



**CUSTOMER BUYING DECISION FRAMEWORK BASED ON DEMAND
AND PREFERENCE FOR SATISFACTION OF CHINESE ENTERPRISE
PRODUCTS**

By

LIU KUN

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia,
in Fulfilment of the Requirements for the Degree of Doctor of Philosophy**

January 2025

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment
of the requirement for the degree of Doctor of Philosophy

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January 2025

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Chinese enterprise products play a crucial role in supporting national services and are essential to daily life. However, many product developers struggle to fully understand the complex demands and preferences of customers, leading to dissatisfaction from the purchasing stage and ultimately affecting purchasing decisions. To address this issue, it is essential to help developers accurately identify customer needs, thereby enhancing satisfaction and product competitiveness. This research is grounded in customer demand orientation as its theoretical foundation. It conducts an in-depth analysis of the product development landscape, characteristics, and purchasing decision processes within Chinese enterprises. The study aims to identify key factors influencing enterprise product demand and consumer preferences. The research utilises data from HMC enterprises, which account for 70.0 percent of business activity in China. Through customer segmentation, questionnaire surveys, multi-source data integration, and random forest analysis of key influencing factors, the study provides a comprehensive understanding of consumer behaviour. Additionally,

an empirical analysis of customer satisfaction is conducted using Analytical Hierarchy Process (AHP), subjective and objective weight calculations, fuzzy comprehensive evaluation, and K-means clustering. Findings indicate that 55 key factors significantly impact customer satisfaction in purchasing decisions, and the evaluation results effectively represent customer sentiment. Furthermore, the study introduces a novel Customer-Based Demand Forecasting (CBDF) framework, offering valuable theoretical and practical insights for product development, marketing strategies, and customer relationship management.

Keywords: New product development, buying decision, product demands and preferences, customer satisfaction and Chinese enterprise product

SDG: GOAL 9: Industry, Innovation and Infrastructure

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**RANGKA KERJA KEPUTUSAN PEMBELIAN PELANGGAN
BERDASARKAN PERMINTAAN DAN KEUTAMAAN KE ARAH
KEPUASAN TERHADAP PRODUK PERUSAHAAN CHINA**

Oleh

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Produk perusahaan China memainkan peranan penting dalam menyokong perkhidmatan negara dan merupakan elemen penting dalam kehidupan seharian. Walau bagaimanapun, ramai pembangun produk menghadapi kesukaran dalam memahami keperluan dan keutamaan pelanggan yang kompleks, yang menyebabkan ketidakpuasan hati sejak peringkat pembelian serta menjejaskan keputusan pembelian. Oleh itu, adalah penting untuk membantu pembangun produk mengenal pasti keperluan pelanggan dengan tepat bagi meningkatkan kepuasan pengguna dan daya saing produk. Kajian ini berasaskan orientasi permintaan pelanggan sebagai asas teori. Ia menjalankan analisis mendalam mengenai landskap pembangunan produk, ciri-ciri, serta proses membuat keputusan pembelian dalam perusahaan China. Kajian ini bertujuan untuk mengenal pasti faktor utama yang mempengaruhi permintaan produk perusahaan dan keutamaan pengguna. Penyelidikan ini menggunakan data daripada perusahaan HMC yang merangkumi 70.0 peratus aktiviti perniagaan di China. Melalui segmentasi pelanggan, tinjauan soal selidik, penyepaduan data pelbagai sumber, serta

analisis hutan rawak terhadap faktor-faktor utama, kajian ini memberikan pemahaman yang menyeluruh tentang tingkah laku pengguna. Selain itu, analisis empirik terhadap kepuasan pelanggan dijalankan menggunakan Analytical Hierarchy Process (AHP), pengiraan berat subjektif dan objektif, penilaian komprehensif kabur, serta pengelompokan K-means. Hasil kajian menunjukkan bahawa 55 faktor utama memberi kesan ketara terhadap kepuasan pelanggan dalam keputusan pembelian, dan hasil penilaian tersebut secara tepat mewakili sentimen pengguna. Selain itu, kajian ini turut memperkenalkan rangka kerja baharu *Customer-Based Demand Forecasting (CBDF)* yang menawarkan pandangan teori dan praktikal yang berkesan untuk pembangunan produk, strategi pemasaran, dan pengurusan hubungan pelanggan.

Kata Kunci: Pembangunan produk baru, keputusan belian, keperluan dan keutamaan produk kepuasan pelanggan dan product perusahaan Cina

SDG: MATLAMAT 9: Industri, Inovasi dan Infrastruktur

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LIST OF ABBREVIATIONS

UPM	Universiti Putra Malaysia
TOC	To Consumer
TOB	To Business
R&D	Research and Development
CBDF	Customer Buying Decision Framework
B2C	Business-to-Customer
B2B	Business-to-Business
CRM	Customer Relationship Management
WMS	Warehouse Management System
ERP	Enterprise Resource Planning
WMS	Warehouse Management System
SSO	Single Sign-On
OA	Office Automation
AHP	Analytical Hierarchy Process

CHAPTER 1

INTRODUCTION

1.1 Introduction

The introduction chapter is explained the research significance and justified main issues for further investigation. It also described the research aim followed by the research questions, research objectives, the scope and area of research, and the contribution of the research. Finally, the outline of thesis is presented at the end.

1.2 Research Background

Customer buying behaviour is an action taken to buying a product or service. When a customer decides to buy a product or a service, they must take a decision between several choices (Palalic, 2021). Customer buying behaviour is a process by which customer identify their needs, collect information, evaluate alternative, and make the purchase decision (Petcharat, 2021), and has a direct impact on the marketing approach (Felix, 2022). In addition, it is a series of choices made by a customer prior to making a buying that begins once the customer has established a willingness to buy. There are several factors were influenced customer buying decision process such as cultural, social, personal, and psychological factors. The consumer decision-making process can be described as the phases that consumers go through in making a final purchase decision (Riaz, 2021).

China's business environment is complex and volatile, encompassing a wide range of industrial structures and multiple levels of market demand (Du,2023). Enterprises operating in this environment not only need to adapt to fast-changing policies,

technologies and market trends, but also meet the diverse needs of different regions, industries and customer groups. Especially in the field of enterprise-level products and services, customers usually have higher requirements for product performance, stability, security and customisation, while emphasising long-term support and service assurance. Therefore, enterprises must have strong technical strength, flexible business models and efficient service systems to meet customers' expectations for high-quality products and professional services (Liu,2022).

In China the decision-making process of a customer can be more complex without any references during it purchasing process. The customer decision-making process also refers to the mental workings of the customer leading up to a purchase choice and has become one of the most important and complex tasks for any businesses. According to Rajan et al., (2021), customer choices are different dimensions like financial, psychological, sociological and some other factors so there is a wider scope for consumer research and analysing, identifying the needs, and buying behaviour. Customer decision-making of purchasing a product is very closely to their demand. Understanding the current and future of customer demand can achieve high product performance (Wilson et al., 2022) and by ignoring them, it will be affecting the business performance and growth (Ali, 2021). Zhao et al., (2017) that customer will be disappointed in the future if the ratio value considered by the economic sacrifice of customers with the goods sold by the company does not meet their expectation.

Meeting consumers and gaining their attention in a competitive environment is not an easy task as they all differ in terms of emotions, personality, and attitudes (Schoultz et al., 2022). In this era of competitive market, businesses are working hard to adapt and

improve their marketing campaigns and marketing strategies in persuasion of effectively reaching maximum numbers of target consumer, whereas, their first challenge is to understand consumers' behaviour; how the consumers define their need, how do they want to meet their needs, wants or demands, how consumers think, feel, reason, and between different alternatives (e.g., brands, products, and retailers), how the consumer is influenced by his or her environment (e.g., culture, family, signs, media), or how do they perceive marketers offers towards their ultimate solutions (Alzoubi, 2022). According to Rachmad et al., (2014), customer buying behaviour focuses on how individuals make decisions to spend their available resource (time, money, effort) on consumption-related items that include what they buy, why they buy, when they buy it, where they buy it, how often they buy it, how often they use it, how they evaluate it after the purchase and the impact of such evaluation on future purchases, and how they dispose it.

