# A Study on the Impact of Consumers' Perceptions of Product and Service Innovation on Firms' Innovation Performance

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**Abstract.** With the development of globalization and informatization, enterprises face increasingly fierce market competition and changing customer demands, and innovation has become a key factor for their survival and development. Consumer product innovation and service innovation are essential aspects of enterprise innovation. This study aims to explore the impact of consumer product and service innovation perception on enterprise innovation performance to enhance innovation capacity and competitiveness. With guidance from theoretical foundations, this study focuses on relevant concepts and models such as consumer perceived value theory, rational action theory, game theory, transaction cost theory, resource-based view, and contingency theory. Consumer perceived value theory holds that customers' perception of product innovation depends on how much value it can bring to their lives. Rational action theory indicates consumers strive to maximize personal benefit when making decisions. In service innovation research, game theory and transaction cost theory emphasize the importance of the interaction and decision-making between customers and service providers. The resource-based view emphasizes the impact of enterprise resources and capabilities on innovation decision-making. At the same time, contingency theory points out the need for enterprises to adopt strategic, flexible, and adaptable strategies in uncertain environments. This study uses a questionnaire survey and structural equation modeling for data collection and analysis. The research model constructs the relationship between consumer product innovation, service innovation, and consumer satisfaction and analyzes the mediating effects. Research hypotheses include mediating effects of perceived product innovation, perceived service innovation, and consumer satisfaction. After verifying the reliability and validity of the data obtained through the questionnaire survey, structural equation modeling is used for data analysis to validate the research hypotheses. The results show that consumer product innovation and service innovation have a significant impact on enterprise innovation performance. The higher the consumer perception of product and service innovation, the better the enterprise innovation performance. In addition, consumer satisfaction partially mediates between perceived product innovation, perceived service innovation, and enterprise innovation performance, which means that satisfied consumers have a certain degree of mediating effect on the impact of product innovation and service innovation on enterprise innovation performance.

**Keywords:** Consumers; product innovation; service innovation; firm innovation performance; impact study;

# 1. Introduction

With the development of globalization and informatization, enterprises are facing increasingly fierce market competition and changing customer demands. Innovation has become an important dimension that businesses must pursue. The innovation of goods and services plays a crucial role in the sustainable development of enterprises. Consumer evaluation of products and services is one of the key indicators to measure a company's success. Therefore, how to maintain or enhance a company's innovation capability under ever-changing market conditions has become the core issue guiding its development. Consumer product innovation and service innovation are essential aspects of corporate innovation. Consumer perception of price is a rigid factor. At the same time, whether innovation can improve a business's market share and customer satisfaction becomes critical in consumer evaluation of remaining value. This study aims to explore the impact of consumer perception of product and service innovation on a company's innovation performance, as well as the mediating effect of consumer satisfaction, to enhance its innovation capability and competitiveness (Jian et al., 2021).

Section 2 of this article introduces the relevant theories and concepts of consumer product innovation and service innovation. The theory of consumer perceived value suggests that consumers' perception of product innovation depends on the value that innovation brings to their lives. Rational behavior theory argues that consumers seek to maximize their individual interests when making decisions. In service innovation research, game theory and transaction cost theory emphasize the interaction and decision-making between customers and service providers. The resource-based view emphasizes the influence of organizational resources and capabilities on innovation decisions, while the theory of bounded rationality points out that in uncertain environments, firms need to adopt strategic, flexible, and agile strategies (Edy & Supriono,2023).

Section 3 of this article presents the research methods, including the construction of research hypotheses, the design and data collection of the questionnaire survey, the data analysis methods, and the construction and hypothesis validation of the research model. The research hypotheses include the mediating effects of perceived product innovation, perceived service innovation, and consumer satisfaction. The research hypotheses are validated by conducting reliability and validity tests on the collected data and using structural equation modeling to analyze the data.

Section 4 of this article encompasses the research results and discussion, including findings from validity and reliability testing and structural equation modeling. The research suggests that consumer product and service innovation significantly impact a company's innovative performance [Daniel R J P,2023]. The higher the perception of consumer product and service innovation, the better the company's innovative performance. Furthermore, consumer satisfaction partially mediates the relationship between perceived product/service innovation and innovative performance, which indicates that satisfied consumers play a specific mediating role in the impact of product/service innovation on a company's innovative performance. The results of this study can provide a deeper understanding of consumers' perception and demand regarding product and service innovation, ultimately facilitating practical innovation (Huyi et al., 2021).

# 2. Relevant Concepts and Theoretical Foundations

## 2.1. Consumer Product Innovation Theory

### 2.1.1. Consumer Perceived Value Theory

The theory of consumer perceived value is a pivotal theory in the field of consumer behavior research, which has been widely applied. The theory posits that when purchasing a product or service, consumers do not only consider the product or service itself but also the additional value it provides. By means of subjective judgment and evaluation, the value perceived by consumers defines the level of satisfaction they have towards the product or service provided by a company (Li et al., 2021).

The research on the theory of consumer perceived value is conducted from different perspectives and dimensions. Zeithaml (1998) examines the overall value of a certain product or service from the

perspective of consumers' perception of gains and losses, where the subjective judgment on the overall evaluation is based on costs that consumers have to bear and the value acquired in return. This evaluation is grounded on the actual costs and benefits experienced by consumers, and it effectively measures the quality of the product or service provider. Woodruff et al. (1997) compare the perceived value generated by expected attributes and gains and losses attributes, claiming that consumers concentrate on both the attributes of the product or service and the perceived value brought about by their purchasing behavior. Keeney et al. (2011) investigate the theory of consumer perceived value from customer relationship management's perspective, stating that perceived value encompasses the difference between product value gained and cost paid from the consumer relationship management system of the company (Nabila et al., 2023).

