Research On the Influencing Factors of Internet Product User Experience Based on FsQCA

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Abstract. The digital age has seen the rise of internet products. User experience is now key to success. This has led to a user-centric strategy becoming vital for staying competitive. It's used to deliver a seamless and satisfying user experience across all platforms. This paper explores the influencing factors of user experience of Internet products and their role mechanism on users' Net Promoter Score (NPS). But the existing research is insufficiently explored in terms of multi-factor linkage role mechanism. The study use the fuzzy-set Qualitative Comparison Approach (fsQCA), constructed the PLEASE model based on the three-factor theory of user experience. And then analyse the impact of six main factors on NPS. The study shows that: firstly, none of the 6 single factors constitute the necessary conditions for high NPS, but they generally contribute to achieving high NPS. The configuration analysis reveals multiple paths to improve NPS, including enjoyment-driven, ease-of-use-driven, synthesis-driven, and production-driven paths. Secondly, Internet products that excel in any of the dimensions of ease-of-use, productivity, or enjoyment can significantly improve NPS, as these dimensions are complementary in the user experience. The study not only enriches the theoretical framework of user experience, but also provides practical guidance for Internet product optimisation. This confirms the key role of NPS in measuring user experience and predicting business success.

Keywords: Internet Products, User Experience, Fuzzy-Set Qualitative Comparative Analysis, Net Promoter Score.

1. Introduction

With the rapid iteration of Internet products and the continuous growth of the number of Internet users worldwide, user experience has become a core element of corporate competition. According to Statista, by 2024, there are more than 5.4 billion Internet users globally, with an Internet penetration rate of 66 percent(https://www.statista.com/topics/1145/internet-usage-worldwide/) [1]. In today's competitive market environment, user experience has a direct impact on user stickiness and product reputation. What's more, it is also closely related to business revenue. Therefore, our study on the influencing factors of Internet product user experience can provide actionable path suggestions for Internet product optimisation. It is of great practical significance for enterprises to formulate user-oriented design strategies and enhance market competitiveness.

When exploring user experience, an important metric is Net Promoter Score (NPS). It is a tool that measures customer loyalty by asking customers the question, 'How likely are you to recommend our products or services to a friend or colleague?' to calculate the score. In our study, NPS is used as an indicator to evaluate user experience.

Research on user experience of Internet products mainly focuses on theoretical areas such as user experience design and user behaviour, as well as technical areas such as interface interaction (Liu, 2017) [1]. However, studies on what affects user experience are scattered. They mainly look at one factor at a time, such as user satisfaction and how easy it is to interact with the product (Wang, et al., 2020; Angosto, et al. 2023) [2][3]. Existing studies lack systematicity and universality, especially in-depth multi-case studies to analyse user experience of Internet products and its influencing factors. We will use a multi-case analysis method to explore the factors affecting the user experience of internet products. It will consider multiple dimensions, to propose optimisation strategies. This

method provides a more comprehensive perspective and enhances the generalisability and applicability of the research results.

Our study is based on the background of rapid iteration of Internet products.It draws on the HEART model and applies the fuzzy-set Qualitative Comparison Approach (fsQCA) based on the group perspective. Our work is as follows. Firstly, based on the theory of three elements of user experience, the study draws on the HEART model to sort out six major factors that may affect the user experience of Internet products. Secondly, fsQCA is applied to explore whether and to what extent individual factors are necessary to influence NPS. Finally, the multifaceted paths to enhance NPS and their functioning mechanisms are analyzed from a configuration perspective. This provides theoretical and practical insights for improving user experience.

2. Literature Review

The current research on the factors influencing user experience with internet products and ways to improve it can be grouped into two categories.

(1) Internet products research

Li, et al. (2024) pointed out that Internet products need to follow the consistency and customization of user experience design. And he emphasizes the consistency, personalisation, and the fit of the interface with the user's habits in order to enhance pleasure and long-term memory [4]. The study by Stefano, et al. (2020) showed that a UX framework based on elements like utility and subjective feelings can move the collaborative work of different people, such as engineers and UX specialists [5]. Xia, et al. (2022) explored mobile Internet product usage scenarios and user experience design, providing an in-depth analysis of user experience design for mobile Internet products [6]. A study by Wakefield, et al. (2011) showed how social features on websites affect how much people use them [7].

