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Configuration Analysis of the Influence Factors of Internet Enterprise Brand Application Extension on Its Brand Equity Accumulation

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Abstract: In order to explore the way that Internet enterprises' brand application extension accumulates their brand equity, this paper takes 105 Internet applications on Apple App Store as cases, collects application reviews and conducts text analysis on them, and uses the fuzzy set qualitative comparative analysis (fsQCA) method to explore the combination path of multiple factors for brand application extension and improving the accumulation of brand equity premium. The research results show that the promotion of Internet enterprises' brand equity premium is the result of multi factor configuration, and the seven paths leading to the accumulation of high brand equity premium can be summarized into three models and analyzed with examples. On the basis of this conclusion, it proposes that Internet enterprises should pay attention to the improvement of the quality and optimization ability of application research and development, actively fulfill their social responsibilities, and focus on meeting consumer needs, which provides theoretical and practical enlightenment for Internet enterprises to extend their brand applications.

Keywords: brand extension; FsQCA method; Brand assets; Extended products; brand image

INTROUDUCTION

In this era of continuous development of digital technology, various Internet service APP are constantly being developed and used by consumers. The relationship between online service applications and consumers is becoming increasingly close, and people's lives or work are increasingly dependent on them[1]. The use and dependence of consumers on APP not only brings huge profits to Internet companies, but also improves their brand reputation and influence (**Hussain and Rashid,** 2016). Therefore, these Internet companies are further encouraged to expand their brands like more mobile services.. Previous research on the concept of brand extension has mostly focused on the fields of manufactured and consumer goods, and has achieved rich results (**Erdem and Swait**, 2001). Related research suggests that a parent brand with strong influence can provide advantages to its sub brands during the process of brand expansion,including customer loyalty, tolerance to crisis, company profits, positive attitude toward price change and brand extension (**Keller**, 2003).

At the same time, the development of the new brand also provides development opportunities for the parent brand through captioning new market segments using the original brand name (**Kerin et al**.,1996) and connecting the new brand with the known parent Brand (**Tauber**, 1988). Beneficial for rapidly increasing brand assets throughout the entire brand expansion process (**Ye et al.,** 2020). In the traditional field of physical

consumer goods, brand extension strategy is an effective means to help new products quickly open up the market. By leveraging the influence of the parent brand, it can convey a trustworthy signal to consumers (**Hultman et al.,** 2021).

In recent years, with the development of information and communication technology (ICT), Web 3.0, and mobile technologies, The number of users using Internet service applications is increasing, and research on APP applications has received great attention (**Steinberg,** 2020; **Zhu et al**., 2023). In China, several internet brands have launched subsidiary brands to gain benefits by reaching out to a wider range of consumers and meeting their diverse needs. (For instance, Alibaba's subsidiary brands include Youku, TaoBao, Eleme, and DingDing, while Tencent's subsidiary brands include WeChat, WeBank, and KuGou Music.）Meanwhile, in the field of brand extension, relevant research suggests that the characteristics of the parent brand (e.g., brand equity) play a role in customers' acceptance of the extended brand in the service industry (**Ahn et al.**, 2018; **del Barrio-García** and **Prados-Peña,** 2019).

A large amount of existing research has shown that brand extension activities of physical enterprises have great value in improving business performance and reducing marketing costs(**Bolton et al.,** 2007). In addition, relevant studies have also pointed out that the brand extension activities of the parent company not only have positive but also negative effects on the subsidiary brands (**Loken and John,** 1993; **Gürhan-Canli and Maheswaran,** 1998). Some scholars have pointed out that if the parent brand carries out inappropriate brand extension activities, it will have negative spillover effects on the subsidiary brands (**Aaker**, 1990; Ahn et al., 2018; **Arslan and Altuna,** 2010; **Buil et al.**, 2009)。Furthermore,Most of the existing research focuses on the field of physical manufacturing enterprises, and few focus on the extension and expansion of Internet brands, most studies focused on the role of original-brand attributes in the product context(**Del Rio et al.**, 2001; **Martinez and De Chernatony**, 2004).and did not examine underlying mechanisms of customers' experience with service brand extension.

With the deepening of the digital wave, network application services have gradually become an inseparable part of people's daily lives (**Steinberg,** 2020). At the same time looking back at the development of Internet applications in China in the past decade, it is not difficult to find that although there are many service APPs available for consumers to choose from, few products have been recognized and trusted by the vast majority of consumers, and only Tencent, NetEase, Baidu and a few other leading enterprises that occupy the market voice behind those APPs that can really be used and paid for by consumers (**Verkijika,** 2020; **Fang,** 2019; **de Luna et al.**,2019; **Dahlberg et al.,** 2015).Thus, based on the review of the literature, the authors found there are three research gaps in existing brand extension studies:

1.For Internet enterprises, what factors affect the success of their brand extension activities?

2.What is the effect of Internet enterprise brand extension activities on its own brand equity accumulation?

3.What methods are available to help newly established internet companies gain market share and gain consumer trust?

In order to fill in these gaps, this study takes 105 Chinese Internet applications on the Apple app store as examples, and uses the fuzzy set qualitative comparative analysis (FSQCA) method to observe the extension strategies and results of these applications in the process of brand extension activities, and pay attention to their impact on the accumulation of corporate brand equity.

