketing mix and brand equity parameters. Next, the survey data have been collected and analysed using Confirmatory Factor Analysis (CFA), and the relationship between the constructs has been measured using Structural Equation Modelling (SEM) for the validation of the proposed framework. The study found that smartphone brand equity consists of marketing programs and brand equity parameters with nine interrelated marketing and brand equity attributes. On these findings, we introduce a framework for CBBE for smartphones. This study contributes to understanding smartphone marketing strategies among researchers, practitioners, and decision makers on how consumers evaluate smartphone brands. In addition, this study also contributes to examining the effect of marketing programs on brand equity dimensions and subsequently, brand equity in smartphones using a comprehensive framework of CBBE. More specifically, the research identifies the effect of Product Features (PF) of smartphones and promotions on Brand Awareness (BA), Perceived Quality (PQ), and Perceived Value (PV) and subsequently the effect of BA, PQ and PV on Brand Image (BI). Finally, the effect of BI on Brand Preference (BP), Brand Loyalty (BL), and Brand Repurchase (BR) is measured. The findings from survey analysis showed that PF plays an important role in creating a positive PQ if the promotion has been made to create BA. PQ helps to enhance BI and marketers need to focus on creating positive BP as BI is not sufficient in creating BL and BR.

The paper is organised as follows: A brief literature on related work is presented in Section 2 which is followed by the proposed framework in Section 3. Section 4 describes the research design, research instruments, research hypothesis, sampling approach, and statistical methods used for the analysis. Section 5 present the results of different statistical analysis to address research objectives. Finally, Section 6 presents the conclusions of the study. The abbreviations used in this manuscript are presented in Appendix A: Table A.1.

2. Related works

In this section, we present a brief review of related works followed by the operationalisation of variables for the study based on the literature review. Over the years, a substantial number of research have been conducted on brand equity, and smartphones marketing, mostly dealing with different facets of consumers' behaviour and attitudes towards smartphones marketing. Pour and Kazemi [9] have argued that one of the major challenges in smartphones marketing is the management of smartphones brands and their equity. Their findings have shown that among the different factors of brand equity, ease of use and product information on quality have the higher priority in smartphones branding. A similar study conducted by Ramli et al. [10] suggested that BA has a positive impact on user intention, and it also facilitates PQ and BI in smartphones marketing. Brand equity relates to the fact that there appear different interrelated and continuous marketing outcomes of a product or service [8,11]. In other words, brand equity refers to the incremental utility or value added to a product by its brand name. Yoo et al. [12] articulated related issues on brand equity to bring the positive effect of brand equity with different aspects such as the company's future profits, long-term cash flow, customer willingness to pay premium prices, merger and acquisition decision-making, stock prices, sustainable competitive advantage, and marketing success.

Brand equity can be defined in many contexts. As cited in [13], the main contexts include the added value endowed by the brand name; BL, BA, PQ, and brand association [14]; differential effect of brand knowledge on consumer response to the marketing of the brand [8]; total utility; and the difference between overall BP and multi-attributed preference based on objectively measured attribute level [15]. Financial brand equity is based on the incremental discounted future cash flows that result from a branded product's revenue over the revenue of an unbranded product. On the other hand, CBBE is defined as the differential effect of brand knowledge on a customer's response to the marketing of the brand. The combined perspective incorporates both financial brand equity and CBBE. CBBE provides a unique point of view as to what brand equity is and how it should best be built, measured, and managed. The basic premise of the CBBE model is that the power of a brand lies in what customers have learned, felt, seen, and heard about the brand as a result of their experiences over time.

Decision-makers want to enhance brand equity in the long term for strategic business planning [16]. To archive this, decision-makers have challenges in building a strong brand in ensuring that customers have the right type of experiences with products and services and their accompanying marketing programs so that the desired thoughts, feelings, images, beliefs, perceptions, opinions, and so on become linked to the brand [11]. A brand is said to have positive CBBE when consumers react more favourably to a product and the way it is marketed when the brand is identified than when it is not. Thus, a brand with positive CBBE might result in consumers being more accepting of a new brand extension, less sensitive to price increases and withdrawal of advertising support, or more willing to seek the brand in a new distribution channel. Chen and Tseng [13] operationalised CBBE into two categories: consumer perception and customer behaviour. Consumer-based brand equity means a measurement of perceptual and/or behavioural brand equity at the individual consumer level through a consumer survey. Although some researchers have defined CBBE based on physical experience to maximise consumers' experiential value [17]. Collectively, brand equity consists of four dimensions: BA, PQ, BI, and BL [18].

2.1. Operationalisation of variables

In this section, we define different types of latent variables and their attributes that have been considered during the study.

2.1.1. Product features (PF)

PF is also called brand quality or brand attitudes and is defined as consumers' overall evaluation of the brand. Brand attitudes are important because they often form the basis for actions and behaviour that consumers take with the brand and play a crucial role in consumers' purchase decisions [19]. Consumers' brand attitudes generally depend on specific considerations concerning the attributes and benefits of the brand [11]. Attributes are those descriptive features that characterise a product or service — what a consumer thinks the product or service is or has and what is involved with its purchase or consumption. Product-related attributes are defined as the ingredients necessary for performing the product function sought by consumers [8]. Smartphones devices come with different user-friendly interactive features that enable smartphones to communicate with users in a more personalised way. Tango et al. [20] explored the impact of smartphones features on branding smartphones. In their findings, it has been highlighted that relatively small screen sizes and privacy concerns are among the major features to attract users. This research has also claimed that friendly design has also impacted the marketing of smartphones.

Kauffman et al. [21] applied natural language processing with sentiment analysis for feature-based marketing decision-making. They have evaluated smartphones' main features by collecting customer feedback on different PF and hence have applied data mining that has allowed them to generate positive and negative PF. Their analytical results have shown that the screen, camera, platform, signal,

processor, and keypad falls under the positive features of smartphones whereas the battery falls under the negative features. Lucerit et al. [22] have presented survey-based findings that have shown that smartphones marketing is influenced by the progression of technological inventions-based features resulting in the enhancement in the functionality and user-friendly suitability of smartphones devices. Similarly, Salim [23] has presented a survey-based finding where it has appeared that user experience on smartphones features such as memory capacity, camera quality, and easiness of smartphone portability have a significant impact on smartphones use. Kiran and Jebakumar [24] study has shown that the features of smartphones processing capacity, camera specifications, battery life, screen size, and device thickness defines the smartphones marketing strategy and hence the price of the smartphones.