In addition to the researchers mentioned above, many others have analyzed the theory of consumer perceived value from different angles and dimensions. Sweeney and Soutar (2001) discuss the formation and determinant factors of consumer perceived from the aspects of product quality, service quality, and perceived value. Holbrook (1994) explains the formation and influencing factors of perceived value from the two aspects of consumer experience and emotion. Rust and Oliver (1994) explore the influence of perceived value on consumer behavior from the degree and manner of meeting consumer needs.

In summary, the theory of consumer perceived value is a crucial theory in the field of consumer behavior research, with important implications for both theory and practice. Understanding consumer perceived value facilitates companies to make targeted innovations and improvements in product and service design, development, and marketing, increasing consumer satisfaction and loyalty, enhancing market competitiveness, and promoting sustainable development.

2.1.2. Rational behavior theory (physics)

The theory of rational behavior is a theory that examines the influence of human attitudes on their related behaviors, which is based on the assumption that human beings are rational and explains the behavioral decision-making process of individuals by analyzing their behavioral intentions, attitudes, subjective norms, and perceived behaviors ( Tu et al., 2023). The theory of rational behavior is represented as shown in Figure 1.
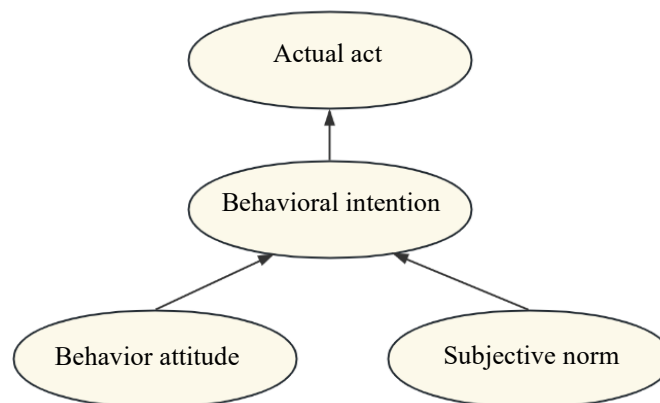


Fig.1: Theory of rational behavior

In the context of the theory of rational behavior, an individual's willingness to act is the immediate determinant of their behavior. This willingness is influenced by various factors, including the individual's attitudes, subjective norms, and perceived behavioral control. Attitudes refer to the individual's positive or negative emotional disposition when faced with specific stimuli, representing the individual's influence on their own behavior. Subjective norms, on the other hand, pertain to the social pressures and external circumstances that influence an individual's behavior under specific stimuli (Nabila et al., 2023).

The theory of rational behavior has further refined the framework of behavioral decision-making by introducing perceived behavioral control as a controlling variable. Perceived behavioral control refers to the driving or inhibiting forces generated based on an individual's subjective perception, which motivate or hinder the adoption of certain behaviors. Building upon the theory of rational behavior, Ajzen subsequently introduced the concept of perceived behavioral control, giving rise to the theory of planned behavior.

According to the theory of planned behavior, an individual's willingness to act is influenced not only by their attitudes and subjective norms but also by their perceived behavioral control. Perceived behavioral control encompasses the individual's subjective evaluation of factors such as ability, resources, and opportunities, as well as their perceived control over the outcomes of the behavior. The degree of confidence an individual has in their own abilities and their control over the outcomes of their actions directly influences their willingness to act and their actual behavior.
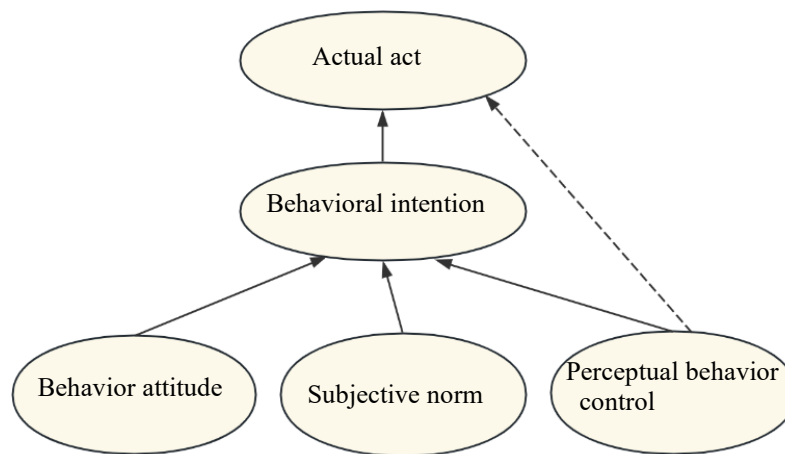
Fig.2: Planned behavior theory

In essence, the theory of rational behavior seeks to explain individual decision-making processes by analyzing attitudes, subjective norms, and perceived behaviors. This theory has extensive applications in studying individual consumption patterns, purchasing decisions, investment choices, and more. It allows businesses to better comprehend and influence consumer behavior, providing them with appropriate marketing strategies and decision-making support. Furthermore, the theory of rational behavior also provides a vital theoretical foundation for predicting and controlling individual behaviors (Elena et al., 2023).