Accordingly, for the business to understand factors that influence the customers purchasing process and buying decision is very crucial (Ridwan, 2022; Palalic, 2021; Yeo, 2022). Orji et al., (2021), consumer behaviour entails the study of people 's needs, motivations, and thought processes used in choosing one product over another and the patterns of purchasing different goods and services. Understanding consumer buying behaviour is critical to fully grasping how and whether the market demands are met and if a firm's marketing is performing well or poorly (Alo & Zahoor, 2023; Haris, 2023). An in-depth analysis of the underlying buying behaviour of consumers can serve as a valuable guide for managers to identify and predict trends and social patterns as a foundation for effective marketing strategies (Joshi et al., 2023). Demand and rapid technological has been imposing all the enterprises to develop a new strategy,

service and product that can stay in the market competition. Customer demand as the one which is formed between consumers and enterprises, benefit-sharing, risk-sharing, long-term, stable, and cooperative and attain the objectives of reducing cost, diversification of risk, gaining critical resources and improving competitive position (Algarvio et al., 2023). Recently, there is a growing interest in the importance of consumer demand in the field of product design and development. Customer demand change request decision is the basis of change response in product design.

In China customer demand and preference for product design often changes and difficult to avoid. In this case, the enterprise needs accurately to answer the customer “whether accept demand and preference change request”, “product reconfiguration scheme”, “when can complete the design task”, “how to change cost” and a series of key issues to ensure the interests of the customer and the enterprise is crucial. Customer can bring ideas in which may then facilitate the development and decision making of a new product innovation as well as will leads for business to success (Kruachottikul et al., 2023). Due to the complex correlation between product composition modules and their design tasks, and the widespread phenomenon of change propagation, it is difficult to accurately assess the impact of demand and preference on the design process, and it is difficult to achieve accurate decisions change. In this way, the rationality of product reconfiguration, design task redistribution and resource rescheduling based on the result of change decision will be affected. If the response scheme is found to be unreasonable in the redesign process of the product, it may reduce customer satisfaction with the enterprise, and even lead to the delay of design tasks and cost increase, which will affect the benefits of the enterprise (Susanto et al., 2023).

1.2.1 Problem Statement

In China most product developers cut costs and compress quality to speed up the delivery cycle, which ultimately leads to poorer overall product quality and service (Liu et al., 2022). This approach gradually sacrifices customer needs and affects the actual experience and long-term value of the product. Since enterprise customers themselves are tasked with the development of the country and have a certain level of development capability, they demand a higher level of product (Yi et al.,2024). Nowadays, enterprise customers are improving their management style, demanding more and more software, recognising more and more, and even able to judge the quality of product development and service level (Gomes et al.,2022). As a result, they become more cautious and rational before making purchasing decisions and are more inclined to choose software products with reliable quality, matching functions and perfect services (Hoel et al., 2024). This trend prompts developers to strengthen product development services, enhance personalisation and customisation capabilities, and provide long-term and stable technical support to meet the growing needs of customers, or else face the risk of customer loss and declining market competitiveness.

Success or failure of new product in the market is depending on the ability to identify and satisfy the customers' demand and preference. Finding customer demand and preference is one of the most concerning issues in business (Huang et al., 2021).

Customers are the end goal for every business since it is the customer who creates revenue. The demand and preference analysis can bring many insights essential for the making in buying decision process. Understanding customers' demand is increasingly becoming important since customer attitudes and preferences intensely influence the direction of enterprise strategies. However, understanding and meeting

customer demand and preference is crucial from the perspective of its competitiveness (Wang et al., 2025).

Customer demand and preference is related to the study of people made decision on purchasing a product. According to Schoultz et al., (2022), customer can compare prices, read customer reviews, and find the best deals, and they are continuously exposed to social contagion through social media and the use of the internet. Identification factors that influenced this situation is significant and it should come with a specific assessment tool or method as a guideline. While focus on the developing of a new product that meeting the demand and preference of customers as factors that also can significantly contributed for the business growth. Moreover, it is also very important for the business to develop a good product for their customers and better than their competitor. The demand for a product including customer preferences, income, prices of related goods, and consumer expectations. Customer preferences play a significant role in determining demand.

The global economic situation has been unpredictable, and business competition and the living environment have undergone subversive changes. Consequently, consumers' consumption patterns have changed, which force organisations to adjust or change their business models. In this case, many new customer-oriented problems have been triggered (Huang, 2022). New product development has been often recommended as a suitable strategy to build competitive advantage and long-term in today's markets success. Product design has been recognised as one of the prominent determinants of companies' competitive advantage and the driver of performance (Correia et al., 2021; Agustian et al., 2023; Agustian et al., 2023). Recognising that superior design can

differentiate products by creating and communicating value to customers, thus improving customer acquisition and retention (Sudirjo, 2023). However, customer demand and preference speedy changes, the businesses need to response quickly and scientifically realise the product especially reallocation, design task redistribution and design resource reaching.

Especially in China, where demand for products is so varied. Modern product development methods are often designed to be more effective and efficient but in case of customer demand and preference especially for a newly developed products are not served, and the outcome is always unsatisfactory (Sun et al., 2023). Thus, understanding customer demand and preference is valuable to have a deep insight to find out how the consumers define their need, want or requirement. Furthermore, the business also should prioritise and invest time and resources to gain an understanding of their consumers (Challoumis, 2024). Understanding customer demand and preference can reacting appropriately to them is most important correlates of product development success. Customer demand and preference is an economic measure of a specific group's desire for a business's product or service based on its availability to customers (Toha & Supriyanto, 2023). It represents consumers' buying habits and helps businesses to determine the specific purchasing trends of their consumers. With the concept of customer orientation is seen as a special case of market-based innovation since it focuses on the share of market intelligence pertaining to the end-users or customer. Customer orientation is the knowledge of customers to create superior value to them (Haaker et al., 2021). Customer orientation is also a business philosophy that puts the customer first. In addition, it is an integrated concept concerning the use of customer's current and future demands and preferences, and

determents in the development of improved or innovative product and services with added value as well as understanding the consumer decision making process is important to any business (Gonu et al., 2023).

Being customer-oriented is an approach in which, rather than solving for the business's needs, the company solves the customer's problems first. Customer orientation is an essential and integral element of a modern business. In addition, exploration of customer orientation will confirm the existence of connections which occur between the focus of a business and needs of customers as well as the level of its innovativeness (Baah et al., 2020; Widelska et al., 2021). However, a lack of concrete and clear guideline on how to adequately process was made it useless. The concept of customer-oriented approach needs deeper apprehension and further investigation to understand the mechanisms of interaction with clients and to identify the factors affecting their efficiency. An attempt to systematise the knowledge concerning of customer orientation it is possible to define the customer demand factors that relate to the innovation as a concept of building the value. The findings here provide further insights of the sales business effectiveness model in which market orientation components, as antecedents of sales effectiveness.

Therefore, gain an in-depth understanding of demand and preference for satisfaction can facilitate the enterprise to know their customers before their can make purchases to compensate for possible losses incurred in the later development process (Wang et al., 2025). By accurately analysing customers' business scenarios and actual needs, enterprises can conduct more effective planning in the early stages of product design

and development and reduce subsequent modification costs and resource wastage due to deviations in requirements.

1.3 Aim

The research aims to develop a new Customer Buying Decision Framework (CBDF) that integrates the elements of demand and preference for satisfaction of the Chinese enterprise products. The development of a new framework attempts to facilitate the product developer to develop a new product based on demand and preference as well as can facilitate the customer to make the buying decision of a new product.

1.3.1 Research Questions

To attain the research objectives, three (3) research questions are states below.

- RQ1 What are the importance factors of demand and preference for satisfaction of the Chinese enterprise products?
- RQ2 What are the elements of demand and preference for satisfaction of the Chinese enterprise products?
- RQ3 How to develop a new framework that integrate the elements of demand and preference for satisfaction of the Chinese enterprise products?

1.3.2 Research Objectives

To meeting the research aim, three (3) research objectives were highlighted as below.

- RO1 To identify the importance factors of demand and preference for satisfaction of the Chinese enterprise products.
- RO2 To investigate the elements of demand and preference for satisfaction of the Chinese enterprise products.

RO3 To develop a new framework that integrate the elements of demand and preference for satisfaction of the Chinese enterprise products.

1.4 Scope and Area of Research

Customer orientation refers to the extent to which organisations and their employees are committed to meeting customer needs and improving customer well-being (Kiffin-Petersen & Soutar, 2020). From a research point of view, a large volume of studies has devoted to understanding the performance implications of customer orientation. For instance, the positive effects of customer orientation on individual, team, and business performance are largely undisputed with empirically evidence supporting such effects (Liu et al., 2009; Homburg et al., 2022; Su et al., 2023; Ang et al., 2022; Pfajfar et al., 2022; Haslanger et al., 2023; Sa et al., 2020; Zang et al., 2020). Customer orientation is also the central element for companies to build long-term relationships with their target market to overall customer relationship performance. Customer orientation is about understanding a business's target market to be able to create continuous superior customer value and understanding as well as creating customer value. It is at the centre of market orientation because it reflects the core of the marketing concept (Schulze et al., 2020), generate higher levels of satisfaction, loyalty, innovation, and performance (Tai et al., 2021).