2.1.2. Promotions

Promotion consists of a number of varieties of tools in marketing such as sales promotion, advertising, and unpaid promotion like word of mouth. Sales promotion consists of a set of various, different, and short-period motive tools that are used for consumers' or buyers' provocation to buy more and faster [25]. Promotion is any paid form of non-personal presentation and campaigning of ideas, goods, and services. Among components of the marketing integrated promotional model, advertising has a more identified position than the other marketing components, because customers are informed of new products through advertising. In other words, promotion is a part of marketing strategies that are designed and delivered through personalised channels such as advertisement, SMS (short message service), and push notifications depending upon customer location, environment, and time [20]. According to Todorova [26], business marketing is the combination of product, place, price, and promotion where promotion is the need for developing durable sales. The advertising messages highlight the product's quality for the promotion connect with the customers effectively and instantly. Any effective marketing promotion relies on advertising, direct marketing, personal and public relations, benefits, and services to the customers. Faulds et al. [27] have argued that interaction with users through multiple promotional features such as coupons and bypassing the time-consuming checkout queue are among the tactics that need to be adopted in the marketing strategy.

2.1.3. Brand awareness (BA)

BA is "the ability for a buyer to recognise or recall that a brand is a member of a certain product category" [6] and consists of both brand recognition and recall [8]. BA is expected to be a crucial moderator [28] and relates to consumers' ability to retrieve the brand from memory when given the product category, the needs fulfilled by the category, or a purchase or usage situation as a cue [11]. BA is argued as being a first and necessary, but not sufficient, step leading to trial and repeat purchases because of the effect of awareness resulting at best in product curiosity [13]. Customer behaviour has significant importance on the perception of BA as BA is the most imperative component of brand equity [29] BA is a central dimension of brand equity and is typically defined as the capability of customers to distinguish and recall a brand [30]. Jocevski [31] has argued that while presenting a new product, sellers should be specified a time slot to organise any form of a customer-engaging event at a prime location within the city to raise BA. These events give opportunities to grow BA among customers. Makrides et al. [32] have mentioned that a digital relationship initiates customer interaction more effectively and hence increases BA. Digital marketing strategies can influence a company to use digital media to enhance BA to reach wider consumers.

2.1.4. Perceived quality (PQ)

PQ has been widely agreed to be a vital element affecting consumer behaviour [13]. PQ has been defined as customers' perception of the overall quality or superiority of a product or service relative to relevant alternatives and with respect to its intended purpose. It is the global assessment based on consumer perceptions of what constitutes a quality product and how well the brand rates on those dimensions [11]. The PQ or consumer's overall obligation and satisfaction with smartphones is another brand equity dimension that helps in smartphones marketing. PQ is not the concrete quality of the smartphones as it differs from customer to customer since the individual customer is different in making verdicts about the quality of a smartphones [33]. PQ is often appearing as a subjective feeling which is based on customers' product knowledge and experience [34]. PQ is impacted by several factors such as demographics, cognitive feeling, psychographics, and affective factors. In addition, the PQ can also be influenced by some external factors such as marketing and social activities. Yoo [35] study has shown that the PQ has the capacity to positively influence the customer to have product satisfaction, which eventually positively influences customers' loyalty. Gallart-Camahort et al. [36] study has shown that PQ brings a positive and significant influence on customer's intention on purchasing a smartphones device.

2.1.5. Perceived value (PV)

The primary goal of a marketer is to enhance target customers' willingness to purchase products. According to Agrawal and Teas [37], two independent streams have emerged in the customers' willingness to purchase. One stream purport that customers purchase products that offer them the greatest PV, whereas the other purports that customers purchase products that pose the least amount of risks. The first stream suggests that consumers use extrinsic cues (such as price, brand name, and store name) to form perceptions of product quality or benefits and perceptions of monetary sacrifice or costs which, in turn, lead them to form perceptions of value. The second stream of research suggests that consumers use extrinsic cues such as price, manufacturer reputation, and warranty to form perceptions of risks, which, in turn, lead them to form perceptions of value. In general, PV brings up customers' judgment or evaluation of a product or service. PV is a particular brand evaluation that customers can perform [38]. Brand reputation is therefore expected to strengthen the effects of customer engagement and customer-PV on customer-brand relationship strength. Customer-PV mediates the effect of customer engagement on customer-brand relationship strength. PV also reveals how much a customer is willing to pay for a product. The study presented by Huang [39] has shown that the PV has significantly impacted mediating the customers' role in the ease-of-use mechanism on the BI. The study performed by Abubakar and Bashir [40] has illustrated that the PV has pointedly related to customers' loyalty towards any branding portfolio.

2.1.6. Brand image (BI)

BI, another component of marketing, is the customer perception of any brand. It refers to how customers remark about individuals' experience with the product. BI, an essential element in marketing research is defined as perceptions about a brand as reflected by the brand associations held in consumer's memory [8]. A positive BI creates a strong, favourable, and unique association which has important implications for building brand equity. The definition of CBBE does not distinguish between the source of brand associations and the way they are formed; all that matters is the resulting favorability, strength, and uniqueness of brand associations [8]. This realisation has important implications for building brand equity. According to Antata et al. [41], developing a positive BI is crucial for any company as without an impactful BI, it is very hard to appeal to new consumers as well as to hold old consumers who have used or bought the product earlier. With the spread of different brands in the consumer market, consumers are making buying decisions mostly based on the BI instead of the product [42]. Furthermore, whenever any BI is reliable and persistent, consumers have preferences for using the product for a longer period. A BI can appear in different forms such as company name, product name,

Table 1
Variables for the proposed study.

Variables (Latent)	Attributes (Observed)
Product Features (PF) [11,20–24]	RAM, processor, ROM, display size, screen resolution, battery capacity, front camera and rear camera
Promotion [20,25–27]	Advertise campaign, friend relative referral and consumer offer
Brand Awareness (BA) [6,8,11,13,29–32]	Highly recognised, brand aware and heard a lot on brand
Perceived Quality (PQ) [11,13,33–36]	Good quality, excellent features and reliable
Perceived Value (PV) [37–40]	Good Purchase Decision, Good Value for Money and Worth For Money
Brand Image (BI) [8,41–44]	Brand pride, brand trust and brand credibility
Brand Preference (BP) [45–49]	Prefer the brand, better than another brand and first preference on future purchase
Brand Loyalty (BL) [11,37,50–54]	Intent to buy the same brand, recommend to friends and relatives and special to me
Brand Repurchase (BR) [55–59]	Repurchase the same brand, search to repurchase and first choice on future purchase

logo, symbol, design, or combination of these which hold the identity of any product or service and differentiate that particular product from the competitors [43]. Usually, in this modern highly competitive, and dynamic business world, the BI plays a crucial role in determining any individual product market position [44].

2.1.7. Brand preference (BP)

BP is a marketing system of measurement that reflects the power of a brand in the market. BP is understood as a measure of BL in which a consumer exercises his decision to choose a particular brand in the presence of competing brands [45]. BP has more enduring attributes and most multinational brands focus on growing the lifetime value of their global brands are built in reference to consumer preferences concerning buying decisions and corporate accountability. BP should be the focus of brand management [46]. Successful brand management focuses on making BPs, ensuring that products and/or services sold under the brand's umbrella of values really are perceived as superior to those of competitors. BP is "the extent to which the customer favours the designated service provided by a certain company, in comparison to the designated service provided by other companies in his or her consideration set" [47]. Customers form BPs to reduce the complexity of the purchase decision process. The study conducted by Maheswair [48] has found that the factors: advertisement, appearance, features, price, service availability, BI, and friends' recommendation have been opined as important factors for BP. The need for smartphones marketing decision to establish their brand positioning and BP is critical if they are to successfully compete in the current unpredictable and competitive business markets. Also, A clear understanding of the factors affecting BP is also critical to ensure that branding efforts by the company are synchronised with the needs of local consumers of dairy products [49].