Literature review

brand extension

Brand extension is one of the most effective and popular strategies to expand the market, and many aspects of brand extension, from the concept and category of brand extension to its advantages and risks and the factors affecting its success,have been studied. (**John; Loken; Joiner,** 1998; **Shokri; Alavi,** 2019; **Kim** 2019; **Huang**, 2020; **Ma; Wang**; **Da**, 2021; **Ke; Wagner**, 2022; **Deng; Messinger**, 2022). Aaker and Keller (1990) used the term"brand extension"to refer to the strategy that launches new products under existing brand names or new entrants in categories different from the parent brands. Although this strategy seems to have many advantages such as reducing communication costs and increasing the possibility of success , the success rate is not guaranteed (**Aaker and Keller**, 1990). The dominant framework for brand extension research proposed by Aaker and Keller identifies three important dimensions that affect brand extension: perceived quality of the parent brand, perceived fit, and product manufacturing difficulty. When the fit between the extended product and the parent brand is good and the perceived quality of the parent brand is high, or when the extended product is considered less easy to manufacture, consumers will have a more positive attitude towards the extended product(**Hultman et al.**, 2021). However, when the perspective of brand extension focuses on Internet brands, the existing research results are not rich.Therefore, this paper will combine the research results of brand extension in traditional manufacturing enterprises, and according to the characteristics of Internet enterprises, review the literature from three aspects: core brand image (including brand reputation, brand social image), extended product characteristics (including technology acceptance, brand community, product reputation, perceived connectivity, and marketing investment), and extended market characteristics (including market capacity and competitive strength).

Core brand reputation

The basic premise for the widespread application of brand extension is that stronger brands provide greater expansion leverage for products compared to weaker brands (**Aaker and Keller,** 1992; **Smith and Park,**1992). In the context of brand extension research, brand reputation is defined as consumers' perception of the quality associated with a brand (**Aaker and Keller** 1990; **Barone et al**. 2000). Relevant research results indicate that high perceived quality brands can be further extended and receive higher evaluations than low perceived quality brands(**Aaker and Keller,**1990; **Sunde and Brodie,**1993; **Dacin and Smith,** 1994). Research in traditional fields has shown that brands with higher reputations can provide consumers with greater risk mitigation, so compared to brands with lower reputations, they can gain more trust and positive evaluations (**Elliott; Wattanasuwan,** 1998; **Mitchell,** 2001; **Holt**, 2002; **Christodoulides,** 2009; **Ots**, 2008). In addition, compared to actual products or services, the useful quality information obtained by consumers through observation is significantly reduced, further weakening their perception of network applications(**Wang and Liu**, 2020). The influence of the brand's own reputation is further enhanced as it can alleviate consumers' uncertainty about emerging online products to a certain extent.Therefore, we posit:

H1: the brand reputation of Internet enterprises positively affects their brand extension ability.

Brand Social Image

Gardner and Levy (1955) first proposed the concept of brand image, believing that brand image is a combination of consumers' attitudes and emotions towards the brand, and is a personified representation of the brand. Aaker (1991) believes that brand image is the overall impression that consumers have of a brand, which includes product features, consumer welfare, and brand personality traits. Existing research has shown that

factors such as brand reputation and brand popularity in brand image have a positive impact on brand extension evaluation (**Hem et al.,** 2003; Park et al., 1991; **Schmitt,** 1994). However, previous studies have overlooked the impact of corporate social image on brand extension. Corporate social responsibility includes the efforts they make towards social welfare and environmental protection (**Liu et al.**, 2021). Research has shown that consumers tend to choose brands that align with their values and cognition (**Deng et al.**,2017). Corporate social image helps resonate with the values of consumers and brands, thereby enhancing consumer identification with the brand(**BIEL et al.**, 1992). Therefore, it is beneficial to some extent for the development of corporate extension activities.Therefore, we posit:

H2:The brand social image of Internet enterprises has a positive impact on their brand extension ability.

Perceived connectivity

Perceived connectivity refers to consumers' perception of the similarity between the extended product and the original brand (**Aaker,** 1990). Generally speaking, the higher the fit, the more likely the high-quality features of the original product are to be transferred to the extended product(**Stewart,** 2006). When two products use a common brand name, consumers perceive that the extended product has higher physical similarity with the original product(**Boush,**1997). Martínez's(2009) research supports the direct impact of brand image on fit. However, compared to traditional channels, Hyperlink is a unique element of the Internet, which reflects the specific relationship between the two sides of the link(**Lin et al.,** 2011). The existence of hyperlink will affect the trust transfer of Internet users to both sides of the link. To describe the strength of the relationship between two linking parties, Stewart (2003) proposed the concept of connectivity and found that the reputation of the linking party can affect users' perception of the connectivity between the two linking parties. Related experiments have shown that perceived connectivity has a greater impact on the strength of trust transfer when consumers transition from offline to online(**Lee et al.,** 2014).Meanwhile, a higher level of perceived connectivity will correspondingly enhance consumers' perceived quality of extended products or services(**Song et al.,** 2010).

Therefore, this paper believes that the success of Internet consumption may indirectly play a role through connectivity.we posit:

H3: Consumers' perceived connectivity to network extension products has a positive impact on their brand extension evaluation.

Product marketing investment

Traditional advertising theory holds that repeated exposure is crucial for the impact of advertising, as repetition of advertising can increase the quantity and value of information presented, amplifying the positive effects of advertising (**Anand and Stern Hall,** 1990; **Batra and Ray,** 1986; **Kakiopo and Petty** 1979). Lane (2000) has demonstrated through experimental methods that advertising can endow brand extension activities with greater intrinsic resilience. After repeated exposure to advertisements that evoke appropriate brand associations, consumers ultimately respond much better to inconsistent extensions than when they first encounter them(**Holbrook et al.,** 1991). Moreover, this increased favor ability puts these in congruent extensions much closer to par with congruent extensions(**Loda et al.,** 2005). Similarly, in the context of Internet product promotion, we can observe that online product applications will need to expand its contact frequency with users more than actual products(**Alshurideh,** 2019). Every product expansion of Internet enterprises will carry out extensive marketing and publicity in major mainstream media or channels, so more advertising

marketing investment is required. Therefore, we propose a hypothesis

H4: Internet enterprises' marketing and publicity investment in extension products affects their evaluation of extension products

brand community

In the context of the Internet, Kozinets (2002) defined brand community as "online brand community". Online brand community is a breakthrough geographical restricted relationship network based on computer technology. Members exchange and share information through the Internet. Internet tools are an important medium for online brand community.Numerous existing studies have shown that businesses can further strengthen their relationships with customers and enhance their brand attitudes by managing their brand communities(**Hickman,** 2005; **Algesheimer et al.,** 2005; **Bagozzi et al.,** 2006). Chang (2007) pointed out that brand communities formed through online social networking can be initiated by enterprises, suppliers or brand fans, and members of the community exchange brand information, share knowledge and exchange experience through the Internet to form lasting relationships and strong identity. Huimei (2014) believe that in the community environment of brand management, community identity has a significant and positive impact on brand loyalty, and the indirect effect mediated by brand relationships is higher than the direct effect. At present, the continuous operation of the enterprise's own brand community has become one of the important means for Internet enterprises to create good customer relations(**Hsu et al.,** 2016). Consumers in the community can timely obtain brand information and trends, and high brand loyalty will also encourage them to participate in enterprise promotion related activities. Therefore, we propose a hypothesis

H5: The operation of Internet enterprises on their brand communities has a positive impact on the evaluation of their extended products.