Satisfaction is the customer good feel which arises because of her perception of proper product performance or serve with his expectations (Naini et al., 2022) and is positive feeling that is created in every person after using the goods or services (Kuan & Abdullah, 2023). Customer is the core of a business. According to Yi et al., (2022), customer satisfaction is one of the most significant challenges for businesses to

achieve and maintaining customer satisfaction and loyalty. Transformation in the business environment and change into customer demand and preference will be helped to develop more innovative product in the market as well as can lead to positive impact on business survival (Caliskan,2021). In this research explored an impact on demand and preference for satisfaction of the Chinese enterprise products. The study attempts to provide further insights into the possible correlation between demand and preference, thereby reducing the standard method bias evident in previous studies on this topic. Furthermore, the research should be further expanded to include other variables and their impact on business performance.

1.5 The Significance of Research

The research contributions are expected to: -

- a) Acknowledge the elements of demand and preference for satisfaction of the Chinese enterprise products.
- b) Introduced a new framework namely as Customer Buying Decision Framework (CBDF) that integrated the elements of demand and preference for satisfaction of the Chinese enterprise products. The framework become a guideline and support the customer buying decision process of a new product as well as help the businesses to more innovative based on customer demand and preference.
- c) Increase innovation in the development of a new product based on customer demand and preference.
- d) Enhance the business performance and it competitive in the global market.

1.6 Outline of Thesis

This thesis consists of six (6) chapters, as described below.

Chapter 1 Introduction - The introductory chapter aims to provide a comprehensive picture of the thesis. After presenting a background to the topic, it was stated the research problem for further investigation. The research aim, questions, objective, scope, and area of research as well as the significant of research is highlighted. Finally, the thesis outline is states to show the research process attempt to achieve the significant outcome.

Chapter 2 Literature Review - This chapter presents a review of significant issues in undertaking research. The study focusses on customer demand and preference in buying decision process toward customer satisfaction. Approach on customer orientation also further study. At the end of this chapter, the research gaps are identified, and a new strategy is proposed.

Chapter 3 Research Method - This chapter described the research methodology that was used in the research. Detailed on data obtain, sample size, instrument, procedure, and data validity are also explained. Finally, the propose of new framework development and its process is highlighted.

Chapter 4 Data Analysis and Results - The chapter reports the empirical data, findings, data analysis details, and a discussion of findings.

Chapter 5 The Development of a New Framework - This chapter summary the finding and develop a new framework. The framework call is Customer Buying Decision

Framework (CBDF) that integrate the elements of product demand and preference as a guideline in buying decision process toward customer satisfaction. The development of a new framework also attempts to facilitate the product developer to develop a new product based on demand and preference and help the customer to make the buying decision of a new product. The validation has conducted to validate the new framework in the end of the chapter.

Chapter 6 Conclusion and Recommendation - This chapter is a conclusion of the whole research that summaries valuable finding and proposed a research recommendation for future.

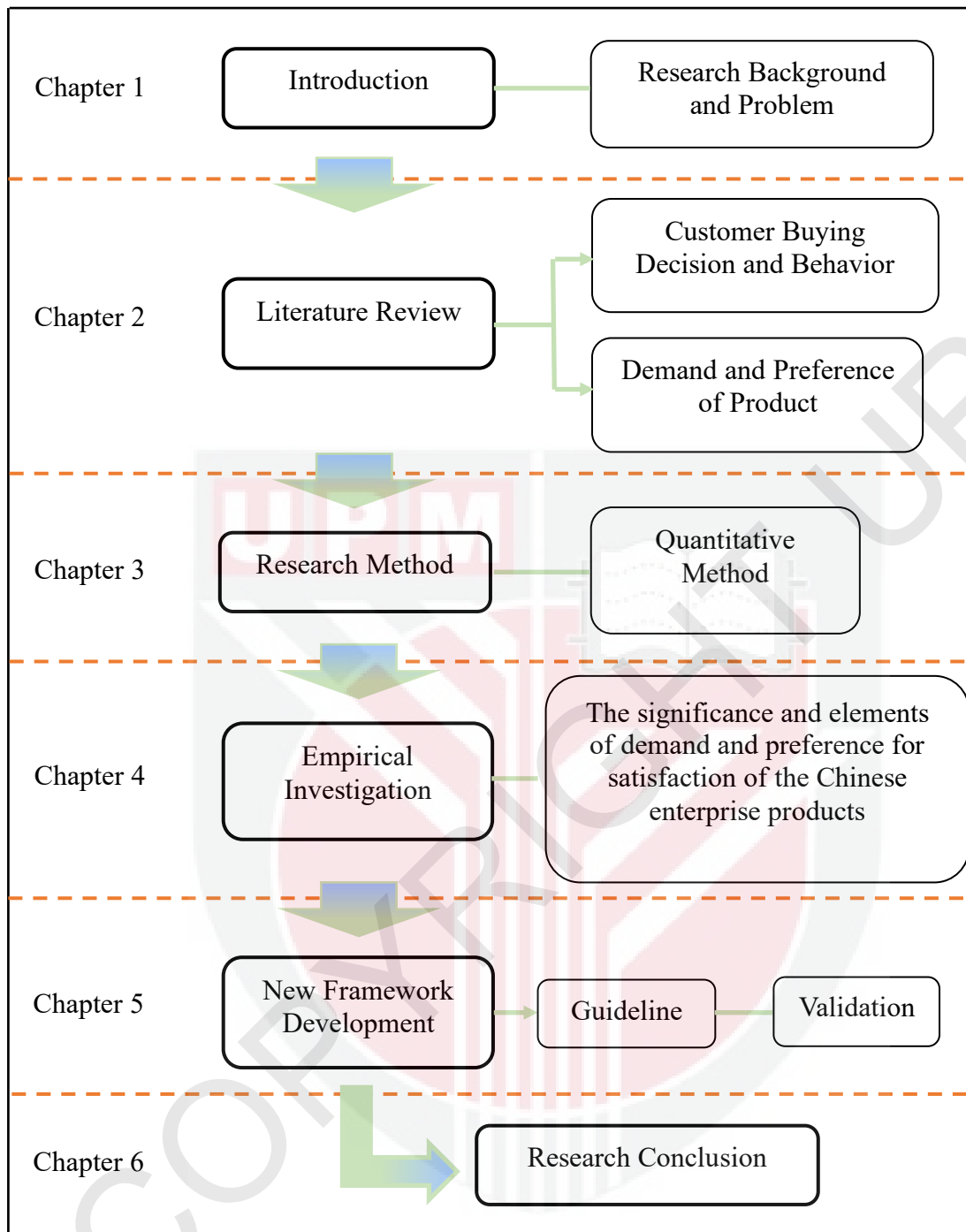


Figure 1.1 : Research Process Associated with Thesis Chapters
(Source by author)

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter presents the literature review of study under investigation. It covers overview of the existing research attempt to understand the scope of the field, current context and specialisations needs from the customer. The reviews were analysed in the three (3) sections on customer buying decision, process and behaviour followed by customer orientation according to the product demand and preference, and approach for customer in buying decision process toward satisfaction. At the end of this chapter, the research GAP highlighted, and a new strategy is proposed (Figure 2.1). In this literature, a review specifically focuses on customer orientation and Chinese enterprise product development as well as clarification of the role boundaries of participants in product purchasing decisions through in-depth analysis of different roles' customer behaviour. Based on the theory of customer orientation and demand analysis of Chinese enterprise products, it explores the customer-oriented analysis method of enterprise products and derive into two directions product demand and preference analysis. Second, the key elements of product demand and preference are integrated, and the gaps in the impact of each element on customer satisfaction are investigated, which serves as a new framework for customers and product developers to know the guidelines to improve customer satisfaction in the purchasing process.