2.1.8. Brand loyalty (BL)

A major outcome of branding is creating customer BL. BL measured from a consumer perspective is a key variable in brand equity management [7]. In addition, BL is a main source of brand equity in Keller's CBBE framework [11]. BL is the biased behavioural response expressed over time through individual decision-making with respect to one or more alternative brands out of a set of such brands and is a function of psychological evaluative processes. With BL, the consumer shows a firm attitudinal and psychological binding with the specific product or service among other similar brands [50]. BL plays a vital role in strategic management. In fact, organisations have been emphasising the significance to build and to manage loyalty for their brands [51]. With the perception that loyalty leads to improved profitability, companies need to develop proper marketing strategies to communicate with the customers to establish BL [52]. Positive customer attitudes towards companies and brands have long been associated with business outcomes such as increased revenues and BL. Also, customer satisfaction has a direct effect on BL, satisfaction may even act as a mediator between service quality variables and loyalty [53]. BL influences positively such that customers continue to purchase from the same brand over and over again, despite competitors offering similar products or services [54]. BL not only brings customers' continuous engagement and purchasing from the same brand but also positive feelings towards that brand. BL has a lot to do with how customers perceive your brand, its actions, and its values. And it is an important way to help retain customer loyalty and increase repurchase rates.

2.1.9. Brand repurchase (BR)

Repurchase intention is defined as consumers' judgment to decide whether to purchase products or services again after they have already consumed some of their products or services [55]. In the smartphones business, promotions partially lead to positive repurchase intentions, unlike other direct effects of sales promotion. Ji and Ha [56] have suggested that the impact of promotions can be described as a functional quality of smartphones devices. Customers' repurchase intentions can be enhanced by positive reviews. Repurchase intention questions are routinely used by marketing researchers and practitioners to measure customers' repurchase responses reflecting marketing strategies. When applying repurchase intentions for managerial verdicts, managers normally make judgmental offers such as predicting the number of actual buyers based on their prior experience [57]. The repurchase objective is an evident motivational situation of consumers on the repetition of purchasing the same brand or product. Over the years, the life span of smartphones is shrinking [58] which eventually creates challenges and opportunities for the strategic decision-makers to develop policies for repurchasing. In addition, the digitalised industry has prompted various brands to apply identical technology and platforms for their consumers [59]. Table 1 illustrates a summary of latent variables used in the study and their attributes.

3. Brand equity framework

Through the years, researchers have defined brand equity frameworks in different ways; however, the definitions and models of Aakar [14] and Keller [8] are noteworthy and popular in the brand literature.

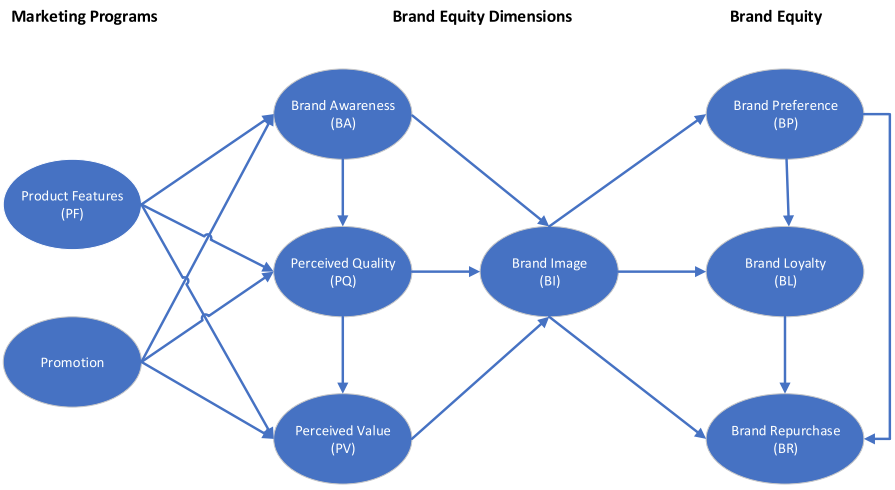

Fig. 1. The proposed three-layer Customer Brand Equity Framework.

3.1. Aaker's Customer-Based Brand Equity (CBBE) framework

Aaker defines brand equity as a set of five categories of brand assets and liabilities linked to a brand, its name, and symbol that add to or subtract from the value provided by a product or service to a firm or to that firm's customers, or both [14]. These brand assets help consumers to interpret, process, and store information about products and brands by adding or subtracting their values. From Aaker's viewpoint, brand equity is "customer-based" instead of "financial-based". Therefore, CBBE becomes more important for this study. Aaker's categorisation of brand assets are: (1) BL (2) BA (3) PQ (4) brand associations, and (5) other proprietary assets (e.g. patents, trademarks, and channel relationships). In this framework, BL deals with a reduction in marketing costs, attracting new customers, and reducing time to competitive threads.

Based on Aaker's CBBE framework, BA deals with the attraction or association of individual brands to be considered for individual customers. PQ deals with why the customer buys any product, their interest, and differentiate customer positions for a particular brand. Brand Associations deal with retrieving brand information and differentiating from other similar products. Brand Assets deal with the competitive advantage of any product. These categories are considered the main basis for brand equity measurement from a consumer-oriented perspective [14]. Aaker has emphasised the fact that brand value to the firm (firm-based brand equity) can be improved by CBBE. High brand equity, including customer-based and firm-based brand equity, allows the brand or product to compete with differentiating brands or products. Thus, brand owners can charge a premium price as well as promote customers' BL. Aaker emphasised that BA must go ahead with brand associations. In other words, a consumer must first be aware of the individual brand to have any associations with the brand.

3.2. Keller's CBBE framework

Building brand equity requires creating a brand that consumers are sufficiently aware of and with which they have strong, favourable, and unique brand associations. This knowledge-building process depends on (1) the initial choices for the brand elements or identities making up the brand (2) the marketing activities and supporting marketing program and the manner by which the brand is integrated into them (3) other associations indirectly transferred to the brand by linking it to some other entity (e.g. the company, country of origin, channel of distribution, or another brand) [8]. Keller explained that market leadership and market share comprise brand strength on macro considerations while micro considerations include consumer familiarity, knowledge, preferences, and loyalty. Macro considerations evaluate the performance of the brand in the market, whereas micro considerations evaluate consumer perceptions of the brand. The Keller model comprises two parts: customer perceptions (brand knowledge) and behaviours (brand responses) which are the two main consumer-related sub-constructs of brand equity. Keller defines brand knowledge in terms of BA and BI. Further, Keller emphasised the importance of creating favourable and unique brand knowledge structures in consumers' minds because successful branding convinces customers that there is a significant difference between the target brand and the competitor brand, thus creating an appealing product image. These differences add value to brands or companies; therefore, consumers show great loyalty to the high-equity brand and are willing to pay a premium price for a brand that has favourable images. According to Keller, brand equity is a multidimensional concept and complex that involves capturing many types of measures. Multiple measures increase the diagnostic power of marketing research. "Brand equity should be considered as a multidimensional concept, which can be offered by the knowledge structures in the consumers' mind". Building a strong brand, according to CBBE model, can be thought of in terms of a sequence of steps, in which each step is contingent on successfully achieving the previous step [60]. He has identified four steps that represent a set of fundamental questions that customers invariably ask about brands-at least implicitly if not even explicitly. These steps include (a) brand salience (b) brand performance and brand imagery (c) consumer judgments and consumer feelings (d) consumer brand-resonance [11].