(2) Factors influencing user experience research

In Xu Wei's (2024) research, he pointed out that there were new needs of user experience and proposed a 'user experience 3.0' paradigm framework and methodology [8]. These included ecological, innovation-enabled, AI-enabled, human-intelligence-interaction experience methods. Given the extensive research conducted in this field, most of the scholars' studies on the factors influencing the user experience of Internet products in recent years have focused on the research aspect. Hu's (2021) study showed that pop-up videos play a role in UX. Its research led to the conclusion that its influencing factors include: visual, content, emotional and functional perception [9]. Besides, more scholars in recent years have linked it to AI. For example, Liao, et al. (2021) have shown people can improve their user experience by driving AI technology choices through their existing needs [10].

In conclusion, existing studies on Internet products and user influencing factors have provided a rich theoretical foundation and empirical experience for exploring the path of NPS enhancement. But there is also room for further exploration. On the one hand, the existing empirical studies are dominated by single-case descriptive analyses. And in the context of the current booming Internet industry, the conditions are in place to carry out multi-case studies. On the other hand, considering that NPS is often affected by multiple and complex factors, fsQCA is more advantageous and can better reveal the complex mechanism of multi-factor linkage. The reason is that it can analyse the combined effects among variables.

3. Research Methods

3.1. Methods

Through other studies, drawing on the HEART model proposed by Google and 'the elements of user experience', 6 conditional variables affecting the impact of user experience of Internet products are sorted out and named PLEASE model after their initials. And the user's NPS is used as an outcome variable of user experience (Daniel, 2024; Rodden, et al., 2010) [11][12]. As a result, we categorize these

6 conditional variables into the 3 dimensions derived from the three-component theory of user experience. They're ease-of-use, productivity and enjoyment. These 3 aspects don't independently have an impact on platform user activity. They work through interactions and combined linkages (Wei, 2024) [13]. Thus, the research idea of our study is shown in Figure 1.

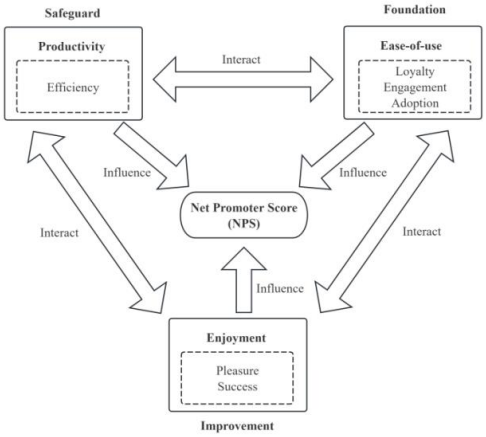

Figure 1. Research ideas on user experience influencing factors

However, the exact mechanism between these conditional variables and the outcome variables has yet to be studied in depth. To analyse how these conditional variables affect the user experience of Internet products, we adopt fsQCA for the following reasons.

Firstly, we obtain 205 valid questionnaires through questionnaire distribution. It's a small to medium-sized sample. fsQCA method is suitable for this type of sample as it provides robust analytical results even with a small sample size (Shi, 2021) [14]. So, it's an ideal choice for our study.

Secondly, as there are 6 conditional variables as influences in our study (Wang, et al., 2018), there is a complex causal relationship with the outcome variable of user experience [15]. fsQCA can identify and analyse such complex causal relationship, which is well suited to the needs of us (Shi, 2021) [14]. Moreover, relative to other QCA methods, fsQCA is able to identify combinations of conditions. It leads to a particular outcome and the results of the analysis are highly interpretable.And this helps us to understand how different factors work together to contribute to user experience.

3.2. Questionnaire Collection and Sample Characteristics

In our study, 205 valid questionnaires are obtained by distributing questionnaires online. The descriptive statistics of the sample are shown in Table 1.