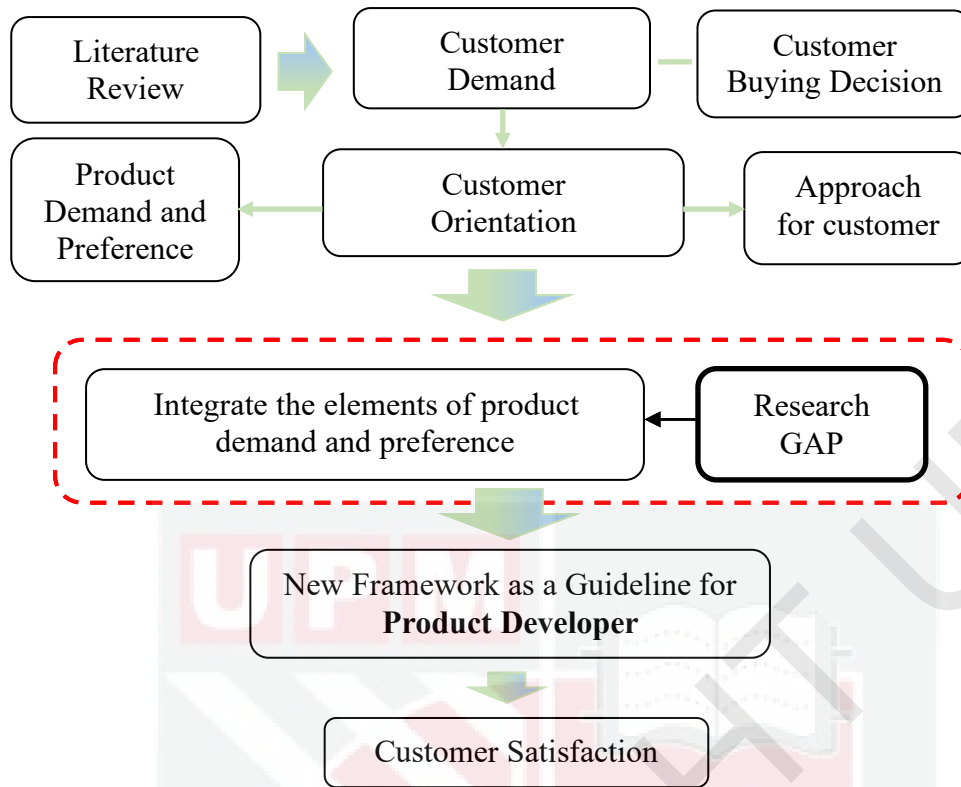


Figure 2.1 : Research Theoretical Framework
(Source by author)

2.2 Customer Demand-Oriented

Adhering to customer demand orientation, enterprises should design and make decisions in all aspects of product development, sales and service with customers' needs, expectations, and feedback at the core. Customer demand orientation can better respond to market changes, enhance customer satisfaction, and maintain an edge in competition.

2.2.1 Customer Orientation Meaning

“Customer orientation” is the concept of customer-oriented marketing throughout the entire process of the enterprise to achieve the purpose of improving customer satisfaction, while fully satisfying the needs (Zhao, 2022). As early as 1990, Narver

and Slater (1999) introduced the classic concept of customer orientation from the organisational level and defined it as having a full understanding of the target buyers so that you can continuously create superior value for them. Since its inception, the concept of customer orientation has been recognised as a fundamental component of marketing theory, and scholars have extensively studied the conceptual definition, path of influence, and mechanism of action of customer orientation over the past few decades (Chi, et al., 2024; Guerola et al., 2021). Customer orientation is at the core of the implementation of marketing concepts in modern companies, as it enables companies to have a thorough understanding of customer needs, which improves the ability of companies to serve customers effectively (Sudirjo, 2023).

This paper provides a research basis for the theory of customer demand, for exploring the dimensional composition of customer orientation, and for revealing the mechanism of customer orientation on the transformation performance of enterprises. Customer orientation is mainly concerned with satisfying customers' expressed needs, which is usually short-term and reactive; whereas market orientation goes beyond satisfying customers expressed needs to be understanding and satisfying customers' potential needs, which is long-term and forward-looking (Khan et al, 2024). Customer orientation is an integral part of market orientation, and customer focus is a core element of market orientation. Therefore, customer orientation and market orientation are not separate components and can be considered "synonymous" (Cobelli, et al., 2023; Gonu, et al., 2023)." Although these studies provide some theoretical guidance for exploring customer orientation, they do not clearly and explicitly explore and answer the proposed research questions posed in this study. Value co-creation is a process whereby a firm authorises all stakeholders along the entire value chain to

participate in all aspects of product development, production and distribution, and it is a process whereby a firm achieves value co-creation through purposeful interactions with stakeholders, such as customers, firm employees and suppliers (Li et al., 2021; Chatterjee et al., 2022). This paper further investigates customer orientation as a component of market orientation as a basis for further research.

2.2.2 Customer Demands Theory

With the deepening of customer demand research work, it is crucial to understand customer demand research work more deeply in the new situation. Many enterprises have realised the systematisation, standardisation and centralised management of customer demand based on the traditional research work. In the construction and application of the system, scientific research on customer demand is carried out to fully satisfy diversified customer needs, realise rapid and low-cost application, promote the establishment and consolidation of enterprises' core competitive advantages, and lay the foundation for enterprises' sustainable development.

- a) Psychological - Maslow's (1943) five-level hierarchy model divides need into physiological, safety, love and belonging, esteem, and self-actualisation, in order from lower to higher levels, which are the most basic and innate human needs. and innate, with the seventh level adding cognitive and aesthetic needs and later expanding to the eighth level of transcendent needs (Papaleontiou et al., 2023). The KANO model is a useful tool invented by Kano (1984), a professor at the Tokyo Institute of Technology, to categorise and prioritise users' needs based on the analysis of the impact of users' needs on their satisfaction, which are categorised into basic, aspirational, and arousing needs (Patil & Bagodi, 2021).

The theoretical basis of demand centres is generally accepted, but the assumption of measurability of demand has been widely criticised (Garegnan, 2024; Kroon & do, 2023; Mandolakani et al., 2024; Akbari et al., 2023; Kaiser, 2024; Vuong & Nguyen, 2024; Gallien & van 2021). Freire et al (2022) categorised needs into implicit and explicit needs. Sawyer (2021) in his related works further categorized needs into negative, no, potential, declining, irregular, sufficient, satiated, and unhealthy needs. Metzinger (2021) argued that needs include basic, special, potential, and unpredictable needs. Taeuscher et al (2022) categorised demand into explicit and implicit demand, etc. According to Mody (2021), in the first stage, the focus is on quantitative consumption; in the second stage, the focus is on qualitative consumption; and in the third stage, the focus is on perceptual consumption, i.e., consumers obtain the satisfaction of perceptual needs, such as spiritual pleasure, individuality, and the embodiment of a sense of superiority, through the act of consumption or the process of consumption.

- b) Marketing - McKnight (1957) developed the concept of customer-oriented marketing. In his influential book *Marketing Myopia*, he proposed customer orientation, arguing that many mass-producing organisations had mistakenly adopted a “product orientation” rather than a “customer orientation” (Yrjölä & Tabas, 2023). French & Risius (2024) proposed a new understanding of marketing in terms of satisfying customer needs. He redefined marketing as the process by which a firm creates value for its customers and builds strong relationships with them to reap the benefits and rewards from them. Numerous customer-oriented to enhance the competitiveness of enterprises cantered on theories and ideas, without exception, the first step is to emphasize the need to understand customer needs and desires (Al-Shammari, 2023). Consumers are usually faced with many products and services to meet specific needs, how to achieve the marketing objectives of enterprises, it is necessary to start from a better understanding of consumer needs than competitors, better than competitors to meet customer needs.

The marketing concept has gone through four stages of 4Ps-4Cs-4Vs-4Rs. The marketing theory of 4Ps theory i.e., product, price, place, promotion. This theory makes the four basic elements of marketing through different combinations of strategies, market-oriented, product sales for the purpose of producing high-quality products, the use of reasonable prices, through the appropriate distribution channels, coupled with the necessary promotional means, you can achieve the desired objectives of the company (Karim et al., 2021; Supena & Hariyadi, 2021; González & Álvarez, 2022; Dwaikat et al., 2022). The marketing theory of 4Cs is based on consumer demand as the basis for the development of marketing strategy, and the marketing strategy is based on consumer demand as the basis for the development of marketing strategy. of 4Cs is oriented to consumer needs and resets the four basic elements of the marketing mix: i.e., consumer, cost, convenience, and communication (Song & Shi, 2022). The marketing theory of 4Vs: Oriented towards innovation “Variation”, “Versatility”, “Value”, “Vibration” (Zheng, 2024). The Marketing Theory of 4Rs: Aimed at building customer loyalty Relevancy, Respond, Relation, Return, building association with customers, Improving market responsiveness, Relationship marketing. Return is the driving force of marketing (Dwaikat et al, 2022).