3.3. Proposed brand equity framework

The proposed framework is illustrated in Fig. 1 where the nine constructs of the conceptual framework have been categorised into three layers: marketing programs; brand equity dimensions; and brand equity. PF and promotion are classified into marketing programs layer as indicated by McCarthy and Borden [61,62]. The Keller CBBE framework indicates that marketing programs are the essential prerequisite for creating BA and BI [8]. Among the four components of the marketing program, product, and promotion have only been considered in the proposed framework. The other components including price and distribution are not included in the proposed framework due to the categorical scale of the smartphone prices and diverse channels of distribution, respectively.

BA, PQ, and BI are the important parameters of Keller and Aakar brand equity framework and most of the studies in other industries have considered these constructs in the framework study [13]. The smartphone industry also shows the same characteristics and has been taken into consideration for the proposed study. PV has also been considered under brand equity dimensions to measure the perception towards the price of the smartphone which could not be considered due to its

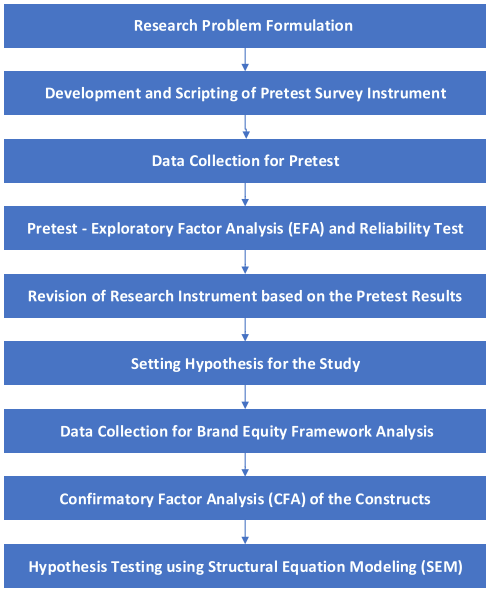

Fig. 2. Overall research methodology process.

categorical nature under the marketing program. Therefore, based on the literature review in Section 2.1 and the nature of smartphones, the nine constructs for the proposed CBBE framework have been chosen.

The relationship between constructs in the framework is defined in three layers and the arrow in the framework (refer to Fig. 1) indicates there is a relationship. One such example is *Product Features* (*PF*) → *Brand Awareness* (*BA*). Firstly, the relationship between PF and promotion activities with BA, PQ, and PV is evaluated. Secondly, the effect of BA, PQ, and PV on the BI has been assessed. Thirdly, the relationship between BI on BP, BL, and BR is examined. After that, the effect of BP on BL and BR has been assessed. Finally, the effect of BL on BR has been investigated.

4. Research methodology

The purpose of this study design is to examine the CBBE model in the smartphone industry in terms of the relationship i.e., casual effect and its strength among the constructs of the customer brand equity framework. The model consists of nine constructs i.e. PF, promotion, BA, PQ, PV, BI, BP, BL, and BR. The fitness of the conceptual framework and interrelationship between these nine constructs has been measured using the hypotheses in the study. The overall research methodology adopted in this research is illustrated in Fig. 2. The detailed description of each step is as follows:

4.1. Research design

A quantitative research design has been used to analyse the data in this study. The purpose of this design is to measure the conceptual model fitness and test research hypotheses. The data has been collected using questionnaire surveys in two phases: pretest and customer brand equity framework analysis. The pretest analysis has been conducted to analyse the unidimensionality and reliability of the nine constructs. In the proposed framework, the measurement model has been estimated using CFA to test the construct validity. This has been followed by the overall model fit of the proposed model and testing of the research hypothesis using SEM.

4.2. Instrument

The proposed model consists of three stages with nine latent constructs as discussed in Section 3 The first stage marketing program in the proposed brand equity framework consists of two constructs: PF and Promotion. The second stage brand equity dimensions possess four constructs: BA, PQ, PV, and BI and the final stage brand equity has three constructs BP, BL, and BR. The items for all the constructs in the conceptual framework have been adopted through literature reviews completed in Section 2.1 and promotional materials including local newspaper advertisements.

The first construct in the marketing program is designed to obtain the respondents' attitudes towards PF with eight items. Similarly, the second construct deals with the measurement of the promotion using the three items. The items for the PF and promotion are created to elicit meaningful insights on the smartphones and the advertisement published in the daily newspapers.

The construct BA has been measured using three items from the studies from [6,8]. PQ and PV are measured using the three items for each construct. The items for PQ and PV are adopted from Marketing Scales Handbook [63]. The items for BI have been adopted from [64]. The items for BL have been derived from [65]. Similarly, the items for BP and BR have been adopted from Marketing Scales Handbook [63]. The perception towards all constructs have been measured using multiple questions as in Appendix B with a five-point Likert scale with the options of strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree. The demographics have been measured using categorical variables.

4.3. Research hypothesis

The hypothesis for the study is set as: one construct has a significant effect on another construct when there is an arrow from one construct to another construct in the framework as shown in Fig. 1. For example, one of the hypothesis, PF has a significant effect on BA. Altogether, seventeen such hypotheses have been developed in this study.

4.4. Sampling approach

At the first stage, the pretest survey questionnaire has been developed, scripted, and hosted in the digital data collection platform. All the questions in the survey questions have been made mandatory in order to remove the non-response bias in the survey. This study adopts systematic random sampling for the selection of the respondents in the twelve busy and prominent locations of the Kathmandu and Lalitpur metropolitan cities of Nepal. The adult respondents with a minimum of two years of experience in using smartphones are intervened and requested to participate in the survey interview. The survey is administered by implying the respondents to express their views in reference to the smartphones they have been using. If the respondents have been using more than one smartphone, they have been requested to express their views on their mostly used smartphones.

A verbal consent has been taken from all the respondents indicating that the survey is to measure brand equity in smartphones for academic purposes and that their involvement is voluntary. The respondents have been communicated that their responses will be kept confidential, and the analysis will be done at an aggregate level with all the responses without revealing or inferring their personal identities. A minimum sample size of 100 data is required for factor analysis [66] and therefore, a sample of 100 has been collected for the pretest analysis. A total of 262 have been intervened to complete the 100 data for the pretest. Among the 262 intervened respondents, there have been 26 partial completions and 136 refusals, yielding a response rate of 38.16%. The partially completed surveys are considered incomplete data and therefore, those data are eliminated from further analysis.