Table.1. Descriptive statistics of the sample

Classifications		Value	Percentage
Gender	Male	110	53.66%
	Female	95	46.34%
Educational Background	College and below	24	11.71%
	Bachelor	147	71.71%
	Masters and above	34	16.59%
Age	Under 18	7	3.42%

Table.1. (continued)

Age	19-25	110	53.66%
	26-35	54	26.34%
	Above 35	34	16.59%
Sum		205	100%

The ratio of males and females in our sample is close, with a large proportion of respondents having a bachelor's degree. Besides, the sample is concentrated in the 19-25 and 26-35 age groups. According to Du's study, youth groups are the main users of the Internet (Du, 2024) [16]. This means that the demographic group most able to support the demand for Internet products at present is in the 19-35 age group. Therefore, our study considers this sample to be representative.

3.3. Questionnaire Design

The questionnaire includes instructions, demographic information and scales. The instructions are mainly to facilitate the respondents' understanding of the influencing factors, as well as the purpose of the study. The demographic information includes gender, educational background, age, etc.The scale is mainly composed of 6 conditional variables and the outcome variable NPS, with seven questions (Alonso-Tapia, et al., 2022; Tong, et al., 2017), using a Likert scale. And the responses are scored on a scale of 1-5, with 1 indicating negative emotions such as 'Unimportant' and 'Dissatisfied' and 5 indicating 'Important', The larger the value, the more satisfied the respondent is with the Internet product experience [17][18].

The aim of our study is to investigate the factors influencing user experience of Internet products. Drawing on the HEART model and three-factor theory of user experience, 6 conditional variables affecting the impact of user experience of Internet products are sorted out and named PLEASE model with their initials. Then, a questionnaire with a total of 7 tier-1 indicators is constructed with NPS as the outcome variable. The details of the specific questionnaire are shown in Table 2.

Table.2. Variables and questions

Variables	Questions
Loyalty	To what extent are you satisfied with reliability and stability of Internet products?
Engagement	How often have you used Internet products recently?
Adoption	How receptive are you to newly launched Internet products or features?
Efficiency	Is efficiency important when using internet products for specific tasks?
Pleasure	How much do you think the first impression of an Internet product affects you ?
Success	Do you feel good after using the internet to do a specific task?
NPS	How likely are you to recommend the Internet products you have recently used?

3.4. Questionnaire Reliability and Validity Tests

We analyse the reliability and validity of questionnaire. The results are shown in Table 3.

For the reliability test, Cronbach's alpha is used. The results show that the Cronbach's alpha for the 6 conditional variables as well as the outcome variable NPS is greater than the recommended value of 0.7, indicating that the internal consistency test of the 6 factors can be passed.

For the validity, KMO is used to. The result shows that the KMO values for loyalty and the other 5 variables and the questionnaire variables consisting of NPS are all greater than 0.7. And it can be used for public factor analysis.

Table.3. Questionnaire reliability and validity tests

Variables	Cronbach's alpha	KMO
Loyalty	0.745	0.701
Engagement	0.812	0.802

Table.3. (continued)

Adoption	0.766	0.76
Efficiency	0.835	0.821
Pleasure	0.781	0.779
Success	0.822	0.812
NPS	0.85	0.793

4. Result Analysis

4.1. Variable Calibration

In fsQCA, calibration is the process of classifying cases into fuzzy sets. The calibrated degree of affiliation falls in the range of 0 to 1. To map the values of the conditional variables to the interval, the actual distribution of the conditional variable needs to be taken into account in the study and the values that represent a moderate degree of the condition variable are selected as the reference points for the calibration. (i.e., Full Affiliation, Crossover Point, and No Affiliation at all, in the Table 4, we refer to them as FA, CP, NA for short.)

In our study, 95%, 50%, and 5% are chosen as calibration points. Excel is used to calculate the crossover point for each variable. The calibration of each variable and the description of all the indicators are shown in Table 4.