Perceived technicality

Internet products launched by Internet enterprises are often of a certain technical nature, and some even require consumers to have certain professional knowledge or literacy to use them(**Kim et al.,** 2010). Therefore, this article cites the technology acceptance model to measure consumers' evaluation of network extension products by analyzing their perceived ease of use and practicality(**de Luna et al.,** 2019; **Dahlberg et al.,** 2015). The Technology Acceptance Model is a very important model for predicting people's acceptance of new technologies (**Verkijika,** 2020; **Fang,** 2019) .In the initial technology acceptance model, perceived usefulness was defined as the degree to which people believed that new technologies could improve their work efficiency; Perceived ease of use is defined as people believing that new technologies can enable them to the degree to which work has become easier to understand (**Davis,** 1989).Numerous studies have shown that if consumers have a stronger perceived ease of use and lower perceived technicality towards online products, they will have a more positive attitude towards the product(**Zhao et al.,** 2012; **Lin et al.,**2011). Therefore, we assume that：

H6: Consumers' perception of network products has a positive impact on their extension evaluation of Internet enterprises

Market characteristics

One specific criticism of the Aaker and Keller model is that it failed to take into account background factors such as competitive activity in the market,which might exert a significant impact on the model’s generalization (**Czellar,** 2003). The competition intensity in the marketplace could potentially affect the

consumer evaluation of brand extension in the emerging markets by altering the consumer perception of the need to switch brands(**Monga and John,** 2007).when the extension product category is dominated by a few trusted brands, consumers will have few incentives for buying any new alternative brands,as doing so may involve considerable risk-taking due to a lack of product knowledge and experience.In contrast, when the competition in the brand extension product category intensifies,there will be more opportunities for consumers to try different products/services to meet their needs and wants, which would inevitably lead to increases in the consumers' experience and knowledge with the product category(**Guo et al.,** 2014). Therefore, we select two commonly used indicators, market capacity and competition intensity, to measure market characteristics and posit:

H7: The characteristics of the Internet product market have a positive impact on the brand extension ability of Internet enterprises.

Brand extension and brand asset accumulation

Brand asset value refers to the total value that a brand possesses (**Luo and Wei** 2005). On the one hand, a certain amount of physical and abstract labor must be invested in the process of brand creation, and on the other hand, the brand itself has a certain value-added ability(**Sichtmann and Diamantopoulos,** 2013). Different brands can bring different excess profits to operators(**Yang et al.,** 2013). Therefore, as an important intangible asset, brand also participates in the production and circulation process of goods, and can complete its own value conversion and accumulation in this process. Brand extension is one of the important ways to convert the value of its assets, and through this process, it can further accumulate and increase the value of brand assets(**Ahn et al.,** 2018). By extending a brand to new products or services, the value of its assets is mainly reflected in four factors: brand awareness, reputation, adaptability (target market range applicable to the brand), and market resources of the brand(**Hussain and Rashid,** 2016). From the perspective of brand extension, the assets of a brand are the sum of the values of the aforementioned elements. As discussed earlier, a company's brand assets provide assistance for its extended activities, such as brand influence, brand reputation, and brand community(**Song et al.,** 2010; **Yang et al.,** 2013). However, it is worth noting that there is also a feedback effect between brands and extended products, and the changes in various elements of brand asset value will follow certain rules(**Ye et al.,** 2020). Therefore, successful extension will expand the brand's visibility and market resources, and the brand's adaptability space will also increase. Consumers' overall reputation for the brand will also be improved to a certain extent, which will undoubtedly increase the brand's assets. Therefore, this article proposes research hypotheses.

H8: There is a positive incentive relationship between Internet enterprises' brand extension activities and brand equity accumulation

Research Methods and Data Collection

In order to explore the core brand equity accumulation effect generated by the matching of core brand image (influence, social responsibility), extended product characteristics (perceived quality, emotional orientation, word of mouth, marketing investment), and extended market characteristics in Internet extended products, this paper will use qualitative comparative analysis (QCA) for data analysis. QCA is a case oriented research and analysis method that combines qualitative and quantitative research based on set theory(**Kent and Olsen,** 2008). This research method is based on a holistic perspective and aims to analyze the configuration effects of interaction conditions on results, discovering multiple different equivalent paths. Configuration theory

and QCA method, as a paradigm based on holistic analysis of multi factor configuration effects, have been widely applied in multiple management fields(**Ragin,** 2008). Traditional statistical analysis methods generally include variables other than the main effect in the analysis by defining mediator and moderator variables, but limit the intrinsic relationship of all independent variables in explaining the variation of the dependent variable(**Fiss,** 2011; **Ragin,** 2008). This study does not focus on the effect of a single independent variable on the dependent variable, but rather on the antecedent configuration of social phenomena(**De Crescenzo et al.,** 2020; **Acquah et al.,** 2021). Therefore, the QCA method is highly applicable to this study. Fuzzy set qualitative comparative analysis (fsQCA) allows researchers to calibrate variables to arbitrary values between fully membership and completely non membership. Compared to clear set qualitative comparative analysis (csQCA) and multi value set qualitative comparative analysis (mvQCA), fsQCA further enhances the ability to analyze distance and ratio variables. At the same time, it also has unique advantages in dealing with changes in degree and partial membership issues(**Kaya et al.** 2020, **Duarte and Pinho** 2019). Therefore, the fsQCA research method is better suited to the questions that this study aims to explore compared to other research methods. Therefore, this paper uses the fsQCA method to select 105 Internet enterprises to carry out brand extension activities to explore the path of their brand equity premium accumulation.