## 2.2. Relevant theories in service innovation research

### 2.2.1. Game Theory

Game theory is a significant discipline aimed at investigating the outcomes resulting from the mutual influence and interaction of individuals or groups during decision-making processes, as well as how to maximize the interests of each participant. By abstracting the interactions and relationships between decision-makers into mathematical models, game theory defines and analyzes situations, strategies, and benefits, thus assisting people in making more rational and scientific decisions to a certain extent (Yang et al., 2023). The research scope of game theory extends beyond decision problems in the economic field and can be applied to other domains such as biology, sociology, politics, and culture. Game theory can be categorized into non-cooperative games and cooperative games. Non-cooperative games refer to decisions made by each party for their own interests without cooperation or communication, where each decision-maker strives to achieve their own benefits through their strategies. On the other hand, cooperative games involve various parties reaching optimal solutions through negotiation and collaboration. In the field of service marketing, game theory can be applied to analyze the returns of service strategies and the relationship between service providers and consumers,

thereby establishing favorable mechanisms for service marketing. For instance, in terms of coordinating the integration of products and services, game theory can quantitatively analyze the integration process through mathematical models, thus formulating more scientific and reasonable service strategies and cooperation mechanisms, ultimately enhancing service value and customer satisfaction (Tang H J et al.,2023).

Overall, game theory is an immensely practical discipline that aids decision-makers in making more well-founded decisions. With the continuous development of data analysis techniques, game theory will play an increasingly important role in the field of service marketing.

## 2.2.2. Transaction cost theory

The theory of transaction costs, proposed by Coase, posits that the existence of firms is due to the presence of certain transaction costs and imperfections in market mechanisms. Transaction costs refer to various expenses incurred in conducting transactions, including search costs, transportation costs, negotiation costs, and contract costs, among others. These transaction costs reflect the costs of market operation. The core idea of transaction cost theory is that markets are not perfect, and market prices do not encompass all transaction information and costs. In neoclassical economics, it is believed that prices in perfectly competitive markets already reflect all transaction costs. However, transaction cost theory argues that due to the existence of transaction costs, the internal organizational form of firms is needed to reduce these costs. In other words, the reason for the existence of firms is that internal organization can allocate and coordinate resources more effectively when market mechanisms fail to address transaction cost issues adequately. In the application of new business models such as generalized service processes or regionalized services, transaction cost theory becomes one of the important criteria for evaluating these models (Di & Haniff, 2023). For example, the sales and delivery processes of highly customized smart solutions can be highly complex, resulting in high transaction costs when providing product service software systems. Additionally, the organizational form and relationships of supply chains in the service sector are also influenced by transaction costs. For companies implementing more comprehensive supply chain management, transaction cost-related factors such as asset specificity, uncertainty, and transaction frequency become even more important, making integrated service solutions more advantageous (Hiroshi G et al., 2023).

In summary, transaction cost theory holds significant meaning for understanding the existence of markets and organizations. It provides a perspective that considers transaction costs when analyzing firms and business models, aiding in decision-making and resource allocation. By effectively controlling and reducing transaction costs, firms can improve efficiency, lower costs, and achieve better economic outcomes.

## 2.2.3. Resource base view

The Resource-Based View (RBV) is a significant management theory asserting that differences between firms arise mainly due to the heterogeneity of their resources and capabilities. RBV was introduced in the 1980s by Penrose and Wernerfelt, who believed that a firm could create and sustain a competitive advantage by developing and integrating a range of valuable, rare, and inimitable resources. Empirical research has provided a theoretical foundation for many papers that support RBV. Applied to service-oriented industries, an RBV-based analysis involves treating various valuable, rare, unique, or organizational assets as resources that contribute towards achieving a business's service-oriented objectives. Existing literature has determined three types of resources and potential capabilities that are critical to service-related undertakings - organizational infrastructure, unique and complex abilities, and improvable service relations. Additionally, services that merge with a product are regarded as scarce resources that can enhance a firm's financial value and spur innovation. With regard to capabilities, scholars have paid ample attention to research on unique abilities related to service-oriented pursuits. They have also analyzed how complex combinations of resources and capabilities can yield a firm an exclusive competitive edge (Kaveh et al.,2023). Furthermore, Kanninen et al. have examined the types of capability required by enterprises in an industry as they

expand through service-oriented activities. Overall, RBV provides a comprehensive managerial perspective and new ideas and methods for firms to acquire a competitive advantage. Enterprises can develop more secure service-oriented strategies by utilizing their specific resources and capabilities while staying attuned to changes and high demand within the service market.

### 2.3.4. Contingency theory

The Contingency Theory is a management theory that is applicable in explaining issues related to the service transformation. This theory assumes that there is a connection between the environment, organizational structure, and performance. According to this theory, consistency is the key to the success of an enterprise's strategy. Success can only be achieved when there is a match between the existing capabilities and the external environmental changes (i.e. internal consistency). However, such consistency is influenced by the design of an organization. Scholars have combined the Contingency Theory with Resource-Based theory and analyzed the reasons for the success of service transformation by studying organizational design from the perspective of service-centered structure and culture, which play a key role in the success of service transformation. Furthermore, other researchers have investigated how the environment and organizational structure affect a company's strategic choices and lead to different business competencies in order to further study the application of contingency theory in service transformation (Xing et al.,2023). They have found that differences in the match between the environment and strategic choices partly explain the performance differences among different integrated solution providers.