4Ps theory by meeting the reality of the same or similar customer demand and profit maximisation: 4Cs theory by meeting the reality and potential personalised demand to develop customer loyalty: 4Rs theory by adapting to changes in demand and create demand, the pursuit of reciprocal relationship between the parties to maximize the 4Vs theory to meet the customer’s pursuit of personal experience and maximise the value of demand. From the development process of marketing theory can be seen, the cultural content of marketing with the development of marketing more and more thick,

cultural marketing as a specialised marketing field is bound to come to the foreground from behind the scenes.

- c) Product design - The Institute of Electrical and Electronic Engineers (Szott, 2022) suggests that software requirements consist of three different levels - business requirements, user requirements, and functional requirements, which also include non-functional requirements. Business requirements reflect the organisation's or customer's requirements for the system, the product's high-level goals, which are described in the project view and scope document. User requirement documents describe the tasks that users must perform to use the product, which are described in the use case documents or scenario descriptions. Functional requirement defines the functionality of the software that the developer must implement to enable users to perform their tasks, thereby satisfying the business requirement.

Most software systems originate from the needs of some client, the software system itself is produced by some developer, and the finalised system is used by users. However, there are three (3) main parts of a new system that we are interested in: the client, the developer, and the user, and those needs that the client requires and that are of interest to the user must be exchanged with the developer. The problem is that the customer often does not understand the software and the software development process, while the developer often does not understand the customer's problems and application areas. This creates a gap in communication between all parties in the development process (Habermas, 2022).

On the basis of modern information technology to collect and analyse customer information, to grasp the characteristics of customer demand and behavioural preferences, to provide products or services for customers in a targeted manner, to develop and manage the relationship with customers, so as to cultivate long-term

customer loyalty, in order to achieve a balance between the maximisation of customer value and the maximisation of corporate revenue, a kind of enterprise management strategy and measures. Usually, high-quality requirements are completed with clear objectives, intuitive business processes, clear functional descriptions, easy-to-understand textual content, clear document structure, and reasonable use of diagrams. In order to avoid the risks of schedule, quality, cost and other aspects caused by requirement changes, it is necessary to manage the scope and timing of requirement changes based on the actual situation of the project construction work and the definition of project “completion” (Kerzner, 2018). This can be achieved through the provision of high-quality products and services, regular follow up and communication. When customers are satisfied and loyal, they are more likely to continue purchasing the company’s products or services, thus increasing the company’s sales and profits (Rebelo et al., 2021; Fiiwe et al., 2023).

2.2.3 Customer Oriented Application Research

In order to adapt to market needs, enhance customer experience, increase organisational competitiveness and thus achieve sustainable development. Customer orientation contributes to the establishment of a positive business ecosystem where individual customers and organisations interact in a mutually beneficial way (Riquelme et al., 2022). Customer Orientation. Customer orientation is manifested at both individual and organisational levels (Ghlichlee & Baya, 2021; Grassi & Fedel, 2022). Customer orientation at the individual level emphasises attention to the differential needs of individuals to provide personalised products and services. Customer orientation in organisations involves an in-depth understanding of the market to pinpoint target customer groups and provide customised products or services.

- a) Customer orientation at individual level - Customer orientation focuses on the individual level, including the behaviours and attitudes that a firm's employees develop toward customers (Ghlichlee & Bayat, 2021). Customer orientation prioritises the interests of customers, but does not exclude the interests of other stakeholders, such as owners and employees, in creating long-term profitability, and in this context, customer orientation can be seen as part of the corporate culture. Therefore, it is not enough to simply focus on information about the needs of current and potential customers without embedding customer centricity in the deeper values and beliefs of the organisation (Roggeveen, 2022). Customer orientation should permeate both high and low customer contact scenarios and be defined as a team function, a function that includes the degree of direct interaction with external customers on a regular basis (Itani & Chaker, 2022).

There is a close relationship between customers' personal values and customer service experience, which has a significant impact on consumer behavioural orientations (Pinto et al., 2021). McKinsey emphasises on understanding the needs of its clients, by communicating and collaborating deeply with them to understand their goals, challenges, and expectations. This in-depth understanding enables McKinsey to grasp the core problems of its clients and provide them with targeted solutions (Lamarre & Zimmel, 2023). The process of mobilising customer engagement during customer-oriented research has a positive contribution to both customer trust and customer satisfaction (Gonu et al., 2023), while increasing customer trust plays a moderating role between customer satisfaction and repurchase intentions (Miao et al., 2022).

- b) Customer orientation at the firm level - Customer orientation is a set of beliefs that identifies customer needs and satisfaction as an organisational priority and places long-term customer satisfaction above achieving short-term profitability goals (Madhani, 2021; Hidayat & Idrus, 2023). Much of the existing research on customer orientation builds on the classic study by

Aydin, (2021), who defined customer orientation as “understanding the target buyer well enough to be able to create superior value for him on a sustained basis,” which implies that an organisation implements a holistic strategy for its customers that is designed to identify and satisfy their needs, a strategy that is designed to identify and satisfy the customer’s needs, and this orientation represents a firm’s commitment to customer satisfaction. Needs, and this orientation represents a firm’s continuous, proactive orientation and ability to understand, serve, and satisfy the needs of its target customers (Schulze et al., 2022; Brege & Kindström, 2021). Customer orientation reflects the strategic orientation of firms to gather information about the needs of current consumers and to analyse the future needs of consumers (Nugroho & Kusumastuti, 2022; Narver et al., 2000). Customer orientation is seen as a long-term commitment to serving customer needs, which requires an ongoing proactive approach to understanding potential, unexpressed customer needs (Duzgun et al., 2016). The close relationship between SME owners and their customer base makes customer orientation an important capability that these firms can effectively use to understand customer needs to provide them with high quality products and services (Kadic-Magljalic et al., 2017).

Search is a concept in the theory of entrepreneurial behaviour that describes the relationship between an organisation and its environment (Taskan et al., 2022). From this perspective, customer orientation can be considered as a form of search in the customer space. This search refers to how the organisation finds its place in the environment. It involves understanding and analysing the environment and exploring it through experiential activities (Maroukas et al., 2023). A customer-oriented organisation usually obtains information from its customers and uses this information to develop appropriate strategies and implement strategies to meet the prevailing customer needs in a responsive manner, thus building long-term relationships with its customers. Therefore, customer orientation is recognised as an essential element for

long-term success and sustainable performance of organisations (Neneh, 2018). In the field of new product development research, customer orientation refers to the extent to which an organisation obtains and uses information from customers, develops a strategy to satisfy customer needs, and implements that strategy by responding to customer needs (Rosário & Raimundo, 2021). In addition, firms with customer orientation can effectively improve the quality of their services to adapt to market demands and enable them to easily outperform their healthy competitors (Shahzad et al., 2024).

- c) Customer orientation in segments - One study distinguishes between the mechanisms by which mainstream and emerging customer orientation influence disruptive and disruptive innovation, where mainstream customer orientation refers to a firm's focus on serving its important existing customers by gathering information about them and developing products to meet their current and anticipated needs, in contrast to emerging customer orientation, which reflects a firm's interest in small but emerging market segments (Ed-Dafali et al., 2023). It involves developing potential customers whose needs are not well identified and whose needs are not known and assessing the size of this market (Silva-Rodriguez et al., 2022). The concept of service customer orientation was developed for the service industry, which is considered to be the basic framework of a service-oriented organisation, related to the continuous interaction between customers and service providers, and is defined as the ability of a service provider to work on a long-term basis to identify customers' expressed, latent, or future needs, and to provide innovative solutions to deliver value to customers (Lee et al., 2021).

In terms of customer acquisition and retention orientation, customer acquisition orientation means that firms focus on obtaining information about potential customers, measuring their potential value, and allocating resources to acquire customers with greater long-term value; customer retention orientation requires focusing on obtaining

information about existing customers and allocating resources based on their long-term value to manage the relationship with existing customers (Al-Gasawneh et al., 2021). Although customer acquisition and retention orientations have different emphases, they are not mutually exclusive and firms can choose to do both (Zheng et al., 2022). In the context of research on organisational cognitive systems and organisational culture, cognitive organisational system customer orientation describes the extent to which customer-related information is processed within the organisation, while affective organisational system customer orientation reflects the extent to which attention to customer needs is rooted in organisational values, belief structures, and norms (Schulze et al., 2022).

2.2.4 Customer Oriented Analysis Dimensions

Customer orientation consists of several independent dimensions that complement each other in improving business performance through a deep understanding of customers and markets (Smirnova et al., 2018). Considering the relationship between customer orientation and corporate culture, Weisshaar et al., (2024) developed a unidimensional scale consisting of nine measurement questions based on personal interviews and existing literature and validated the feasibility of their scale in the United States of America, China, and other countries after testing the concepts and measurement methods in Japan.