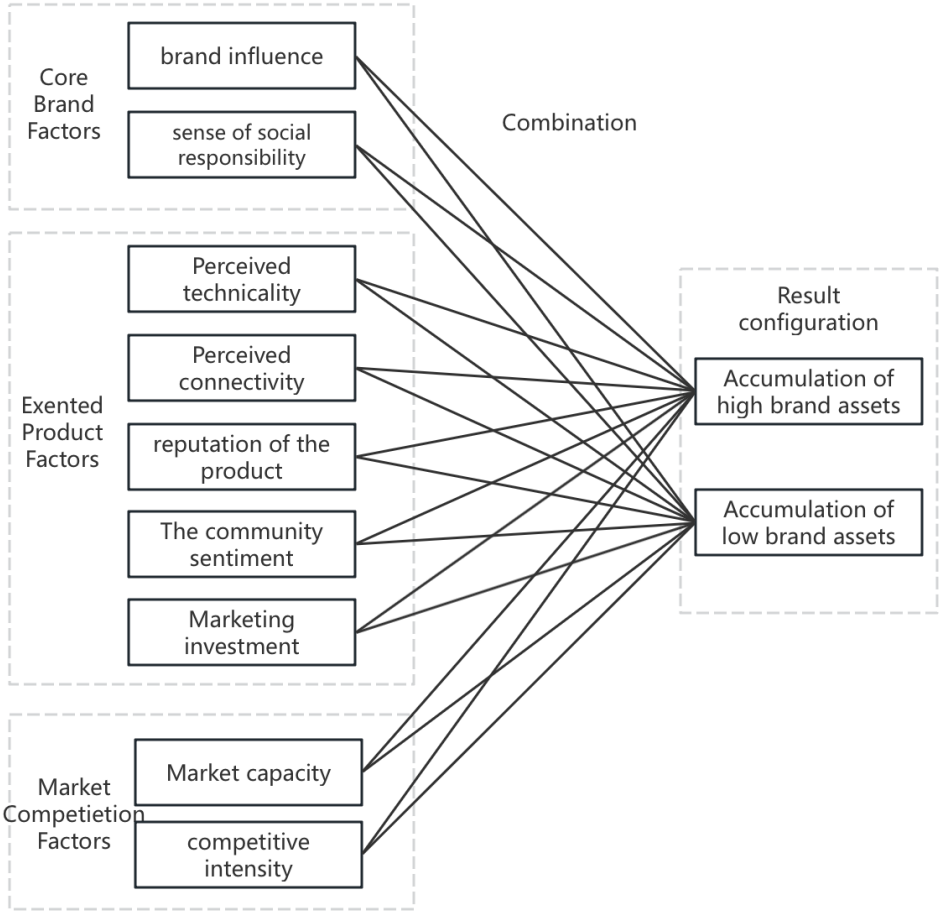

Figure 1 Conceptual model

1.Data collection

As a mainstream Internet application download center at present, Apple App Store has huge influence and sufficient users, which can ensure the quality and quantity of brand case study data. Therefore, this paper selects 300 Internet application brands in daily tools, entertainment, education and training, financial management, social media, life and other fields as the research object through random selection. In order to ensure the reliability of the data, this article first excluded 132 applications that did not have brand extension activities. On this basis, a total of 63 applications with less than 10000 comments were further excluded, resulting in 105 measurable samples.

Online comments on Internet applications can reflect consumers' subjective evaluation of the use of the app and their psychological experience, as well as their satisfaction and attitude towards the brand. Therefore, this article crawls the comment data of 105 selected applications on the App Store using a Python crawler method(**Lei et al.,** 2020; **Song et al.,** 2023). Subsequently, data filtering was conducted, and the more words a comment contains, the more information it reflects. Therefore, a large number of invalid comments (such as highly repetitive comments, comments unrelated to application information, and positive review template comments) were removed in descending order of word count(**LIU et al.,** 2021). After data filtering, the top 2000 comments with the highest word count will be retained, and their comments will be subjected to text mining and sentiment analysis to reflect variables such as consumer reputation, perceived technicality, and emotional tendencies.

Table 2 Variable measurement methods 、 Reliability and Validity

Measurement indicators	Measuring Method	load	Cronbach's α	C.R.	AVE
Parent brand influence	Search engine index	0.76	0.916	0.947	0.855
Brand social responsibility	Brand Enterprise Public Opinion News	0.87	0.843	0.932	0.873
Perceived technicality of applications	Jieba Chinese word segmentation program statistics word frequency	0.79	0.841	0.905	0.760
Perceived connectivity of extended applications	Degree of similarity between the extended application and the parent brand name	0.78	0.864	0.911	0.853
Extended application reputation	App Store's rating system for applications	0.83	0.895	0.934	0.826
Extended application community emotions	SnowNLP Text Sentiment Analysis Program	0.79	0.900	0.938	0.834
Marketing investment for applications	Recommended location ranking and assignment for each application	0.69	0.807	0.904	0.759
Market capacity of applications	Number of similar applications launched for each application	0.82	0.855	0.929	0.867
Competition intensity of applications	Calculate CR4 and CR1 scores for similar applications	0.78	0.914	0.947	0.856
Brand asset premium	Jieba Chinese word segmentation program statistics word frequency	0.86	0.922	0.918	0.847

2. Anchor point determination and variable calibration

FsQCA analysis is based on the idea of sets, so it is necessary to calibrate the data by converting it into a set membership degree of 0-1 for further analysis. Considering that the variable data in this article are all discrete variables, and their measurements are mostly derived from text analysis, the calibration method lacks external and theoretical standards(**Fiss, 2011**; **Ragin,** 2008). Therefore, the direct calibration method is adopted. The quartile based on sample statistics will be used as anchor points for calibration, with 25% quantile, 50% quantile, and 75% quantile representing complete non membership, crossover, and complete membership, respectivelys(**De Crescenzo et al.,** 2020;**Acquah et al.,** 2021).Using the fsQCA method to calibrate all data, it was found that the membership score appeared to be 0 In further case analysis, due to the software's inability to determine 0 Whether 5 is biased towards affiliation or non affiliation will exclude this case(**Acquah et al. ,**2021, **Kaya et al.** ,2020, **Duarte and Pinho,** 2019). To avoid this situation, for values with a fuzzy set membership score of 0.5, a constant of 0.001 will be added.