Table.4. Indicator description and calibration of variables

Variables			Indicator description	FA	CP	NA
Outcome variable	NPS		1.People absolutely recommend Internet products after using them.	1	0.492	5
			2.People are likely to recommend Internet products after using them.			
			3.People hardly recommend Internet products after using them.			
Conditional variables	Ease-of-use	Loyalty	1.Users satisfies the reliability and stability of Internet products.	1	0.494	5
			2.Users think reliability and stability of Internet products moderately.			
			3.Users don’t satisfy the reliability and stability of Internet products.			
		Engage-ment	1.Users use Internet products multiple times a day.	1	0.351	5
			2.Users use Internet products multiple times a week.			
			3.Users hardly use Internet products.			
		Adoption	1.Users are open to newly introduced Internet products or features.	1	0.497	5
			2.Users think newly launched Internet products or features neutrally.			
			3.Users are object to newly introduced Internet products or features.			
	Producti-vity	Efficiency	1.Efficiency is an very important factor when using internet products.	1	0.359	5
			2.People are neutral about how efficiently internet products work.			
			3.Efficiency is not an important factor when using internet products.			
	Enjoy-ment	Pleasure	1.First impressions of Internet products are very attractive to users.	1	0.350	5
			2.First impressions of Internet products are general to users.			
			3.First impressions of Internet products have little appeal to users.			
		Success	1.Users feel a great sense of achievement and satisfaction after completing a specific task using an Internet product	1	0.852	5
			2.Users feel a general sense of achievement and satisfaction after completing specific tasks using Internet products			
			3.Users feel less achievement and satisfaction after completing specific tasks using Internet products			

4.2. Necessary Condition Analysis

In our study, fsQCA4.1 is used to analyse whether the 6 conditional variables constructed by the PLEASE model are necessary for NPS. As shown in Table 5. We find that for high NPS users,

although their coverage is generally high and explanatory, the consistency of the single conditional variables is below 0.9, the lower limit of necessity of the necessary conditions. This indicates that there are no necessary conditions for generating high NPS users. For non-high NPS users, only two conditional variables, non-high engagement and non-high impressions, has consistency above 0.9. This shows that these two variables are necessary to produce non-high NPS users.

Overall, the explanatory power that each individual condition variable has for NPS is weak. So, these antecedents are imported into fsQCA4.1 to find different condition groupings that affect high and non-high NPS.

Table.5. Indicator description and calibration of variables

Conditional variables		Outcome variable			
		High NPS		Non-high NPS	
		Consistency	Coverage	Consistency	Coverage
Ease-of-use	Loyalty	0.889	0.782	0.812	0.567
	~Loyalty	0.413	0.839	0.688	0.587
	Engagement	0.488	0.915	0.583	0.683
	~Engagement	0.831	0.762	0.927	0.531
	Adoption	0.769	0.775	0.841	0.528
	~Adoption	0.532	0.842	0.642	0.635
Productivity	Efficiency	0.401	0.924	0.495	0.718
	~Efficiency	0.875	0.736	0.944	0.478
Enjoyment	Pleasure	0.356	0.911	0.449	0.718
	~Pleasure	0.891	0.722	0.945	0.478
	Success	0.761	0.763	0.762	0.476
	~Success	0.478	0.763	0.621	0.618

* '~' indicates the none of a logical operation.

4.3. Configuration Analysis

We use fsQCA4.1 to conduct a configuration analysis of 12 conditional variables. Then we can achieve high (non-high) NPS and explore the multivariate pathways through which multiple factors produce high (non-high) NPS. Referring to existing studies and combining the sample size of our study, the sample frequency threshold is set to 3. The raw consistency (Raw) threshold to 0.8, and the PRI consistency threshold to 0.7. The core and edge conditions of each set of solutions are determined by analyzing the parsimonious solutions against the intermediate solutions (Liu & Huang, 2024) [19]. In the representation of the solution, we adopt the conventional practice of existing studies. '●' shows the presence of core condition. '●' shows the presence of edge condition. 'U' shows the absence of core condition. 'U' shows the absence of edge condition.The blank shows either presence or absence. The detailed results are shown in Table 6.