The customer orientation scale developed by Racela and Thoumrungroje (2020) includes market perception, customer affiliation, and customer responsiveness and consists of 12 question items. Market perception capability describes a firm's ability to identify market trends and its ability to anticipate them before competitors do;

customer affiliation capability reflects a firm's ability to develop and maintain a close relationship with its customers and the ability to promote organisational openness so that shared information can be turned into knowledge; customer responsiveness describes a firm's ability to effectively meet customer needs, viz., the expertise and speed required to respond to customers in situations that require quick action. Based on the analysis of three sets of survey data and combined with interviews with industry experts, one study classified customer orientation into two dimensions: customer-centric strategy and customer service delivery, both of which help firms serve customers, adapt to market conditions, optimise growth, and improve profitability (Smirnova et al., 2018). To expand the research related to new product development, some scholars have proposed a complementary theory between information technology adoption and customer orientation, where the measurement of customer orientation consists of three dimensions, namely customer centricity, customer involvement, and communication with customers: Customer centricity is measured by four question items, where the evaluation focuses on satisfying customer needs and dealing with customer complaints; customer involvement consists of six question items, which measure customer involvement consists of six items, which measure the degree of customer participation in new product design and development programs; the dimension of customer communication is measured by investigating the timeliness, accuracy, and frequency of respondents' communication with customers, and consists of three items (Lin, et al., 2023).

However, several empirical studies based on unidimensional scales have questioned the net benefits of customer orientation, with some suggesting that customer orientation may weaken innovation (Schulze, 2022), lead to short-sighted Research

and Development (R&D), or confuse business processes (Pranata et al., 2023). The common theme of these critiques is that if firms respond only to customer wants and needs, then both the firm and society will be penalised. In response to this scepticism, it has been argued that the disagreement over the relationship between customer orientation and firm performance is due to an overly narrow understanding of customer orientation, and that a dimensional measure of customer orientation allows for a more comprehensive consideration of the mechanisms by which customer orientation operates (Kindermann et al., 2021).

2.2.5 Customer Oriented Value Analysis

The effects of customer orientation on customers include the perceived quality of the firm's products or services, customer loyalty, and customer satisfaction with the firm's products and services. Customer orientation increases customer satisfaction and loyalty because customer-oriented firms are better able to anticipate customer needs and provide products and services to meet those needs (Gatter et al., 2022). The results of exploring the role of customer orientation at the firm level have mostly focused on its impact on organisational performance (including financial performance and innovation performance). According to Abbas & Kumari (2023) to clearly identify the relationship between customer orientation and firm performance, not only confirm that customer orientation has a positive impact on firm performance, but also show that the impact of customer orientation on firm performance becomes more significant as risk-taking, innovativeness, and opportunity concentration increase. The effect of customer orientation on profit is more significant than the effect on sales because customer orientation focuses on customer retention rather than customer acquisition (Zheng & Na, 2022). In addition to financial performance, customer orientation is also

an important factor influencing a firm's innovation performance, which not only has a direct effect on innovation performance, but also influences innovation performance through the mediating role of technological and operational innovation, supplier cooperation, and technological capabilities (Khan et al., 2022). In a study that analysed binary data from 225 strategic business units, firms' focus on customer acquisition orientation improved breakthrough innovation performance but hindered incremental innovation performance, while firms' customer retention orientation had the opposite effect (Ritala et al., 2023).

Most studies agree that customer orientation is an important driver of positive outcomes such as firm performance and new product development (Homburg & Wielgos, 2022; Makhloufi et al, 2021), but some studies question the general positive impact of customer orientation. In the screening stage of the new product development process, where it is essential for managers to make an accurate assessment of the new product idea, there are two contradictory conclusions. On the one hand, when firms adopt customer orientation, they are better able to satisfy customer needs, i.e., they are more likely to introduce successful new products; on the other hand, Derosia and Elder's (2019) findings suggest that the negative effect of adopting customer orientation lies in the fact that when managers consider the needs of their customers, they tend to spontaneously mentally visualise their customers, which can lead to strong unrealistic optimism, which in turn reduces the ability of managers to identify successful products. At the same time, strengthening customer orientation has a negative impact on the creation of novel products, because current customers are more inertial to existing products in the market and therefore have less acceptance of novel product ideas, which means that firms' efforts to monitor customer needs and

expectations will not lead to the creation of new product innovations (Aldoseri et al., 2024). Scholars have also examined whether customer orientation hinders breakthrough innovations (both technology-based and market-based innovations), and the results show that customer orientation promotes innovations using advanced technologies i.e., technology-based innovations and provides greater benefits to mainstream customers, but inhibits innovations targeting emerging market segments i.e., market-based innovations (Hossain et al., 2024).

2.3 Chinese Companies' Product Development

With the development of marketing theory and practice, business-to-business marketing is gradually becoming a hot topic in marketing theory. Enterprise products refer to products that serve organisations, enterprises, and business institutions (Lim, 2023), such as the well-known enterprise WeChat, Nail, and other products. On the one hand, it is due to the fact that in the organisational market, whether in terms of transaction frequency or transaction amount, the enterprise market occupies an absolutely important position, and is directly related to the country's economic development rate and residents' living standards, and is the top priority of the country's macroeconomic regulation and control (Szczepańska- & Gatna, 2022) on the other hand, from the perspective of the development of organisational marketing theory, the enterprise's business activities are the starting point of research and development and the focus of research and development. The focus of its research and development (Sarpong et al., 2023).

At the same time, the development of enterprise products must be based on customer demand orientation to accurately meet the functional needs of enterprise users,

efficiency improvement and cost optimisation goals. Against the background of intensifying global competition and accelerating digital transformation, the development of Chinese products not only needs to adapt to the changing needs of the domestic market, but also needs to pay attention to the competitive landscape of the international market (Agustian et al., 2023). Therefore, an in-depth analysis of the development of Chinese products and the exploration of the evolution path of enterprise products under demand orientation are of great significance for enhancing enterprise competitiveness and promoting industrial upgrading.

2.3.1 Companies' Product Background

The product development of Chinese enterprises exhibits complex influences in several areas, including policy support, economic development, social and cultural changes, and management levels. Factors such as the management level and technological innovation capability of enterprises have combined to drive product development to adapt to an increasingly complex and changing market and social environment, and to achieve sustainable development and competitive advantage.

- a) Policy level - Since 1978, the spring breeze of reform has blown across the land of China, especially with the rapid development of the Internet, China's Internet industry has ushered in a new opportunity and development momentum. Internet products as an important part of the "14th Five-Year Plan", is an important part of the future economic development. With the continuous improvement and optimisation of policies, many entrepreneurs, for example, the national "Made in China 2025" plan is committed to promoting the transformation and upgrading of China's manufacturing industry, improve product quality and added value. The quality of service and the service system of the enterprise Internet industry has been continuously developed and improved.

- b) Economic level - In the context of the steady development of the domestic economy, with the continuous improvement of the consumption level, the consumer's consumption concept gradually shifted from the material level to the spiritual level, from the initial "wear warm, eat well" gradually transformed into "wear well, eat well", and the "90s", "00s" and other young people as the emerging consumers are also more favourable to cultural products, quality, and personality. "90" "00" and other young people as emerging consumers, but also more favourable to the culture, quality, personality products. For example, "one person economy", "other economy", "lazy economy", "green health" and other new forms of business emerge. New national brands are emerging frequently under the general trend of industry development.
- c) Social and cultural level - Since China's reform and opening, the overall income of our nationals has been rising, and their lifestyles have undergone significant changes, with a higher degree of acceptance of the ever-changing online shopping methods. As people's pursuit of quality improves, platforms with corporate service systems are more trusted by consumers (Warui et al., 2021). For example, Tian Mao is currently the largest sales platform in China, and Mei Tuan is the largest takeaway platform in China, prompting the development of the takeaway delivery industry. The change in consumer culture has prompted companies to accurately match buyers and sellers through the B2C model, as an intermediary party with identification and service functions.
- d) Management level - For enterprise users, embracing the industrial internet is also the best opportunity to improve productivity, realise enterprise transformation and regain the market high ground. Especially for small and medium-sized enterprises (SMEs), which will be the main consumers of standardised enterprise services, the market demand for modular SaaS services will continue to grow at a high rate (Li & Kumar, 2022). Chinese enterprises are facing the challenges and opportunities of digital transformation to improve productivity, reduce costs and create more competitive products. Enterprises are evolving from traditional "large-scale

production” to “small-lot production”, “customisation” and “flexible production”. The upgrading of the industry provides a complete industrial chain for national brands, giving them the advantages of low cost and high quality.