Overall, the Contingency Theory provides a useful perspective for us to understand the issues in the service transformation. It emphasizes the consistency between the enterprise's strategy, environment, and organizational structure, as well as the significant role of organizational design in service transformation. Through reasonable organizational structure design and shaping of service-centered organizational culture, companies can better adapt to changes in the service market, and enhance competitiveness. Additionally, the application of the Contingency Theory can help us analyze the differences in performance during the service transformation process, and gain insights and guidance from them (Chang & Hang, 2023).

### 2.3.5. Theory combination application

The combination and application of theoretical frameworks play a crucial role in the research on service-oriented transformation. Specifically, the integration of transaction cost theory and the resource-based view enhances our understanding of the benefits and costs associated with different levels of service orientation, facilitating informed decision-making during the initiation of the service-oriented process. This theoretical combination provides us with an analytical framework to examine the transformation to a service-oriented approach, guiding decision-making throughout its implementation. Transaction cost theory focuses on the choice between market transactions and internal transactions within an organization. By analyzing transaction costs, we can determine which services can be better achieved through internal transactions, thereby reducing costs and improving efficiency. On the other hand, the resource-based view examines the differences in resource and capability endowments among organizations, aiming to create competitive advantages through the development and integration of valuable, rare, and unique resources. By combining these two theories, we can better balance the utilization of internal and external resources during the service-oriented transformation, selecting the appropriate transaction models and resource allocation strategies for each organization. Furthermore, the combination of the resource-based view and the resource dependence theory is also beneficial for studying issues related to digital serviceization. With the advancements in information technology and digitization, new business models involving digital services are emerging. By integrating the resource-based view with the resource dependence theory, we can identify the capabilities required to deploy digital services in technology and R&D-intensive industries, thereby enhancing the competitive advantages of organizations. This theoretical combination aids organizations in understanding the resource and capability requirements of digital

transformation, providing guidance for innovation and development in the realm of digital services (Bijoylaxmi et al.,2023).

# 3. Research Methodology

## 3.1. Models and Hypotheses
### 3.1.1. Construction of the theoretical model
This article focuses on constructing a theoretical model regarding the impact of consumer perception of innovation on consumer behavior in the mobile phone market, examining both perceived product innovation and perceived service innovation. Consumer satisfaction is measured as the mediating variable. Through the support of relevant literature and theoretical foundations, this study aims to deepen our understanding of how consumer perception of innovation influences their behavior and drives market development. Previous research has shown that even during times of economic recession, consumers are still willing to set aside their financial concerns and purchase the latest and greatest innovative products. For example, Shipman and Vigna's (2009) study found that even during the peak of the economic downturn in the high-tech industry, consumers were willing to spend significant amounts of money on new products such as smartphones, indicating that offering new products can separate winners from losers in the industry. Based on this viewpoint, this research chooses the mobile phone market as its research object.

The theoretical model of this article is constructed based on the Consumer Perceived Value theory. According to this theory, when consumers perceive innovation in a product or related service that will meet their needs, it generates satisfaction. At the same time, the perceived value or positive emotions also have a certain influence on subsequent behaviors, such as purchase intention and brand spreading. Therefore, this research takes perceived product innovation and perceived service innovation as independent variables, consumer satisfaction as a mediating variable, and purchase intention and brand spreading as outcome variables for study.

The preliminary theoretical model is shown in Figure 3, where perceived product innovation and perceived service innovation are the independent variables, consumer satisfaction is the mediating variable, and purchase intention and brand spreading are the outcome variables. Through this model, we can gain a deeper understanding of how consumer perception of innovation impacts their purchasing and brand spreading behavior. This model will help us better understand the mechanisms of consumer behavior.
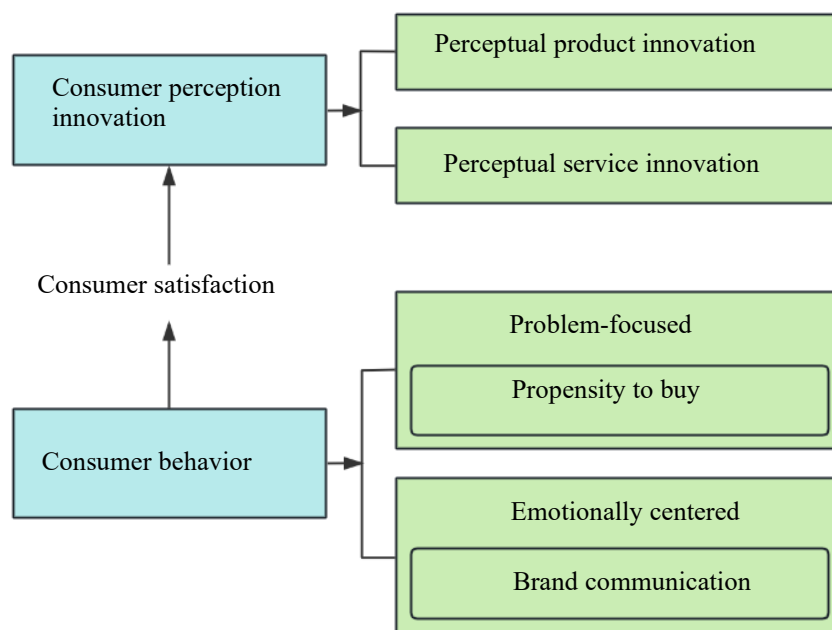


Fig.3: Theoretical model

The construction of theoretical models is a pivotal stage in research, providing researchers with a framework to address issues, explore causal relationships, and further advance the academic understanding of consumer behavior and market development. By studying factors such as consumers' perception of innovation, purchase intention, brand communication, and more, we can better formulate marketing strategies and offer practical recommendations, thereby bringing competitive advantages to businesses.