3. Common method bias and measurement reliability and validity

Harman single factor method was used to test for common method bias in the data, and it was found that the variance explained by the first factor was 35.41%, which was lower than 40%, verifying that there was no significant common method bias in this study. Secondly, SPSS 23.0 and AMOS 24.0 were used to analyze the reliability and validity of the scale. The Cronbach's reliability coefficient (a), combination reliability (CR), and average extracted variance (AVE) indicators are shown in Table 2. The a values of each variable are all greater than 0.7, indicating that this scale has high reliability. In addition, the AVE values of the variables are all above 0.5, and the CR values are all above 0.7, indicating that this scale has high convergent validity. Meanwhile, as shown in Table 2, the square root values of AVE exceeded the correlation coefficients between the corresponding variables, indicating that this scale also has good discriminant validity.

Table 3 Variable correlation coefficient and AVE square root

	M	SD	1	2	3	4	5	6	7	8	9	10
Parent brand influence	3.86	1.16	0.71									
Brand social responsibility	4.79	1.49	0.35***	0.86								
Perceived technicality of applications	4.39	1.21	0.42***	0.46***	0.88							
Perceived connectivity of extended applications	3.96	1.21	0.44***	0.44***	0.43***	0.72						
Extended application reputation	4.47	1.22	0.21***	0.37***	0.49***	0.35***	0.81					
Extended	4.73	1.14	0.56	0.38	0.31	0.43	0.53	0.86				

application community emotions			***	***	***	***	***					
Marketing investment for applications	4.18	1.16	0.34 ***	0.29 ***	0.42 ***	0.39 ***	0.32 ***	0.43 ***	0.81			
Market capacity of applications	4.23	1.15	0.41 ***	0.34 ***	0.38 ***	0.28 ***	0.43 ***	0.37 ***	0.61 ***	0.77		
Competition intensity of applications	4.19	1.31	0.36 ***	0.41 ***	0.19 **	0.41 ***	0.37 ***	0.20 ***	0.34 ***	0.42 ***	0.73	
Brand asset premium	3.94	1.23	0.29 ***	0.52 ***	0.30 ***	0.36 ***	0.28 ***	0.26 ***	0.42 ***	0.38 ***	0.45 ***	0.79

Note: The diagonal value is the square root of AVE p<0.05，***p<0.001*

4.Qualitative Comparative Analysis Based on Fuzzy Sets

This article uses the fuzzy set qualitative comparison method (fsQCA) to analyze the interaction between core brand image (influence, social responsibility), extended product characteristics (perceived quality, emotional inclination, reputation, marketing investment), and extended market characteristics, in order to identify the configuration that achieves high brand asset premium accumulation.

(1) Analysis of necessary conditions

After calibrating data through software, it is necessary to detect in advance whether there are necessary conditions among the antecedent conditions that lead to the expected results. The necessary condition analysis results of the data in this study using fsQCA 3.0 software are shown in Table 4 (**De Crescenzo et al.,** 2020; **Acquah et al.,** 2021). The results show that the perceived practicality of extended applications and the reputation of extended products are necessary conditions for consumers to accumulate high asset premiums for the parent brand (consistency greater than 0.9). This factor can be considered important because they have a high coverage (0.50 and above). A necessary condition is a condition that must exist to cause the result to occur, but the existence of a necessary condition does not guarantee that the result will necessarily occur. It still needs to be combined with other factors to produce the corresponding result. In addition, although the factors of perceived utility and reputation passed the necessity test in the above necessity analysis, the degree of agreement did not fully reach 1, which may occur in some special cases. Therefore, these two conditions will be added to the variable list for analysis again when conducting configuration analysis.

Table 4 Analysis of the necessity of a single antecedent condition

Precedent conditions	Accumulation of high brand assets		Accumulation of low brand assets	
	Consistency	Coverage	Consistency	Coverage
Parent brand influence	0.642742	0.70049	0.678769	0.454624
～Parent brand influence	0.639023	0.757336	0.564763	0.411341
Parent brand's sense of social	0.728656	0.78244	0.640717	0.422824

responsibility				
～Parent brand's sense of social responsibility	0.601937	0.725158	0.682268	0.505127
Perceived technicality of applications	**0.935168**	0.813787	0.61484	0.368183
～Perceived technicality of applications	0.491022	0.667998	0.70098	0.586063
Perceived connectivity of applications	0.841044	0.868352	0.567312	0.321716
～Perceived connectivity of applications	0.404374	0.596751	0.779795	0.70722
Extend the reputation of the product	**0.974646**	0.945197	0.456413	0.342248
～Extend the reputation of the product	0.600372	0.637488	0.93858	0.612655
The community sentiment of the application	0.785997	0.859919	0.454263	0.305428
～The community sentiment of the application	0.504575	0.595508	0.803599	0.582862
Marketing investment for applications	0.594403	0.66874	0.727331	0.50289
～Marketing investment for applications	0.697588	0.799529	0.53284	0.375316
Market capacity of applications	0.649787	0.791525	0.562376	0.421003
～Market capacity of applications	0.664122	0.706207	0.733461	0.47932
Competition intensity of applications	0.625667	0.736763	0.639758	0.462983
～Competition intensity of applications	0.683399	0.749236	0.648197	0.436733

Note: ~ represents non in logical operations.