The pretest data have been collected, and analysed and the practically non-significant items of the constructs have been eliminated from the pretest questionnaire, and the revised questionnaire is used to perform the next stage of the proposed brand equity framework survey. The minimum sample size for the proposed brand equity framework at

95% confidence interval, five (5)% margin of error, and the response distribution of 50% have been estimated using Cochran's formula [67]. Using this formula, the minimum sample size appears as 384 to be statically significant. A sample size of 576 data has been adopted for systematic random sampling. In the second phase of the survey, a total of 1261 respondents intervened where 580 data have been completed, 127 have been partially completed and 554 refused to participate, yielding a response rate of 46%. The partially completed surveys are considered as incomplete data in this case also and therefore, those data are eliminated from the further analysis.

4.5. Data analysis

Data analysis is applied, which enables the analysis to pull out valuable insights from data [68]. The data analysis is performed in two stages: Pretest analysis and brand equity framework analysis.

4.5.1. Pretest analysis

The pretest analysis has been conducted prior to the collection of the data for the brand equity framework analysis. The pretest analysis has been performed in three phases. In the first phase, the sample demographic characteristics of the collected data have been presented in tabular form using descriptive statistics. The demographics characteristic consists of age group, gender, education, and occupation. In the second phase, a test for unidimensionality has been conducted using EFA with principal component extraction with the varimax rotation method. In the third phase, a test of reliability has been performed using the coefficient alpha. Based on the pretest analysis, the questionnaire has been modified with the elimination of practically non-significant items of the constructs.

4.5.2. Brand equity framework analysis

The sample questionnaires have been revised with the elimination of practically non-significant items on the constructs based on the pretest results and the second phase survey data has been collected accordingly. In this research study, data analysis has been conducted using data analysis tools: SPSS and AMOS in two phases. In the first phase, the demographic characteristics of respondents i.e. gender, age, education, and occupation has been performed using descriptive statistics. In the second phase, the SEM has been applied using two sub-models: a measurement model and a structural model. First, a CFA identifies the measurement model, which shows the relationship between the observed and latent variables and confirms to construct validity of a set of measured items. The second measurement model, the structural model, estimates a causal relationship among the latent variables and tests the hypotheses given the complex relationships among constructs [69]. With these analyses, all construct variances, the covariance between constructs, and error variances have been estimated. After that, the overall model fit in both measurement and structural models has been evaluated using conventional fit indices including Chi-Square/df ratio, Root Mean-Square Error of Approximation (RMSEA), Normed Fit Index (NFI), Relative Fit Index (RFI), Comparative Fit Index (CFI), Incremental Fit Index (IFI) and Parsimony Normed Fit Index (PNFI) [66].

5. Results, analysis and discussion

In this section, we perform a pretest analysis which is followed by a brand equity framework analysis.

5.1. Pretest analysis

A pretest analysis is conducted in three stages as discussed in Section 4.5.1.

Table 2
Demographics characteristics of respondents in the pretest.

Demographics	Frequency (n)	Demographics	Frequency (n)
Gender			
Male	53	Female	47
Age Group			
<20	12	$20 \leq and \geq 25$	38
$26 \leq and \geq 30$	15	$31 \leq and \geq 35$	12
$36 \leq and \geq 45$	15	≥ 46	8
Education Level			
School level	6	Intermediate	13
Bachelors	54	Masters and above	27
Occupation			
Private service	34	Government service	14
Business	18	NGO/INGO	3
Student	25	Others	6

5.1.1. Sample description

A pretest has been conducted to 100 smartphone users through an administered survey. The respondents have been asked the demographic characteristics (gender, age group, education, and occupation) and questionnaire. The demographic characteristics and questionnaire used for this study are illustrated in Appendix B. The demographics of the participants are illustrated in Table 2. The majority of the respondents are between the ages of 20 to 45 years (92%) and respondents with bachelor's degrees and above constituted 80% in the pretest study.

5.1.2. Unidimensionality test

Table 3 presents the Factor Loading (FL) obtained from EFA analysis for the pretest data. It has been observed that all the FL has been above 0.50 except the battery capacity on the construct PF. Any FL score less than 0.5 is considered important but not practically significant [70] and therefore, the battery capacity parameter is removed for further study. Hence, the results ensured the unidimensionality of each construct in the study.

5.1.3. Reliability test

The scale reliability has been computed using SPSS in order to purify the scales prior to the collection of second phase data. Scale reliability is a measure of the internal consistency of the construct indicators, depicting the degree to which they indicate the common latent (unobserved) construct [66]. A Cronbach's alpha coefficient (α) is generally used to measure the internal consistency and the values of 0.60 or higher have been deemed acceptable if the research is exploratory in nature [66]. The coefficient alpha estimates for all nine constructs of the pretest are presented in Table 4. Based on the suggested cut-off point of 0.60 for exploratory research, all measures appeared to be good indicators of each construct with multiple items. As an outcome of the pretest analysis, the scale reliability confirms the unidimensionality of the construct and internal consistency of the construct indicators, and hence the revised questionnaires are produced for the brand equity framework analysis.

5.2. Brand equity framework analysis

The process of data analysis for the brand equity framework analysis is conducted in three steps: In the first step, the sample characteristics of the respondents have been identified using descriptive statistics. In the second step, the measurement model has been estimated using CFA to test the construct validity of a set of measured items. In the final step, the overall model fit of the proposed framework and the research hypotheses has been tested using SEM.

Table 3
Factor Loading (FL) results from Exploratory Factor Analysis (EFA) analysis.

Construct	FL	Construct	FL
PF		**PV**	
RAM	0.855	Worth for money	0.724
Processor	0.827	Good value for money	0.902
ROM	0.842	Good purchase decision	0.867
Display size	0.677	**BI**	
Screen resolution	0.775	Brand pride	0.789
Battery capacity	0.459	Brand trust	0.882
Front camera	0.795	Brand credibility	0.850
Rear camera	0.765	**BP**	
Promotion		Prefer the brand	0.867
Advertise campaign	0.813	Better than other	0.862
Friend relative referral	0.683	First preference on future buy	0.884
Consumer offer	0.763	**BL**	
BA		Intent to buy same brand	0.854
Highly recognised	0.757	Recommend to others	0.884
Brand aware	0.702	Special to me	0.837
Heard a lot on brand	0.807	**BR**	
PQ		Repurchase the same brand	0.953
Good quality	0.784	Search to repurchase	0.956
Excellent features	0.871	First choice on future buy	0.931
Reliable	0.927		

Table 4
Reliability test results for pretest data.