### 3.1.2. Research hypothesis

(1) Perceived product innovation

In recent years, there has been an increasing demand from consumers for product innovation, and more and more studies are exploring the perception and reaction of consumers to product innovation. Previous literature has revealed that there are numerous mature concepts and models regarding the perception of innovation by consumers both domestically and internationally. Perceived product innovation refers to the innovative evaluation that consumers make of a product or service, which originates from their understanding and experience of products, services, or technologies.

Studies have shown that perceived product innovation has a significant impact on consumer satisfaction, purchasing tendency, and brand dissemination. For instance, based on Raju and Lonial's (2002) research, when product innovation is viewed from consumers' perspectives rather than solely from the dimension of technological personnel in the enterprise, consumers are more likely to feel satisfied and business innovation abilities can be significantly enhanced. Furthermore, empirical research conducted by Carison et al. (2012) indicated that when consumers perceive significant innovation in a certain shopping website, they tend to be more willing to shop there. As a result, not only does this increase the number of visits to the website, but it also lowers conversion behavior and boosts the consumers' purchasing tendency. Elliott et al. (2013) also investigated the impact of perceived product innovation on consumers' purchasing tendency and willingness to pay for technological products. The results showed that product innovation, through consumers' perceived value, not only directly affects their purchasing tendency, but also helps relieve the effects on their purchasing tendency caused by their attitudes and subjective norms. Furthermore, high product innovation can promote word-of-mouth communication amongst consumers.

Although perceived product innovation has a significant positive impact, some studies have shown that its effect on consumers is not only positive, but may also have certain negative effects. For instance, Schmidt and Calantone (2010) suggested that perceived product innovation may also cause consumers to doubt some innovations or feel that the functional innovation may increase their burden, thus resulting in a perceived risk and having a negative effect on their purchasing tendency. Ch'ng and Tan (2012) also discovered that some aspects of innovation perceived by consumers may have a negative impact and could further suppress consumer behavior.

Based on the above studies, this paper combines relevant research and proposes the following hypotheses:

H1a: Perceived product innovation has a significantly positive impact on purchasing tendency.

H1b: Perceived product innovation has a significantly positive impact on brand dissemination.

H1c: Perceived product innovation has a significantly positive impact on consumer satisfaction.

(2) Sensing Service Innovation

According to the research results of Blazevic and Lievens (2004), service innovation can be considered as an evaluation of consumer satisfaction resulting from the innovative outcomes of a new service development team, or as an internal evaluation of the potential responses that consumers may have towards this innovation. However, this evaluation is often conducted from a company's internal perspective rather than from the viewpoint of consumers. In related fields of the service industry, the outcomes of service innovation directly impact consumer satisfaction and subsequent behaviors.

In a study conducted by Albarq (2013) on local consumers in Riyadh, it was found that improving service quality is a necessary condition for enhancing customer satisfaction. When service innovation is approached from the perspective of consumers, it is better able to meet their needs, thereby boosting consumer satisfaction. Research by Li Xiaojun et al. (2012) also revealed that

innovative behavior in service provision increases consumer satisfaction. Taking banks as an example, Titko and Lace (2010) emphasize that providing satisfactory services is where a bank's competitiveness lies. If customers are satisfied with a bank's services, they will easily accomplish their goals, feel satisfied with the bank, engage in relevant transactions with the bank, and promote the bank's innovative services to more friends. Similarly, in the context of mobile phone sales and after-sales services, service-related behaviors have an impact on consumers' perceived value. High-quality service and a positive experience lead to consumer satisfaction, which, in turn, has a positive influence, stimulating consumers' purchasing intentions and willingness to promote the brand, thereby attracting more customers to experience high-quality service.

To summarize, service innovation has significant effects on consumer satisfaction and subsequent behaviors. Through service innovation behaviors that take into account consumers' perspectives, their needs can be better addressed, thereby increasing consumer satisfaction. In the service industry, high service quality and innovation ability are essential factors for a company's competitiveness. Placing consumers at the core and paying attention to their feelings and needs will help companies implement successful service innovations. However, it is important to also consider consumer feedback and experiences during the service innovation process to avoid potential negative impacts. In addition, there is still a lack of research on the relationship between service innovation and consumer behavior in the domestic context, indicating the need for further in-depth studies in the future. Therefore, based on the literature reviewed above, the hypotheses regarding the perception of service innovation and consumer behavior are as follows:

H2a: Perceived service innovation has a significant positive impact on purchase intention.

H2b: Perceived service innovation has a significant positive impact on brand promotion.

H2c: Perceived service innovation has a significant positive impact on consumer satisfaction.

(3) The mediating effect of consumer satisfaction

Customer satisfaction refers to the perception and evaluation of consumers towards a product or service. It represents a way of delivering "hedonic value" and stimulates consumers to be more willing to re-experience the product or service, thus providing motivation for goal-directed actions. As such, it can be predicted that customer satisfaction will guide consumers to take action in order to achieve the goal of prolonging or re-experiencing their satisfaction. Therefore, the relationship between customer satisfaction and purchase intention is as follows:

H3a: Customer satisfaction has a significant positive impact on purchase intention.