(2).Configuration analysis

After analyzing the necessary conditions, different configurations of antecedent conditions were obtained using the fsQCA 3.0 truth table algorithm. The truth table lists all possible antecedent condition configurations, i.e. 18 potential configurations. Each sample will be assigned to these 105 configurations, so some configurations may not have samples, while others may include multiple samples. Then reduce the number of rows in the truth table by setting frequency thresholds and consistency levels. Considering the minimum number of cases required for the solution and the sample size of this article, the frequency threshold is set to 1; Considering that preserving the configuration requires compliance with sufficiency requirements, the threshold for RAW Consistency is set to 0.80, and the threshold for PRI Consistency is set to 0.75.

Simplify the truth table into simple combinations based on Boolean algebra algorithm logic. By comprehensively applying simple and difficult counterfactual analysis, fsQCA will obtain a Similar Solution, and the result of using only simple counterfactual analysis will be an Intermediate Solution. By combining the results of the simplified solution and the intermediate solution, it can be explained whether the elements are auxiliary or core conditions in the process of generating the results. Specifically, the conditions that only appear in the intermediate solution results are auxiliary conditions, while the conditions that appear in both the intermediate solution and the reduced solution results are core conditions [21]. According to the simplified and intermediate solutions calculated by fsQCA 3.0 software, the conditional configurations that lead to high social presence are shown in Table 4. Table 4 shows that there are four antecedent configurations that can cause extended products to accumulate high asset premiums for the parent brand, demonstrating the important

characteristic of the configuration perspective of "different paths leading to the same destination".

In qualitative comparative analysis, consistency and coverage indicators are important indicators for determining the relationship between different antecedent configurations and outcomes. The results of this study indicate that the consistency of the conditional configurations that lead to the accumulation of high brand assets is greater than 0.8, indicating that all four antecedent conditional configurations in this study are sufficient conditions for the accumulation of high asset premiums. Compared with other configurations, the consistency of configuration H4 is relatively high, indicating that the consistency of cases belonging to the same result is the highest for this configuration. The overall coverage of the configuration that leads to high social presence is 0.76, indicating that the results of fsQCA treatment explain approximately 76% of the reasons for the accumulation of high asset premiums. From the original coverage and unique coverage, it can be seen that configurations H1 and H4 have a greater explanatory power for the accumulation of high brand asset premiums.

Table 5 Realize the configuration of accumulating high brand assets

conditional variable \ configuration	H1	H2	H3	H4	H5	H6	H7
brand influence	●	⊗	●		●	●	⊗
sense of social responsibility					●	●	●
Perceived technicality	●	●	●	●	●	●	●
Perceived connectivity	●	⊗	●		●	●	⊗
Reputation of the product	●	●	●	●	●	●	●
The community sentiment				●	⊗	●	●
Marketing investment		●	●		●	⊗	●
Market capacity	●	●	⊗	⊗	⊗	⊗	⊗
competitive intensity	⊗	⊗	●	●	●	●	●
consistency	0.93	0.96	0.94	0.93	0.98	0.92	0.97
Original coverage	0.59	0.61	0.53	0.49	0.62	0.63	0.58
Unique coverage	0.02	0.01	0.04	0.07	0.03	0.10	0.06
Overall consistency	0.94						
Overall coverage	0.77						
● indicates the presence of a conditional variable, ⊗ indicates the absence of a conditional variable, where the large circle represents the core condition,Small circles represent edge conditions; Spaces indicate that variables are irrelevant							

(3).Robustness test

In QCA research, robustness testing of analysis results is essential. Given that QCA is a set theory method, this paper uses a method of changing the consistency threshold for robustness testing(**Ragin,**2008). When conducting robustness testing, a stricter threshold was used for result analysis, increasing the consistency threshold from 0.80 to 0.85. The results show that it has similar condition combinations, consistency, and coverage to the original model, indicating the robustness of the research conclusions in this paper.

Research Conclusion

Based on the data analysis results of fuzzy sets, namely the brand equity accumulation values corresponding to the scoring combinations of different Internet extension products, the following conclusions can be drawn:

Conclusion 1: For all Internet enterprises that carry out brand application extension, the perceived technicality and reputation of extension application are necessary conditions for the success of extension application, and also important factors for parent brands to accumulate asset premium.From the analysis of the necessary conditions of a single factor, it can be seen that consumers' perception of the technicality and reputation of the extended application (i.e. previous users' feelings or evaluations of the application) are two necessary conditions for the success of the extended product. This conclusion is mutually confirmed with the research results of previous scholars(**Steinberg,** 2020) . For Internet products, if consumers' perception of the application is less practical and their satisfaction with the service they want is not high, then their evaluation of the application will be low, and they will also have negative feedback on the attitude of the parent brand. For example, Tencent, a famous Internet enterprise, once developed an online application called "Tencent Medicine", which claimed that it could measure food calories to help consumers optimize their eating structure. But only for unprocessed food, the recognition accuracy for cooked food is low, so it cannot meet the actual needs of consumers and has not achieved corresponding success. In addition, consumers still play an important role in perceiving the technicality of extended products. For users, even if an application service can greatly meet their needs, it is difficult to achieve great success if the learning time and cost of using the application are too high. As an enterprise that has achieved great success in the field of short video, "ByteDance" has conducted extended development on short video clip applications. In the past, the cost of video editing was too high, requiring users to engage in specialized learning and invest significant practice time. And this extended application, with its low perception technology and pre developed template tool, can help users quickly get started with editing related operations, greatly improving the user experience.