Construct	Coefficient (α)	Construct	Coefficient (α)
PF	0.888	Promotion	0.613
BA	0.624	PQ	0.828
PV	0.779	BI	0.793
BP	0.839	BL	0.820
BR	0.942		

5.2.1. Sample description

The respondents in the brand equity framework analysis are asked the same demographic characteristics (gender, age group, education, and occupation) along with updated questionnaire after the pretest. A total of 580 sample data are collected through an administered survey. The demographics of the participants are illustrated in Table 5. The samples of the brand equity framework analysis consists of 301 male (51.9%) and 279 female (48.1%). The majority of the respondents have been below the age of 30 years (77.3%). The age group of 20–25 years (40.5%) is the largest group. The brand equity framework analysis consists of 260 respondents (44.8%) with bachelor's degree qualifications. Respondents with high school and above qualifications consisted of 91.4% in the sample study. The majority of respondents consists of 228 students (39.3%) followed by 119 private service job holders (20.5%).

5.2.2. Measurement modelling analysis

The CFA result of the measurement model for all constructs is presented in the second column of Table 6. The recommended desired value for a good fit [66] is also presented in the fourth column of the Table. The result shows that all elements of goodness-of-fit statistics are within the desired value except two statistical elements: NFI and RFI. These two elements are in the range of marginally acceptable levels and assumed that it is acceptable for further processing. Next, convergent validity has been performed between theoretically defined sets of variables.

Convergent validity has been assessed from the measurement model by determining whether each indicator's estimated pattern coefficient on its posited underlying construct factor is significant [71]. This is assessed by examining the FL estimates for constructs i.e. standardised regression weights and Average Variance Extracted (AVE). All indicator FLs i.e., Standardised Estimate (SE) for constructs should be at least 0.5 for convergent validity [66]. Table 7 presents the SE of the brand equity framework analysis. The values in Table 7 showed that all SE regression weights are mostly over 0.5 and are significant ($p < 0.001$) except for two items: Consumer offer (0.376) and friend relative referral (0.333). Additionally, the variance extracted estimate should be equal to or greater than 0.50 for a construct to ensure convergent validity [66]. The analysis has shown higher variance extracted values when the indicators are truly representative of the latent construct. The AVE obtained from the CFA study are presented in Table 8 and the AVE of the constructs of PF, promotion, and BA obtained from the CFA are 0.464, 0.309, and 0.348, respectively which are less than the threshold level of 0.5. The lower values of these three constructs indicate that more than half of the variance for the specified indicators is not accounted for by the constructs. Such findings lead to exploring additional loadings for these indicators on the other construct if theoretically justified [66].

Owning to the convergent validation problem, the item scale display size and rear camera with the FL 0.558 and 0.653 are removed from the construct PF. Similarly, the item friend relative referral with the FL 0.333 is also removed from the construct promotion. Similarly, item BA with FL 0.570 is deleted from the construct BA. Finally, due to the high standardised residual covariance of the item worth for money with FL 0.636 for the construct PV, the item is also removed. The FL on the item the consumer offered in the construct promotion is 0.376 does not meet the minimum required value of 0.5. However, this study retains this item since the statistical tool AMOS does not support the single-item scale. The average variance extraction estimates, after removing some of the items, have shown improvement in the AVE, as shown in Table 9. The AVE estimate of PF, promotion, and BA after item deletion are 0.526, 0.496, and 0.554 respectively. Although the AVE of promotion (0.496) is very close to the margin level of 0.5 and this study assumes the validity of this construct. The analysis has shown that the AVE values obtained from the CFA are 0.5 and above, thus it confirmed the convergent validity for all the nine latent constructs.

Table 5
Demographics characteristics of in the brand equity framework analysis.

Demographics	Frequency (n)	Percentage (%)
Gender		
Male	301	51.9
Female	279	48.1
Age Group		
<20	99	17.1
20 ≤ *and* ≥ 25	235	40.5
26 ≤ *and* ≥ 30	114	19.7
31 ≤ *and* ≥ 35	45	7.8
36 ≤ *and* ≥ 45	47	8.0
≥ 46	40	6.9
Education Level		
School level	50	8.6
High School	155	26.7
Bachelors	260	44.8
Masters and above	115	19.8
Occupation		
Private service	119	20.5
Government service	46	7.9
Business	115	19.8
NGO/INGO	16	2.8
Student	228	39.3
Others	56	9.7

Table 6
Measurement model fit of the proposed model.

Statistics	Initial model	Revised model	Desired value [66]
χ^2/df	1364.31/383 = 3.562	1125.76/276 = 4.079	< 5.00
RMSEA	0.067	0.073	< 0.08
NFI	0.895	0.904	> 0.90
RFI	0.873	0.887	> 0.90
CFI	0.922	0.925	> 0.90
IFI	0.922	0.926	> 0.90
PNFI	0.737	0.768	> 0.50

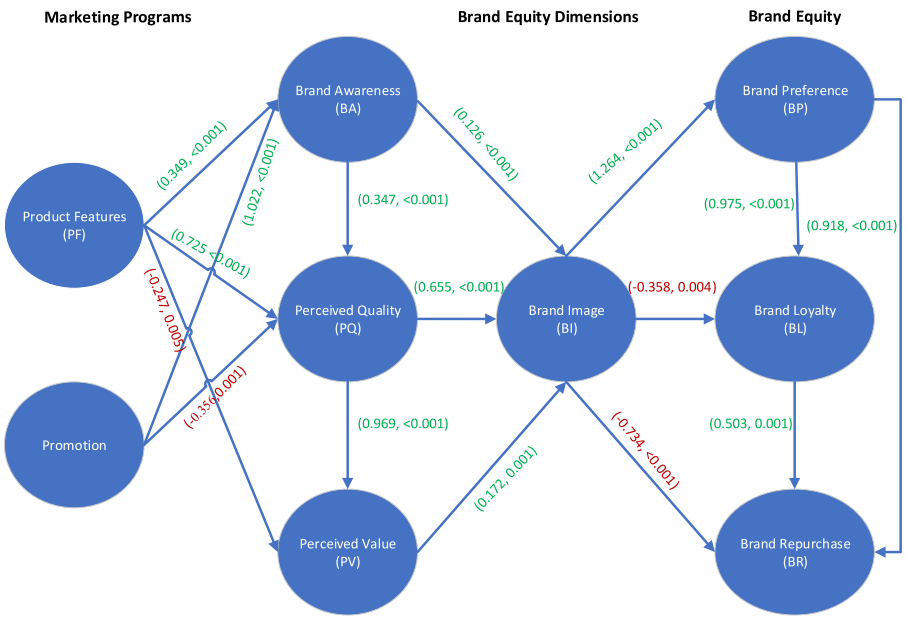

Fig. 3. The path estimate for the proposed model using SEM.

Table 7
Standardised Estimate (SE) of the brand equity framework analysis with p <0.001.