2.3.2 Company’s Basic Product Features

The sales process for enterprise products is usually more complex than that for consumer products, involving long-term co-operation with business customers, communication of requirements, technical discussions, and contract negotiations. Therefore, the highly specialised nature, problem-solving capabilities, and long-term cooperation require customised production, the provision of high-quality service support, and ensuring security compliance and supply chain stability.

- a) The target users are groups of people - Many B-end users are enterprises or organisations, and B-end product design features involve several different types of roles and require multiple people to work together. The 2B market has distinctly different characteristics, with business customers on the B side having relatively complex businesses, long decision-making chains, and greater reliance on the one-to-one sales model (Yang et al., 2022).
- b) Efficiency first, experience second - In contrast to ToC (To Consumer, a business model for individual customers) products, ToB (To Business, a business model for enterprise customers) products pay more attention to the efficiency improvement brought by product design and whether the function is applicable, whether the product can solve the customer’s problems and needs is the most critical, the experience before the efficiency is only a plus, emphasising abstraction and logic.
- c) Complex logic - The logic of ToB product design is complex, and the long process may include the operation and change of the whole business line. Due to the operation and adjustment of the business line, the personnel, division of labour, collaboration, mode, process, and rules involved in the

whole product design may be changed at any time. In Enterprise (organisation) product design, it is very necessary for Enterprise product designers to master the ability to organise and abstract customer problems and needs into concrete functional products for the whole industry, to be applicable to most of the business operation processes in the same industry, which is also a situation and problem often encountered by enterprise product designers in the product design process (Zhou et al., 2021).

- d) Quality is difficult to quantify - Cross-border e-commerce platform merchant management tools for merchant management, such as managing ads, intelligent placement of ads and so on. The primary indicator for advertising effectiveness is the ad conversion rate (user views/ user payment times). However, there are many factors that affect ad conversion, such as ad keywords, product quality, price, discount strategy, policy, user psychology and so on. Although this tool can help users find quality ads with relevant content, the conversion rate of merchants' ads may still be unsatisfactory due to a combination of other factors. In fact, in the process of product conversion, there are many deterministic and uncertain factors that can affect the conversion rate of the product, enterprise product design can only do part of the optimisation and improvement work, but not 100 percent guarantee that the design changes will enhance the growth of the business, the business and the market are constantly changing, and the product should always adjust its own functions to adapt to the rhythm of the market (Shi et al., 2022).

2.3.3 Chinese Companies' Product Types

Enterprise products can be divided into three (3) directions according to the service object: the business platform direction to support business teams, the office collaboration direction to support internal staff collaboration, and the merchant management direction to support the supply side in the platform business model. These three (3) directions cover all internal and external business management and business operations.

- a) Business platform orientation - Business platform products are mainly for the entire enterprise's various business services, providing the underlying basic services and support, which can be divided into different types of product lines, including vertical business product lines, basic service product lines and trading platform product lines.
- i) Vertical business products - Vertical business products are products that provide support and services for each specific vertical business unit, such as CRM (Customer Relationship Management) systems for sales and dealer teams, supply chain management systems for logistics service providers, WMS (Warehouse Management System) systems for warehouse teams, ERP (Enterprise Resource Planning) systems for enterprise service management applications, etc. In the broad sense, CRM includes customer development management, sales process management, customer resource management and sales behaviour management throughout the customer life cycle management process; CRM in the narrow sense refers to the use of systems by sales staff to use visual data for enterprise sales to provide sales decision-making software (Shahbaz et al., 2021). MS (Warehouse Management System) Warehouse Management System. Mainly for the support of warehouses, goods, personnel management, and other business systems. ERP Enterprise Resource Planning management. Broadly speaking, it includes raw materials procurement and sales, raw materials production and manufacturing, inventory warehousing and distribution management, financial management and other information throughout the company's integrated enterprise services management software (Rana et al., 2022). ERP in the narrow sense is usually understood only as a financial system. Broadly speaking, it includes customer service platform, telemarketing system, enterprise phone, call service platform, which includes complete software, hardware, and communication system. In a narrower sense, it refers to the software system that supports inbound and outbound customer service, including customer service system, quality inspection system, knowledge base system, and so on.

- ii) Basic service product - In the process of building the enterprise software system design, the abstraction of each system with repeated functions of the software module (common requirements), and the implementation of a unified construction and maintenance, the services provided are called basic product services, the need to undertake upstream products, for all downstream products to provide business services and technical support. For enterprises with many employees, you can establish a unified customer account management platform to facilitate communication between employers and employees, employees and customers can work more conveniently, while ensuring the company's information security. Master Data Management (MDM), enterprise architecture design is a very important part of the data is the lifeblood of enterprise development (Ghiani et al., 2022).

Data is the lifeblood of enterprise development, providing accurate and transparent data can enhance the sense of trust between enterprises and partners, and make more confident and accurate decisions to achieve strategic advantages in the dynamic market. Enterprises with large volumes will set up their own authorisation system, divide users, roles, and authorisations by RBAC principles, and carry out unified management through a centralised authorisation management platform, which facilitates business personnel with different types of authorisation roles to access different business systems with their respective IDs, and realises the decentralised management of role authorisations (Moreno et al., 2021). Messaging service refers to the unified function module that reaches each system through the establishment of unified information and announcements. SSO (Single Sign-On) service records the path of user login information, so that the user can log in once and connect to other related systems to avoid the second login, which is the connection between accounts. That is, the user logged into the same browser under the Ali pay account, if previously authorized account trust management, the user logs into Tao bao without the need to verify the account (Athanere et al., 2022).

- iii) Trading platform product - TOC's of e-commerce business is mainly for pulling new, promote live, conversion, compared to the TOC of e-commerce, here the trading platform product line is mainly for the background products to support business development. It is roughly divided into payment process board, commodity SKU management board, marketing management board and order processing board, after-sales process board. Common trading platforms are mainly divided into enterprise-type transaction mode, that is, enterprise payment and self-supporting business. Provide related services or products to businesses enterprise mode - business-to-business e-commerce products (Tolstoy& Özbek, 2023); B2C (Business-to-Customer) mode - business for consumers to make online purchases, and through the Internet to pay to complete the running of the back-end products.
- b) Collaboration product - Collaborative office direction product line mainly includes services for enterprise staff office and management of business systems such as OA (Office Automation), IM products, the main purpose is to improve the efficiency of the enterprise office. OA is a communication technology that uses computers as a carrier to quickly collect, organise, process, and store information in an enterprise or an administrative organ (Hawashin et al., 2022). In the enterprise is mainly to carry out data queries, vacation financial approval, report processing, information management and other functions to improve the efficiency of office affairs. Internal IM: internal communication tools. Such as NAIL, enterprise Wei Bo, Dong Dong, Fly Book, Elephant, etc. Human resource management software. Human resource management is mainly to assist in dealing with the enterprise's human resources-related issues, including personnel on-the-job information, attendance information, salary management, benefits management, organisational development, employee care and other functions. It greatly facilitates the participation of the company's employees in the work of the company and the transmission of the company's culture and values. Financial Management System: The most professional business system, which requires designers with relevant professional background to design professional systems, such as financial portal, expense statistics, expense query,

reimbursement approval, invoice approval, asset management, procurement budget, financial analysis, and audit supervision, etc., (Rangsipunyaporn, 2021).

- c) Merchant management product - Merchant Management System. The merchant management system can comprehensively manage and control the merchants stationed on the enterprise platform, mainly dealing with issues related to the merchant account system, merchant order management, risk assessment and qualification verification, and is an integrated, open, and secure platform (Kuan & Abdullah, 2023). Merchant Autonomous Management System (MAMS), which provides merchants with an autonomous management platform, must start from the actual business perspective of merchants, understand the business management requirements of merchants, provide accurate and reasonable services, and implement the management functions of product management, order management, marketing management, after-sales service management, and advertising placement. It also includes financial and report management, and user profiling and behaviour tracking functions based on big data.

2.3.4 Companies' Product Lifecycle

Most enterprise products are business-oriented products, and therefore enterprise products are usually product systems designed to serve various business strategies. In this case, enterprise products typically have a relatively long-life cycle from creation to retirement. This is very different from TOC products, which tend to have shorter life cycles. Unless the product has good growth numbers early in its life and is well managed later, most TOC products face the end of the line and exit from the market if they fail to gain a user following in a short period of time. The core reason, of course, is that the product's business objectives and the company's business strategy determine the product's lifecycle (Paranko, 2024).