Research conducted by Bagozzi (1999) and others has found that customer satisfaction not only contributes to consumers sharing their product experiences, but also leads them to recommend the product to other consumers. This not only benefits consumers in re-experiencing satisfaction, but also aids in brand dissemination. This finding was further confirmed by the study conducted by Gabbott et al. (2011). Therefore, the hypothesis regarding the relationship between customer satisfaction and brand dissemination is as follows:

H3b: Customer satisfaction has a significant positive impact on brand dissemination.

Furthermore, the research conducted by Roseman et al. (2013) has shown that customer satisfaction plays a mediating role in the relationship between cognitive evaluation and coping behavior. The study conducted by Zolfgharian and Paswan (2008) found that factors such as product attributes, consumer attitudes, and individual characteristics affect the relationship between consumer perception of product innovation and purchase intention. Therefore, it can be deduced that customer satisfaction serves as a mediator in the relationship between perceived product innovation and purchase intention, as well as the relationship between perceived product innovation and brand dissemination. Therefore, the following hypotheses are proposed:

H4a: Customer satisfaction mediates the relationship between perceived product innovation and purchase intention.

H4b: Customer satisfaction mediates the relationship between perceived product innovation and brand dissemination.

H5a: Customer satisfaction mediates the relationship between consumer perception of service innovation and purchase intention.

H5b: Customer satisfaction mediates the relationship between consumer perception of service innovation and brand dissemination.

Based on the aforementioned research, the hypothesis summary can be seen in Table 1.

Table 1. Summary of research hypotheses

| Serial number | Research hypothesis |
|---|---|
| H1a | Perceived product innovation has a significant positive effect on purchase propensity |
| H1b | Perceived product innovation has a significant positive effect on brand communication |
| H1c | Perceived product innovation has a significant positive effect on consumer satisfaction |
| H2a | Perceived service innovation has a significant positive effect on purchase propensity |
| H2b | Perceived service innovation has a significant positive impact on brand communication |
| H2c | Perceived service innovation has a significant positive effect on consumer satisfaction |
| H3a | Consumer satisfaction has a significant positive effect on propensity to buy. |
| H3b | Consumer satisfaction has a significant positive effect on brand communication. |
| H4a | Consumer satisfaction mediates the relationship between perceived product innovation and propensity to buy. |
| H4b | Consumer satisfaction mediates the relationship between consumer-perceived product innovation and brand communication. |
| H5a | Consumer satisfaction mediates the relationship between consumer-perceived service innovation and propensity to purchase |
| H5b | Consumer satisfaction mediates the relationship between consumer-perceived service innovation and brand communication. |

## 3.2. Research Design
### 3.2.1. Selection of Survey Subjects
The empirical research in this study derives directly from the collection of questionnaire data. The quality of the questionnaire and the selection of survey subjects play significant roles in obtaining persuasive, reliable, and objective research results. Therefore, this study primarily employs a combination of on-site questionnaire collection and online survey methods.

In this study, the mobile phone industry is selected as the surveyed industry, which encompasses a large number of potential survey subjects. To ensure the comprehensiveness and objectivity of the sample, this study primarily adopts a stratified sampling method, which allows for the reasonable control of population proportions such as gender, age structure, and industry distribution. This approach aims to maximize the representativeness of the sample.

### 3.2.2. Questionnaire collection and data processing
The main focus of this study is the leading brands in the mobile phone market, which include Huawei, Honor, Xiaomi, OPPO, vivo, Apple, and Samsung. To observe the differences and development trends in product innovation among these brands, the research selected their flagship products from the past three years, such as Huawei's P series and MATE series, Xiaomi's digital series and MIX series, and Honor's V series and digital series. To collect data, the study used a questionnaire survey. From March to May 2023, a total of 383 questionnaires were collected, of which 358 were valid, resulting in an effective response rate of 93.5%. To ensure the diversity of the sample and exclude the impact of a single group's preferences, both online and offline channels were used for questionnaire distribution (Caudill, 2023).

In the online channel, the researchers created a questionnaire using Tencent Questionnaire and collected responses by inviting classmates and friends to fill it out, as well as distributing it in mobile phone enthusiasts' WeChat groups and QQ groups. There were 269 responses collected online, and after eliminating repeat IDs, excessively quick responses, and low-quality responses, 245 valid responses were obtained, with an effective response rate of 91.0%. In the offline channel, the

researchers distributed questionnaires to consumers in different brand experience stores. A total of 114 questionnaires were collected, and after excluding those with illegible handwriting, 113 valid responses were obtained.

Through this questionnaire collection method, the researchers were able to gather a large amount of consumer feedback and opinions, thereby gaining an understanding of consumer satisfaction and their perception of product innovation for different brand flagship products. These data will serve as the basis for further analysis and exploration of the mediating effects of consumer satisfaction on purchase intention and brand advocacy.

### 3.2.3. Data analysis methods

The present study utilized SPSS software for data analysis, and conducted correlation analysis using Pearson correlation coefficient. Through these analyses, it was found that there exists a significant positive correlation among perceived product innovation, perceived service innovation, consumer satisfaction, purchase intention, and brand dissemination, as shown in Table 2.