Construct	FL	Construct	FL
PF		**PV**	
RAM	0.692	Worth for money	0.636
Processor	0.736	Good value for money	0.667
ROM	0.635	Good purchase decision	0.884
Display size	0.588	**BI**	
Screen resolution	0.747	Brand pride	0.745
Front camera	0.702	Brand trust	0.823
Rear camera	0.653	Brand credibility	0.792
Promotion		**BP**	
Advertise campaign	0.821	Prefer the brand	0.867
Friend relative referral	0.333	Better than other	0.702
Consumer offer	0.376	First preference on future buy	0.849
BA		**BL**	
Highly recognised	0.542	Intent to buy same brand	0.870
Brand aware	0.570	Recommend to others	0.741
Heard a lot on brand	0.652	Special to me	0.870
PQ		**BR**	
Good quality	0.791	Repurchase the same brand	0.942
Excellent features	0.721	Search to repurchase	0.950
Reliable	0.822	First choice on future buy	0.882

The CFA result of the measurement model, after the removal of some of the items, for all constructs is presented in the third column of Table 6. The result shows that all elements of goodness-of-fit statistics are within the desired value except for RFI which is in the range of a marginally acceptable level [66]. Hence, the results of the measurement model show the acceptable fit of the model. The measurement model and convergent validity entail that the scale and constructs are fit for structural modelling analysis.

5.2.3. Structural modelling analysis (SEM)

An SEM is performed to evaluate relationships between independent and dependent variables. The direct effects between independent variables and dependent variables are illustrated in Fig. 3. In Fig. 3 the relationship weight i.e., path estimate path, p-value (γ, p) is shown in each edge when the relationship is significant. The p values are less than or equal to 0.05 and therefore, significant in all cases except between promotion to PV. Therefore, there are significant relationships exist in the proposed model except between promotion to PV, where p is 0.142. Therefore, the hypothesis considered in Section 4.3 as one construct has a significant effect on another construct when there is an arrow from one construct to another construct in the framework (Fig. 1). This is valid for all cases constructed except in one case which is a promotion to PV. The positive value at the edge indicates that there is a positive impact of one construct on another directly and the negative value at the edge indicates that there is a negative impact of one construct on another. The value of γ indicates estimate path coefficient between variables when other variables are controlled.

A detailed SEM analysis results with standardised total, direct and indirect effects between independent and dependent variables is presented in Table 10. The total effect between the independent variable and dependent variables is positive in all cases except between promotion to PQ where the value is very low negative. Based on analysis, it has been observed that PF has a significant positive effect on BA and PQ. However, it has a significant negative effect on PV. However, PF has a positive effect on PV if BA has been made creating positive PQ. Therefore, the marketers should focus on creating positive PQ which will subsequently enhance PV. Similarly, promotional activities have a significant positive effect on BA. However, these activities have a significant negative effect on PQ. The relationship between promotion and PV is insignificant. However, if the promotion has been made in creating BA and subsequently creating PQ. Then, PQ has a positive significant effect on PV.

Overall, the results have indicated that the PF has an important role in creating positive quality perception if the promotion has been made to create BA, and therefore, positive PQ enhances PV. The result shows that PQ has a significant positive effect on BI. The effect of BA and PV on BI is very low. This indicates that the BI is formed through enhanced PQ with a nominal contribution of BA and PV. In addition, there is a significant positive effect of BI on BP. However, the effect of BI on BL, and BR is negative. This indicates that the marketers need to focus on creating positive BP as BI is not sufficient in creating BL and BR.

5.3. Implications

This framework provides a strategic understanding to the decision-makers' interpretation of CBBE in smartphone marketing. To begin with, the study will add to the body of knowledge on brand equity in smartphones. In addition, the identified and developed constructs and scales will be a valuable tool for the assessment of CBBE enabling researchers to get more accurate results for the upcoming study.

Table 8
AVE and factor correlation matrix with the square root of the AVE on the diagonal.

	AVE	BL	PF	Promotion	BA	PQ	PV	BI	BR	BP
BL	0.601	**0.775**								
PF	0.464	0.586	**0.681**							
Promotion	0.309	0.295	0.323	**0.556**						
BA	0.348	0.689	0.620	0.626	**0.590**					
PQ	0.607	0.804	0.798	0.250	0.787	**0.779**				
PV	0.544	0.714	0.610	0.253	0.657	0.804	**0.737**			
BI	0.620	0.929	0.688	0.269	0.854	0.990	0.814	**0.787**		
BR	0.856	1.010	0.490	0.273	0.625	0.678	0.604	0.791	**0.925**	
BP	0.653	1.055	0.597	0.286	0.721	0.831	0.706	0.949	0.965	**0.808**

Table 9
AVE and factor correlation matrix with the square root of AVE on the diagonal after deletion.

	AVE	BL	PF	Promotion	BA	PQ	PV	BI	BR	BP
BL	0.615	**0.785**								
PF	0.526	0.596	**0.725**							
Promotion	0.496	0.238	0.261	**0.705**						
BA	0.554	0.526	0.423	0.533	**0.744**					
PQ	0.608	0.803	0.794	0.215	0.575	**0.779**				
PV	0.617	0.726	0.524	0.196	0.443	0.800	**0.786**			
BI	0.621	0.926	0.685	0.229	0.652	0.989	0.825	**0.788**		
BR	0.857	0.996	0.500	0.226	0.472	0.678	0.617	0.791	**0.925**	
BP	0.653	1.044	0.606	0.240	0.544	0.831	0.715	0.949	0.965	**0.808**

Table 10
Standardised total effects, direct effects, and indirect effects.

Independent variable	Dependent variable	Total effects	Direct effects	Indirect effects
PF	BA	0.349	0.349	–
	PQ	0.847	0.725	0.121
	PV	0.573	−0.247	0.821
	BI	0.697	–	0.697
	BP	0.881	–	0.881
	BL	0.609	–	0.609
	BR	0.722	–	0.722
Promotion	BA	1.022	1.022	–
	PQ	−0.002	−0.356	0.355
	PV	0.138	0.14	−0.002
	BI	0.152	–	0.152
	BP	0.192	–	0.192
	BL	0.132	–	0.132
	BR	0.157	–	0.157
BA	PQ	0.347	0.347	–
	PV	0.336	–	0.336
	BI	0.412	0.126	0.285
	BP	0.52	–	0.52
	BL	0.36	–	0.36
	BR	0.426	–	0.426
PQ	PV	0.969	0.969	–
	BI	0.822	0.655	0.167
	BP	1.039	–	1.039
	BL	0.718	–	0.718
	BR	0.851	–	0.851
PV	BI	0.172	0.172	–
	BP	0.217	–	0.217
	BL	0.15	–	0.15
	BR	0.178	–	0.178
BI	BP	1.264	1.264	–
	BL	0.873	−0.358	1.232
	BR	1.035	−0.734	1.769
BP	BL	0.975	0.975	–
	BR	1.598	0.918	0.68
BL	BR	0.697	0.697	–

Furthermore, the proposed study presents an integrated framework of CBBE by identifying the constructs and the relationships between them in the smartphone industry. The stakeholders can explore how the marketing programs help to create brand equity dimensions (BA, PQ, PV, BI) and ultimately brand equity i.e., BP, BL, and BR. In addition, the results of this study will reveal how customers perceive brand equity in smartphones which will help smartphone manufacturers to understand how customers evaluate their brand and develop clear directions to position their brand based on customer preferences. Besides, the examination of the effects of antecedents on the consequences in the brand

Table A.1
Abbreviations used in this manuscript.