Table.6. Configuration for high and non-high NPS

Conditional variables		High NPS				Non-high NPS		
		H1	H2	H3	H4	NH1	NH2	NH3
Ease-of-use	Loyalty	U			U		U	U
	Engagement	●	●	●	U	●	U	●
	Adoption	●	●	●	U	●	U	U

Table.6. (continued)

Productivity	Efficiency	U	U	●	●	U	U	●
Enjoyment	Pleasure		U	●	●	U	U	●
	Success	●	U	●	U	●	U	U
Consistency		0.903	0.883	0.881	0.871	0.792	0.84	0.821
Coverage		0.448	0.243	0.641	0.193	0.411	0.235	0.267
Unique Coverage		0.032	0.029	0.096	0.03	0.113	0.056	0.081
Solution Consistency		0.857				0.814		
Solution Coverage		0.485				0.431		

4.3.1 Analysis of Driving Mechanisms for High NPS

The truth table shows that the consistency is higher than 0.8 for all 4 paths that produce high NPS groupings. This means that in at least 80% of the cases of these 4 combinations of conditions in our study, the combination of conditions also appears when the outcome appears. Therefore, we identify it as a sufficient condition for high NPS. The consistency of the solution is 0.857, also validating its adequacy. In addition, the solution coverage is 0.485. It means that these 4 paths explain 48.5% of the Internet product usage scenarios in which users generate high NPS.

In each of the other 3 paths, if each core condition that produces a non-high NPS configuration is not present, a non-high NPS result is produced. And the consistency of the 3 paths is essentially greater than 0.8, which can be recognized as a sufficient condition to produce a non-high NPS. The consistency of the solution is 0.814, which proves its sufficiency. Also, the coverage is 0.431, which means that the 3 paths can explain 43.1% of the users to produce non-high NPS.

Based on existing studies and reports, we use engagement, efficiency, and success as ‘labels’ for configuration naming. The 4 paths that generate high NPS are described below.

(1) Enjoyment-driven

H1 illustrates that when an Internet product has high success. This means that if people feel good after using an Internet product to complete a specific task, it will have a good product user experience, i.e., high NPS. This implies that high success is more important for high NPS performance than the other conditions. It’s because that it can alone constitute a sufficient condition to explain the generation of results. This means the success can removes the constraints imposed on the user experience of Internet products by objective factors such as ease-of-use, productivity, and enjoyment. The path can explain 44.8% of the high NPS cases, while about 3.2% of the cases are explained only by this path. In addition, this path has only success as a core variable in terms of enjoyment, so it is named ‘enjoyment-driven’.

(2) Enjoyment-driven

From H2, when an Internet product has high engagement, it needs to be accompanied by general user adoption to achieve a high NPS. Where engagement as a core condition and adoption as a complementary condition implies that users identify with or accept their existing or upcoming new products in the context of frequent use of the Internet product in order to achieve high NPS. Since these 2 conditions belong to ‘ease-of-use’, we name it ‘ease-of-use driven’. As the Table 6 shows, it can explain about 24.3% of the cases, and about 3% of are explained only by this path.

(3) Synthesis-driven

For H3, when an Internet product has high adoption, efficiency, impression, and success, the target should focus on efficiency and success as core variables. Adoption and pleasure are supplementary variables. This means that the higher the efficiency and success of an Internet product, the higher the focus on improving user acceptance and optimizing user’s overall impression of the product will help to achieve a high NPS. Since the 3 aspects of this path, ‘ease-of-use’, ‘productivity’, and ‘enjoyment’ interact with each other and lead to the result, it’s named ‘synthesis-driven’. This path can explain about 64% of the cases, and about 9.6% of the cases are explained only by this path.

(4) Production-driven

From H4, it can be seen that when an Internet product enables users to gain high efficiency, then it can also generate high NPS for users. That is to say, a company that focuses on solving the pain point of user's efficiency can also gain good user experience for its product. This path can explain 19.3% of the cases, and about 3% of the cases are only explained by this path.

4.3.2 Analysis of Driving Mechanisms for Non-high NPS

The causal asymmetry of the QCA approach implies that the presence or absence of an outcome needs to be explained separately using different 'combinations of causes' (Liu & Huang, 2024) [19]. So, to more comprehensively explore the driving mechanisms for improving NPS, we further analyse the configuration (pathways) that lead to non-high NPS, and the results are shown in Table 6.