As the second core factor affecting the success or failure of extended products, word-of-mouth cannot be ignored. By analyzing the selected extended cases, it can be observed that all cases that have accumulated high brand asset premiums have received high ratings from consumers for the word-of-mouth of extended applications. In addition, if the existing market has already developed a negative attitude towards the extended application and consumers have a relatively negative evaluation, it will bring great difficulties to the subsequent extension process of the application. For example, Baidu once attempted to extend and expand into the food delivery field, developing an application called "Baidu Food Delivery". However, due to its own unreasonable application settings and poor service capabilities, it often encountered problems such as timeout and inability to deliver, resulting in a decline in its reputation among consumers and ultimately being banned by the market. Therefore, actively encouraging users and participants to conduct high-quality word-of-mouth evaluation and scoring can greatly improve the success probability of Internet extension products

Conclusion 2: When the target market of Internet extension applications is in the "blue ocean", that is, the market capacity is large and the competition intensity of application products is small. Core brands can leverage their high brand influence and perceived connectivity to transfer consumers' high-quality impressions of the parent brand to extended products, thereby guiding consumers to develop a positive perception attitude towards the application and accumulating premium brand assets. If its own core brand influence is weak, it should strengthen marketing investment and awaken consumers' awareness of the brand.

From the configuration H1, it can be seen that Internet brands with high brand influence, high perceived connectivity and high reputation are more likely to succeed in the process of application extension. Analyzing the reasons, it can be concluded that in the "blue ocean" market environment, consumers' needs for such services have not been reasonably met, and the competition intensity for such products is not fierce(**Wang and Liu**, 2020). Therefore, when a brand with high influence enters the field, it can rely on its accumulated resources and audience to spread the message. Due to the high level of consumer awareness and trust in such brands, consumers also update their tendencies and develop a more positive attitude and usage tendency towards this application. For example, when Tencent extended its short video application market, it developed an application called "Tencent Weishi", which uses its existing channels and accumulated users for coverage and dissemination. A large number of users accumulated in a short period of time. Obtained high praise and trust from consumers towards the parent brand.

However, from configuration H2, it can be seen that in the blue ocean market, if the parent brand lacks brand influence, then the core brand should strengthen its marketing investment and promotion in the process of brand extension if it wants to accumulate high asset brands. The reason is that in this context, due to the lack of influence, the brand's own audience base is relatively weak, and there is a lack of a broad fan base and customer loyalty. Therefore, it is very important to quickly make consumers understand and trust the brand, and marketing and advertising methods can directly and quickly compensate for consumers' perception of the brand, guiding them to trust and support it. At the same time, due to the high conversion rate of marketing investment in the "blue ocean" market, strengthening marketing investment in it can to some extent compensate for the negative impact of insufficient influence of core brands on extended applications. A classic case is the "Didi Chuxing" ride hailing app extended by Beijing Xiaoju Technology. Due to its unique service, this app recruits drivers and converts private cars into ride hailing services. On the other hand, it is necessary to quickly attract users for use and consumption. Therefore, in the early stages of operation, the marketing expenses spent by its parent brand once accounted for over 50% of its total revenue. Of course, nowadays, this application has also become the largest ride hailing platform in China.

Conclusion 3: When the target market of Internet extension applications is in the "Red Sea", that is, the market capacity is small and the application competition intensity is high. Core brands not only need to ensure that their applications have good perception technology and high-quality consumer reputation, but also can help extend their applications to achieve success by strengthening marketing investment and brand community operations, thereby gaining a higher accumulation of brand asset premium.Through the analysis of configurations H3 and H4, it can be seen that both configurations have strong market competition, but both have accumulated high brand asset premiums. The reason for this can be found that both configurations have obtained element tests in brand community operation and marketing. Therefore, it can be proven that on the one hand, building good customer relationships with consumers, creating intimate community environments, and actively maintaining emotional resonance and interaction with consumers through extended applications can still gain

consumer recognition of the core brand in a competitive market, thereby accumulating higher brand asset premiums. Meanwhile, by configuring H4, it can be observed that when consumers choose extended products due to the high-quality community operation provided by their extended applications, which brings them good emotional perception, the influence of their core brand becomes less prominent. This indicates that even companies with weaker original core brand influence can still accumulate asset premiums for their core brands in a fiercely competitive market by strengthening their emotional investment, selecting suitable target audiences, creating good community service relationships, and creating high-quality emotional application experiences for consumers. A classic case in this scenario is the development of the music software "NetEase Cloud Music" by NetEase. This application not only focuses on the enjoyment of music, but also emphasizes the exploration of the stories behind music, encouraging every listener to write down their own insights and thoughts. This kind of interactive music sharing has won the favor of a large number of music enthusiasts. At the same time, the application also creates an online community where fans can interact and communicate intimately with singers, greatly satisfying the emotional demands of the audience. Therefore, even in the fiercely competitive music application market, this application service software still occupies an important position, has gained numerous loyal fans, and accumulated rich premium assets for the parent brand.

On the other hand, in the "red ocean" market, due to the intense competition of applications, consumers have more opportunities to choose from available services. Therefore, continuous marketing and promotion have become particularly important. Which application product is exposed to the audience's field of view more frequently and for a longer period of time, and the number of downloads for consumers will also increase. Therefore, it is necessary for core brands to strengthen their investment in marketing and promotion of their extended products, choose suitable platforms and channels for their extended products, strengthen publicity efforts, in order to obtain more download opportunities. In the case studied in this article, Tencent's "Yuanmeng Star" leisure club, Doudou, adopted this high marketing investment extension approach. In the case of fierce competition in the mobile game market, its competitors are also Internet giants with abundant resources, and the brand influence and reputation of all parties are not much different. Therefore, Tencent invested over 10 billion yuan in promotional expenses during the early stages of game promotion, and combined its own channels and platforms for endorsement and promotion, which successfully obtained some resources in the leisure and entertainment mobile game market, giving its extended products the opportunity to be recognized and understood by consumers.

Conclusion 4: When the target market of Internet extension applications is in the "Red Sea", that is, the market capacity is small and the application competition intensity is high. Core brands not only need to ensure that their applications have good perception technology and high-quality consumer reputation, but also can gain consumer recognition by strengthening their own sense of social responsibility and carrying out relevant public welfare activities. The combination of the above three factors can enable extended applications to gain consumer recognition and favor in the highly competitive Internet and application market, so as to strengthen the asset premium accumulation of its core brands.