AVE	Average Variance Extracted	BA	Brand Awareness
BI	Brand Image	BL	Brand Loyalty
BP	Brand Preference	BR	Brand Repurchase
CBBE	Customer-Based Brand Equity	CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index	EFA	Exploratory Factor Analysis
FL	Factor Loading	IFI	Incremental Fit Index
INGO	International Non -Government Organisation	NFI	Normed Fit Index
NGO	Non-Government Organisation	PF	Product Features
PNFI	Parsimony Normed Fit Index	PQ	Perceived Quality
PV	Perceived Value	RFI	Relative Fit Index
RMSEA	Root Mean-Square Error ofApproximation	SE	Standardised Estimate
SEM	Structural Equation Modelling		

equity framework will advance the marketer's understanding of factors that may dilute or enhance brand equity ultimately enhancing to gain business success.

6. Conclusions

A framework for smartphone brand equity is introduced and validated using two phases of survey data. The framework can be used among the decision-makers and academicians to understand the smartphone market attributes and their relationships, which eventually helps in drawing strategic long-term smartphone marketing plans. The framework will fulfil the gap that appears with the emergence of the open market and the availability of various smartphone brands which is crucial for the decision on marketing smartphones has become strategically important. Different approaches and models have been applied for effective marketing-related decisions. In support of the marketing of smartphones, this paper introduces a framework for Customer Brand Equity Model based on Keller and Aakar's model for the smartphone industry, as a case study of the smartphone market. In other words, this study examines the dimensions of brand equity using two CBBE models proposed by Keller [8] and Aakar [6] in the smartphone industry.

A framework has been proposed considering various parameters of smartphones and the local context. The study proceeds with the examination of the relevant constructs to measure brand equity in the smartphone industry. Two-step surveys have been conducted to validate the proposed framework. This study commence with the pretest analysis with a sample size of 100 to filter the initial instrument using EFA and reliability test. Upon filtering the instrument, samples of 580 have been collected and model fitness is tested. This is followed by convergent validation. The pretest analysis consists of a unidimensionality and reliability test of nine constructs i.e. PF, promotion, BA, PQ, PV, BI, BP, BL, and BR with a total of 33 items. Upon deletion of scale: battery capacity with the FL of 0.459 in the construct PF, the questionnaire tool is ready for the brand equity framework analysis with the FL greater than 0.5 for every item and Cronbach's alpha greater than 0.6 for each construct.

In further analysis, the measurement model of the brand equity framework analysis is estimated using CFA to ensure goodness-of-fit statistics and convergent validity of the construct. Upon removal of the items' display size and rear camera in the construct PF, friend relative referral in the construct promotion, brand aware in the construct BA; worth for money in the construct PV; the convergent validation problem has been resolved. Finally, an integrated model has been developed and tested to find the causal relationship between various dimensions of brand equity in the proposed framework. The results have indicated that the PF has an important role in creating a positive quality perception if the promotion has been made to create BA. PQ helps in enhancing BI. The marketers need to focus on creating positive BP as BI is not sufficient in creating BL and BR. Overall, the survey-based result shows that marketing programs are the stimuli for creating brand equity.

There are a few limitations in this study that relate to the interpretation and generalisation of the findings. Firstly, the items for the construct PF have been created eliciting meaningful information and developing promotion scales from the daily newspapers. This may have been caused by low FL scales. Thus, in future research, there is a need to adopt rigorous studies to identify potential modifications on scales of PF and promotion. This study is conducted in only two metropolitan cities of Nepal which has the scope of enhancing across other cities to adopt more generalised results. Besides this, we observed that the response rate is in the low range, which has been a challenge during the survey.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

Appendix A. Abbreviation

See Table A.1.

Appendix B. Questionnaires

Dear Respondent,

The objective of this survey is to study the perception of smartphone users. You are requested to assess the smartphone that you are using currently. Your response will be used in aggregate form only and your answers will be kept confidential. You can leave the survey anytime you feel to leave. Please provide the information as per your best knowledge. There are two parts:

- Part A

1. Mention your Gender:
   (a) Male (b) Female (c) Other
2. Your Age group:
   (a) Under 20 years (b) 20–25 years (c) 26–30 Years
   (d) 31–35 Years (e) 36–45 Years (f) Above 45
3. The category that best describes your education level:
   (a) School level (b) High School (c) Bachelor (d) Master or above
4. The category of occupation that best describes your mainstream:
   (a) Private Service (b) Government service (c) Self-employed
   (d) NGO/ INGOs (e) Student (f) other (Specify).....

- Part B
  - Indicate how much you agree or disagree with each statement about the smartphone that you are using. Circle one answer that reflects your opinion. (“1= strongly disagree”, “2=disagree”, “3=neither agree nor disagree”, “4=agree” or “5=strongly agree” with each statement) (see Table A.2).

Table A.2
Questionnaires.

Statements	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
My mobile performs fast while I use multiple applications simultaneously.	1	2	3	4	5
My mobile performs fast while the opening of programs, selecting new applications like games, videos, music, etc.	1	2	3	4	5
My mobile can install a large number of applications programs and data.	1	2	3	4	5
My mobile has a big screen.	1	2	3	4	5
My mobile shows a clear and bright picture.					
My mobile captures good quality pictures from the front camera.	1	2	3	4	5
My mobile captures good quality pictures from the rear camera.	1	2	3	4	5
The brand of my mobile launched many advertisement campaigns.	1	2	3	4	5
My friends/relatives advised me to purchase this mobile brand.	1	2	3	4	5
The brand of my mobile phone provides many consumer schemes/offers.	1	2	3	4	5
My mobile has good quality.	1	2	3	4	5
Brandof my mobile is highly recognised.	1	2	3	4	5
Having this brand of mobile is my pride.	1	2	3	4	5
I am highly aware of the brand of my mobile.	1	2	3	4	5
I got much more worth for money than I paid for my mobile.	1	2	3	4	5
I have heard a lot about the brand of my mobile.	1	2	3	4	5
I intend to buy this brand of mobile if I need to buy again.	1	2	3	4	5
I preferred this brand over any other brand of mobile phones.	1	2	3	4	5
I trust the brand of my mobile.	1	2	3	4	5
I will probably buy the same brand again.	1	2	3	4	5
I would be inclined to buy the same brand of mobile again. I would recommend my friends/relatives to purchase this brand.	1	2	3	4	5
In future purchase, the brand of my mobile will be my first choice.	1	2	3	4	5
My mobile has excellent features.	1	2	3	4	5
My mobile is reliable.	1	2	3	4	5
My mobile provides good value for money.	1	2	3	4	5
Purchase of this mobile is a good decision.	1	2	3	4	5
The brand of this mobile is special to me.	1	2	3	4	5
The Mobile of this brand has credibility.	1	2	3	4	5
This brand meets my requirements of mobile better than other brands.	1	2	3	4	5
When it comes to make a purchase, the brand of my mobile is the first preference.	1	2	3	4	5

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