**Table 2.** Correlations between variables

| Concepts | | Perceived Product Innovation | Perceived Service Innovation | Consumer Satisfaction | Purchase Propensity | Brand Communication |
|---|---|---|---|---|---|---|
| Perception Innovation | Product | 1 | | | | |
| Perceived Innovation | Service | .588** | 1 | | | |
| Consumer Satisfaction | | .529** | .478** | 1 | | |
| Purchase Propensity | | .492** | .403** | .653** | 1 | |
| Brand Communication | | .433** | .356** | .637** | .638** | 1 |

The Pearson correlation coefficient is a commonly used statistical method for quantifying the linear relationship between two variables. In this study, this coefficient was used to evaluate the correlation between different variables. The coefficient has a range of -1 to 1, where positive values indicate a positive correlation, negative values indicate a negative correlation, and values close to 0 indicate no correlation. The analysis results showed a significant positive correlation between perceived product innovation, perceived service innovation, consumer satisfaction, purchase intention, and brand dissemination in this study. This indicates that when consumers have a higher perception of product and service innovation, their satisfaction, purchase intention, and brand dissemination also increase correspondingly. This suggests that in marketing, by strengthening product and service innovation, consumer satisfaction and loyalty to the brand can be improved, thereby promoting purchasing willingness and brand dissemination.

## 4. Results and Discussion

### 4.1. Validity test

Validity refers to the extent to which a measuring tool accurately captures the concept, nature, or characteristics under investigation. It primarily encompasses content validity and construct validity, where a higher validity indicates a greater degree of responsiveness of the data obtained to the research objectives (Matthias et al., 2023).

Content validity assesses whether the adopted scale adequately covers the objects to be measured. In this study, we referred to relevant scales from various domestic and international fields and engaged in detailed discussions with professionals in the mobile industry. Additionally, in-depth interviews were conducted with 25 consumers to closely examine and refine the scale under the guidance of our mentor's recommendations. Consequently, this study possesses good content validity.

Construct validity is used to assess the degree of agreement between the research objects and to understand the actual characteristics of the relevant concepts. It includes convergent validity and

discriminant validity. Convergent validity is often measured through confirmatory factor analysis to evaluate the degree of association between different items under the same concept. When formulating measurement indicators, we first examine the standardized factor loadings, which generally should exceed 0.5 to ensure good convergent validity. Secondly, the value of average variance extracted (AVE) is typically required to be greater than 0.5, indicating that the sample can explain more than 50% of the effective variance. The measurement indicators are presented in Table 3.

Table 3. Statistical values of measured variables

| Latent Variable | Observed Variables | Loadings | αvalue | CR | AVE |
|---|---|---|---|---|---|
| Perceived Product Innovation | PPI1 | 0.650 | | | |
| | PPI2 | 0.784 | 0.758 | 0.756 | 0.510 |
| | PPI3 | 0.701 | | | |
| Perceived Service Innovation | PSI1 | 0.714 | | | |
| | PSI2 | 0.696 | 0.761 | 0.760 | 0.513 |
| | PSI3 | 0.738 | | | |
| Consumer satisfaction | CS1 | 0.903 | | | |
| | CS2 | 0.863 | 0.856 | 0.865 | 0.683 |
| | CS3 | 0.700 | | | |
| Purchase Propensity | PI1 | 0.947 | | | |
| | PI2 | 0.975 | 0.969 | 0.970 | 0.915 |
| | PI3 | 0.947 | | | |
| Brand communication | BE1 | 0.860 | | | |
| | BE2 | 0.944 | 0.918 | 0.921 | 0.795 |
| | BE3 | 0.869 | | | |

Based on Table 4, it can be observed that the square root of the Average Variance Extracted (AVE) for each latent variable is greater than the correlation coefficient values between variables. This implies that the variables used in this study, including perceived product innovation, perceived service innovation, consumer satisfaction, purchase intention, and brand communication, exhibit robust construct validity.

**Table 4.** Effectiveness analysis

| Latent Variable | Perceived Product Innovation | Perceived Situational Innovation | Consumer Satisfaction | Purchase Propensity | Brand Communication |
|---|---|---|---|---|---|
| Perceived Product Innovation | 0.714 | | | | |
| Perceived Service Innovation | 0.588 | 0.716 | | | |
| Consumer satisfaction | 0.529 | 0.478 | 0.826 | | |
| Purchase Propensity | 0.492 | 0.403 | 0.653 | 0.957 | |
| Brand communication | 0.433 | 0.356 | 0.637 | 0.638 | 0.892 |

In light of the aforementioned, the scale utilized in this study demonstrates commendable content validity and structural validity. Through meticulous design and prudent selection, we ensure that the obtained data possesses high levels of validity, thereby enhancing the reliability and credibility of the study's findings. Nevertheless, further validation and refinement in future research endeavors are still

necessary to enhance the trustworthiness and applicability of the study.

## 4.2. Reliability testing

The process of assessing the measurement tool's error, examining its consistency and stability is referred to as the test of reliability, commonly known as the reliability measurement. In this study, we utilized the α coefficient method to conduct the reliability test. The reliability test of the scale can be determined through Cronbach's α coefficient and Corrected Item-Total Correlation (CITC). Cronbach's α coefficient reflects the internal consistency among all items in the measurement tool. It is generally believed that when the Cronbach's α coefficient is below 0.7, it indicates poor reliability of the scale and requires modification. Conversely, when the Cronbach's α coefficient is above 0.7, it indicates good reliability of the scale. Additionally, after measuring the Cronbach's α coefficient, the CITC value can be utilized to determine how to modify the scale. If the CITC value is less than 0.5, the item can be removed.