(1) Configuration NH1: It shows that no matter how good an Internet product is in terms of ease-of-use and enjoyment. If the overall impression (Pleasure) giving to users is not good or even missing, then the users won't recommend it to other people, generating non-high NPS.

(2) Configuration NH2: Even if an Internet product can provide users with high loyalty, engagement, efficiency, and success, if users express non-high acceptance and adoption to its features, it will largely hinder the user experience.

(3) Configuration NH3: It's similar to the previous two configurations. If the user has a non-high adoption of its functionality and fails to generate a relatively high emotional value, i.e., a non-high success, then this will also generate a non-high NPS.

5. Conclusion, Recommendation and Outlook

5.1. Conclusion

The 6 conditional variables included in the PLEASE model constructed in our study can effectively improve the user experience of product use. And the key to the improvement of user experience lies in how to improve NPS. Based on the three-factor theory of user experience, we use the fsQCA4.1, combining with these 6 variables of user experience, and analyse the combination of ease-of-use, productivity and enjoyment aspects of achieving a high NPS of the platform from the configuration perspective. The conclusions of our study are as follows.

(1) Using the fsQCA, we find that none of the 6 conditional variables included in the PLEASE model constituted a necessary condition for achieving a high NPS. But these aspects play a more general role in achieving a high NPS for users.

(2) Analyzing from the configuration perspective with fsQCA4.1, we find that if an Internet product can satisfy one of the 3 aspects of users' ease-of-use, productivity or enjoyment, then it will have a relatively good user experience, that is, high NPS. When 'ease-of-use', 'productivity' and 'enjoyment' are all present in an Internet product, it is bound to have a high NPS.

(3) From non-high NPS configurations, Internet products that lack the 2 aspects of 'enjoyment' and 'ease-of-use', even if they make users more productive, it's hard to get high NPS from users.

And for the future, to address the limitations of our study, we will use qualitative research to improve the current theoretical model and to reduce the impact of selectivity bias. So, subsequent research will delve into the applicability and flexibility of the PLEASE model across various product and service types.And this aims to more accurately capture the dynamic shifts in user experience and their timely impact on user satisfaction and loyalty.

5.2. Discussion

The existing research mainly focuses on the Internet product itself or research of experience influencing factors. For example, some scholars investigated the relationship between Internet products and user experience design. Other scholars investigated that AI is also one of the user experience influencing factors, and that one can improve one's user experience through AI. In our study, however, the 6 conditional variables constructed in the PLEASE model are explored to what

extent they can have an impact on user experience, while fsQCA is used to analyse the multivariate paths to enhance NPS and their mechanisms of action from the configuration perspective.

5.3. Recommendation

Based on our study, there are 3 recommendations as follows.

Firstly, for Internet products that lack a high success, the user's sense of achievement and satisfaction can be enhanced by improving user experience, enhancing interactivity, personalisation, and product features, and collecting feedback. Through well-designed user interfaces and smooth operation processes, users can be made to feel a sense of success when using the products. At the same time, by providing personalized services and features to meet users' specific needs, it can increase users' sense of belonging. Active user feedback collection and rapid product iteration can increase the sense of success by making users feel that their voices are valued.

Secondly, in the case of products that exhibit low levels of engagement and adoption, it is essential to do the following things. Ensure that users possess a clear understanding of the product's functionality, are motivated to utilise it, and are aware of the avenues available to them for obtaining assistance when they initially encounter the product. The needs of users can be addressed through the processes of user research and feedback. This can facilitate the rapid iteration and improvement of a product, thereby enhancing user satisfaction and the frequency of use. Furthermore, product features are continuously added and enhanced in response to shifts in user requirements. An illustrative example is the evolution of WeChat from a basic chat tool to a comprehensive super-application.

Finally, for products that lack high efficiency, network requests can be optimized to reduce the frequency of data acquisition and packet size, add caching, and achieve data compression and delayed loading. In addition, technology and algorithm innovation and optimization can be used to improve the speed of Internet products in processing user demands and increase efficiency.

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