From the perspective of configuration H5、H6 and H7, the intensification of market competition has posed a greater challenge to the extension of Internet brand applications. As more and the same kinds of applications have emerged in the market for consumers to choose from, and enterprises with strong brand influence have also participated in the competition, consumers are no longer sensitive to the extension advantages brought by the original brand. Therefore, under the condition that various extension applications have roughly the same

investment in marketing and advertising, it can be seen from the truth table that the social responsibility of the original brand has become particularly important. This research conclusion also indirectly confirms the existing research viewpoint that consumers' perception of corporate social responsibility is becoming stronger, and their positive attitude towards brand image is also becoming more positive. So the brand will have more advantages in the extension field. Consumers and businesses are both bearers of social responsibility for public welfare. Jiang(2019)pointed out in her research that when consumers choose companies that make social contributions such as public welfare and environmental protection, they often see themselves as part of the responsibility. Therefore, it will positively affect their own consumption satisfaction, strengthen their positive impression of the brand, and help the brand accumulate intangible premium assets.

A representative case in this category is Alibaba's extended application "Ant Finance". The Internet application competitive products in the financial field are relatively fierce. Not only various Internet head brands develop online financial services, but also banks, securities and lending companies have participated in the competition. The key to Ant Financial standing out among many competitors is that, on the one hand, the application cleverly binds the green tree planting activities related to social responsibility with consumers, promising that consumers will participate in tree planting activities simultaneously when investing and managing their finances on the application, capturing consumers' active commitment to green social welfare responsibilities. At the same time, its parent brand Alibaba has continuously participated in public welfare activities, establishing a good brand public welfare image and helping it open up the consumer market for users.

Conclusion and Prospect

To explore the driving path of the extension activities of online brands on their brand asset accumulation, this article collects and analyzes data from the Apple App Store, and uses the fuzzy set qualitative comparative analysis (fsQCA) method to explore the impact of core brand image (influence, social responsibility), extended product characteristics (perceived technicality, perceived connectivity, community sentiment, reputation, marketing investment), and extended market characteristics on brand asset accumulation. The research finds that the accumulation of high brand equity in brand extension activities is caused by the joint configuration of multiple factors in the Internet context(**Whelan and Clohessy,** 2021; **Zhang,** 2020; **Cai et al.,** 2021). The connection between various factors will form different paths, and finally seven paths for Internet enterprises to form high brand equity premium accumulation when carrying out brand extension activities are obtained. Each path is composed of different factors, reflecting the combination of multiple equivalent antecedents of core brand image and extended product characteristics. The perceived technicality and reputation of extended products are the biggest driving forces for enhancing brand asset premium accumulation; Brand influence, social responsibility, and community sentiment are important factors in enhancing the premium of brand assets; But the above factors need to be combined with the market environment of specific extended products. Based on the above conclusion, the following insights can be drawn:

1. In the process of brand extension, Internet enterprises pay attention to the improvement of perceived technology of extension applications and consumer reputation.

The perceived ease of use and perceived practicality of extended applications are important factors that affect whether consumers download them. Therefore, on the one hand, enterprises need to fully understand and research the consumer groups targeted by the application, understand the actual needs of users, and develop applications with high perceived practicality. On the other hand, attention should also be paid to the usability of application products, and the threshold for operation and use can be simplified for different user groups. The

analyzed cases all indicate that products with low usability can gain positive recognition from consumers. In addition, companies need to attach importance to improving their reputation and actively encourage users to give praise and evaluations in order to enhance the reputation of their products.

2. Select different combinations of extension strategies based on different market conditions.

This article analyzes two different market environments, "blue ocean" and "red ocean". It can be seen that most Internet enterprises choose different extension strategies in different market environments. In the "blue ocean" market, companies with high brand influence can strengthen customers' perception of the connection between extended products and their parent brand through the advantages of their parent brand, and leverage the competitive advantage of their parent brand to carry out extended behavior. Enterprises with lower influence can stimulate consumers' perception of extended products by strengthening marketing investment, thereby helping to open up the market for extended products. In the "Red Sea" market, enterprises need to pay more attention to maintaining community emotions, establish good emotional communication relationships with consumers, create rich and colorful community experiences for consumers, and attract user attention through emotional marketing to gain extended advantages. In addition, enterprises also need to focus on cultivating their own sense of social responsibility. For strong enterprises, strengthening investment in social welfare activities will bring unexpected competitive advantages in their extended activities.

3. For Internet enterprises, brand extension and brand equity are two-way promoting relationships.

Through the analysis of the case in this paper, it can be concluded that for Internet enterprises, highly influential parent brands will provide many competitive advantages in the process of their extension activities, including stable customer groups, mature marketing channels and high advertising investment. These brand assets will help them quickly open up the market in the expansion of extended products, thereby attracting user attention. The success of extending applications can also help the parent brand accumulate brand assets in just one step, such as attracting new users, expanding profitable businesses, and so on. Therefore, it is also true that the current Internet enterprises, by fully measuring their own brand equity and brand influence, choose appropriate extension activities to help enterprises grow more sustainably and steadily.

At the same time, there are also shortcomings in the research aspect of this article. Firstly, this study used web crawlers to collect relevant data. Although a large number of invalid comments (such as highly repetitive comments, comments unrelated to application information, and positive review template comments) were removed to ensure the validity of the data, due to the subjectivity of the comments and the fact that some applications were too early, there may still be deviations in the situation. Secondly, although the theoretical framework used in this article already covers the main influencing factors such as core brand image (influence, social responsibility), extended product characteristics (perceived technicality, perceived connectivity, community sentiment, word-of-mouth, marketing investment), and extended market characteristics, there are still omissions that can be studied from different perspectives in the future. Finally, although this article attempts to validate research conclusions using the fsQCA method in a standardized manner, there is a lack of comparison with traditional quantitative research methods, and future research is worth further discussion.

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