By analyzing the obtained data using SPSS, we obtained the following results as shown in Table 5. The table presents the Cronbach's α coefficients and CITC values for each item. The results reveal a high overall reliability of the scale, with a Cronbach's α coefficient of 0.901, and all CITC values exceeding 0.5. The analysis of the data obtained using SPSS is presented in Table 5.

Table 5. Results of the confidence analysis

| Variables | Topic Items | Corrected item total relevance    CITC | The value of *Cronbach*'s alpha with the item deleted | *Cronbach α* |
|---|---|---|---|---|
| Perceived Product Innovation | *PPI1* | 0.543 | 0.726 | |
| | *PPI2* | 0.638 | 0.617 | 0.758 |
| | *PPI3* | 0.583 | 0.680 | |
| | *PSI1* | 0.613 | 0.656 | |
| Perceived Service Innovation | *PSI2* | 0.574 | 0.701 | 0.761 |
| | *PSI3* | 0.590 | 0.683 | |

In summary, the purpose of reliability testing is to assess the measurement tool's error in results and examine its consistency and stability. In this study, we employed the α coefficient method to evaluate the reliability of the scale, using Cronbach's α coefficient and CITC values. The results indicate that the scale utilized demonstrates high reliability and consistency, confirming its effectiveness in measuring the intended characteristics. It is important to note, however, that reliability testing can only assess the stability and consistency of the measurement tool results, and cannot demonstrate whether the tool measures the intended concept. Therefore, when conducting data analysis and drawing conclusions, it is necessary to consider other factors in conjunction.

## 4.3. Structural equation modeling results

Structural Equation Modeling (SEM) is commonly used to analyze multivariate data. Typically, SEM analysis involves three steps: model construction, model fitting, and model evaluation. In this study, we examined the fit of our model through confirmatory factor analysis. Key indicators used to evaluate model fit include the Chi-squared to degrees of freedom ratio (CMIN/DF), the Root Mean Square Error of Approximation (RMSEA), the Goodness of Fit Index (GFI), the Adjusted Goodness of Fit Index (AGFI), the Comparative Fit Index (CFI), and the Tucker-Lewis Index (TLI). These measures reflect the quality of the model fit.

Generally, a smaller Chi-squared to degrees of freedom ratio indicates a better model fit. A ratio below 5 is considered acceptable, with a ratio below 3 being preferable. An RMSEA value between 0.05 and 0.08 is typically considered as a good fit. The GFI and AGFI values range from 0 to 1, with a

value above 0.9 being ideal, although some scholars regard a value greater than 0.8 as acceptable. A CFI and TLI value of greater than 0.9 is generally considered optimal (Mahmood et al.,2023).

In our study, we used the software AMOS to test model fit and obtained the results shown in Table 6. These results indicate that our model exhibits good fit, with all indicators performing well. Specifically, the CMIN/DF value is 1.4, indicating a good model fit. The RMSEA value is 0.054, falling within the good range of 0.05 to 0.08. The values of GFI, AGFI, CFI, and TLI all exceed 0.9, demonstrating that the model fits well. As such, we can conclude that the SEM model utilized in this study exhibits good fit for our research object (Huang et al.,2023).

Table 6. Results of fitting structural equations

| Indicators | Fitting Indicator | | | | | |
|---|---|---|---|---|---|---|
| Specific indicators | CMIN/DF | GFI | AGFI | CFI | RMSEA | TLI |
| Judgment Criteria | <3 | >0.9 | >0.8 | >0.9 | <0.08 | >0.9 |
| Empirical results | 2.765 | 0.924 | 0.887 | 0.965 | 0.070 | 0.955 |
| Fit Evaluation | pass | pass | pass | pass | pass | pass |

In summary, structural equation modeling (SEM) is a method commonly used to analyze multivariate data. In this paper, the fit of the model was examined using a validated factor analysis and several key indicators were obtained. The results of the analysis show that the variables used in this paper for structural equation modeling have a good fit on the object of this study, and therefore the model is reliable and valid in this study (Zhao et al.,2023).

# 5. Conclusion

This study holds significant importance for businesses seeking to innovate and improve their competitiveness, as it examines the impact of consumer perceptions of product and service innovation on a company's innovation performance. The results indicate that both product and service innovation have a discernible effect on a company's innovation performance, with consumer satisfaction playing a mediating role in this relationship. This study provides practical guidance for business managers and decision-makers. Firstly, businesses should focus on meeting consumer needs and perceptions in their efforts towards product and service innovation, thereby improving the quality of their offerings. Secondly, companies should prioritize consumer satisfaction by providing high-quality products and services, which can enhance brand recognition and customer loyalty. Lastly, businesses must take into account various factors that influence innovation decisions, including consumer perceptions and resource and capability allocation. In conclusion, consumer perceptions of product and service innovation significantly affect a company's innovation performance, with consumer satisfaction playing a crucial role. By promoting interaction and understanding with consumers, companies can elevate their innovation and competitive capabilities, achieving success in an ever-evolving market environment. This benefits not only the business's long-term development, but also the quality of life and satisfaction levels of consumers.

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