Enterprise product 0 to 1 design and development process is long, complex, and systematic. The product design process may be accompanied by the development and adjustment of business objectives and business models, and from the start of the project to the product launch, the enterprise product will be in a different state as the business model changes with the development rhythm of the whole team, which is the life cycle of the enterprise product (Lechuga et al., 2023). As in the case of a human being from birth to death, so is the life cycle of a company's product, which includes the period of newborn, growth, maturity, and twilight. The main principle of product life cycle division depends on the stage of product and business development. Therefore, each stage of the product life cycle is mainly influenced by business needs, the cost of its inputs will be different, the milestones of work will be different, and the number of people involved, and their roles will be different.

2.4 Chinese Buying Decision Participant Demand Analysis

With the development of enterprise products in China, the purchasing decision of enterprise customers has become an important factor affecting the competitive landscape of the market. When choosing products, enterprise customers not only pay attention to the characteristics, quality and price of their own products, but also consider brand reputation, after-sales service, technical support and other factors to ensure that the purchased products can effectively improve business efficiency and meet long-term development needs (Habib & Sarwar, 2021). Therefore, it is important to study the purchasing decision process of enterprise products in depth and understand the changes in demand preferences of enterprise customers in the decision-making process, to optimise product design and marketing strategies and improve market competitiveness. Based on this, the following content will focus on the analysis

of corporate product purchasing decision, including the participants of purchasing decision, behavioural process, related research, and buyers' product satisfaction, to systematically explore the logic of corporate customers' purchasing and influencing factors (Nicolescu & Tudorache, 2022).

Enterprises in the Internet environment have gradually shifted their focus to a customer-centric business model. In the case of determining the target market from the target market customer groups to identify meaningful and valuable customers for the enterprise as the object of enterprise implementation, can bring better value for the enterprise products. Customer purchase decision is mainly formed by two stages, the first stage is the customer to make decisions before the perception of the product or service; the second stage that is through the perception of the formation of decision-making on the consumption of practice (Hoek et al, 2021). In the real enterprise customer consumption process, product demand and product preference in the decision-making through the interaction and influence, together form the complete process of customer decision-making. Clarify the product demand and product preference in customer orientation, and influence analysis on buyer decision-making. For better research, it can classify the relationship between users and customers of different products into the following categories: users and customers are completely unrelated; some customers are also users; users are customers. The "buyer" is considered as a subset of the customer, with the former focusing on a single transaction and the latter emphasising a long-term relationship and exchange of value with the firm (Saether et al., 2021).

2.4.1 Buying Decision Participant

According to Webster (2023), when the core of business buying consists of five (5) categories of members involved in the buying decision and buying process, namely users, determinants, influencers, buyers, and supervisors. Among them are.

- a) Users, who are the people who use the purchased product.
- b) Decision makers, who are the people who choose and decide on suppliers and product brands.
- c) The buyer, who is the person who executes the decision.
- d) The supervisor, the person who controls the information that goes to the heart of the purchase, e.g., he can prevent the supplier's salesperson from meeting the user or decision maker.

For example, if you want to consume a television, it is the wife who makes the request and it is the husband and wife who decide whether or not to consume it; the wife has a greater say in the size and shape of the television, and the television company can recommend to the wife products that are popular in terms of size, shape, etc., and the husband makes the decision about the brand of the television, so the television company can make a decision about the husband more often than not. Sometimes one person can play several roles; and many people can also all play a role in a certain kind of role, the various members within the procurement core, due to their different positions in the enterprise, their experience, education, cognitive ability, and tasks are different, often making each of them have a unique feeling, purpose, and behaviour, etc.

The International Organisation for Standardisation (Alsyouf et al., 2021) defines a customer as an organisation or individual who receives a product. According to this definition, the customer is the one who pays, but not necessarily the user or consumer. Client, which means customer, is also a legal term, meaning party, principal. In the eyes of the seller, the client is on a higher level than the consumer. Marvin Bauer, the founder of McKinsey in the 1950s, said “We don’t have customers, just have clients”. He believed that customers were ordinary users of goods and services, while McKinsey was supposed to provide professional services. Consumer, which is an economic concept about, the English is consumer, consumer is and producer, operator corresponds. Consumers are the end users of products and services rather than producers and operators, that is, the purpose of his consumption of goods is mainly for personal or family needs, rather than production and business needs.

In the field of marketing, for business operators, in order to be consumer-oriented and provide them with various experiences of buying and using products (Rejeb & Treiblmaier , 2023), it is important to know the three roles of consumers: buyer, payer and user, the buyer is the role that the consumer plays at the stage of choosing goods and is responsible for making the purchase decision; the payer is the one who pays the money after the purchase decision; the user is the one who pays the money after the purchase decision; and the user is the one who pays the money after the purchase decision. The buyer is the role played by the consumer in the product selection stage, responsible for making the purchase decision; the payer is the person who pays after the purchase decision; and the user is the person who uses the product, as referred to in the field of user experience design (see Table 2.1).

Table 2.1 : Role Definition

Role	User	Consumer	Client
Usage Behaviour	The user of the product	May or may not be a user of the product	May or may not be a user of the product
Purchasing Behaviour	May or may not be the purchaser of the product Purchase relationship is all possible	Purchasers of the product focus on one-time purchases	Purchasers of products focus on long-term business relationships
Transaction Properties	Cannot be resold	Can be resold	Can be resold

(Source by Keels et al., 2024; Eslami et al, 2022)

In the corporate marketplace, it is critical to understand the roles and decision-making authority of all relevant decision makers. These decision makers may include purchasing, engineering, finance, etc. It is also necessary to understand the preferences and priorities of these decision makers to develop appropriate sales strategies based on their priorities (Keels et al., 2024). There is also a need to consider competitors when influencing the buying decisions of business customers. By understanding the strengths and weaknesses of competitors, one can better position the differentiating advantages of one's own products and develop appropriate sales strategies (Eslami et al., 2022). As shown in the Figure 2.2 below, due to differences in size, many people have multiple roles, or one person has multiple roles. For this study, it has conducted a product framing study based on the premise that the roles of user (product user) and customer (Product purchase negotiator) are completely independent in a business organisation.

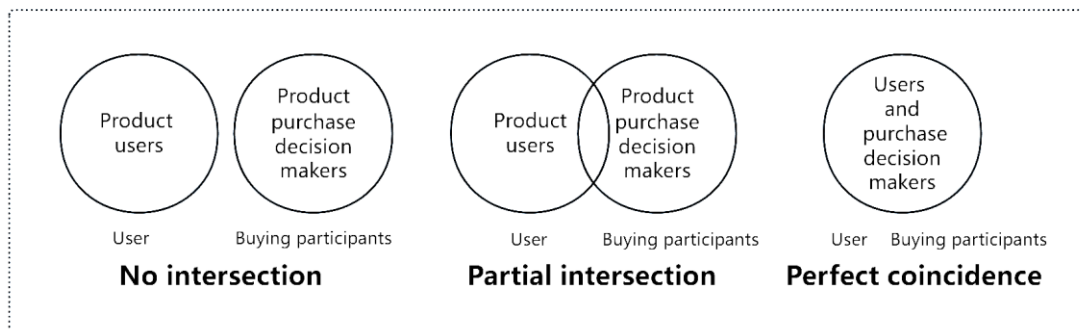


Figure 2.2 : User and Customer Relationship
(Source by author)

2.4.2 Buying Decision Behaviour Process

Nicosia was based on the concept of Specification of Requirements (SOR), the consumer decision-making process as the basis of research, consumer purchasing behaviour model is divided into the external information process, information gathering and evaluation of the programme, purchasing behaviour and information feedback (Dash & Sharma, 2022). Zhan et al., (2022) proposed three decision-making processes: (1) central control system, i.e., the consumer's mental activity process (Yim & Lee, 2021); (2) information processing; (3) decision-making process; and (4) environment. Kim et al., (2022) proposed a model of the buying behaviour of B firms with four (4) variables that influenced the firm to make buying decisions are environmental, organisational, interpersonal (between core buying members) and personal variables. Customers in consumption before the existence of a decision-making process (Ngcamu, et al., 2023), but due to a variety of internal and external factors, different customers of the consumer decision-making process are different, the usual consumer decision-making process mainly has the following processes:

- a) Generate demand - The starting point of customer consumption decision-making process is the emergence of demand awareness (Kambala, 2025). The formation of customer demand, either instinctively driven by the human body,

can also be stimulated by external conditions, such as because it was raining and had to buy an umbrella, saw the watch ads on TV and intend to buy a watch, passing by the cake shop to see the freshly baked cakes and decided to consume and so on.

- b) Access to information - When the consumer demand is formed, the customer will satisfy it by performing some relevant behaviours. If the product or service that the customer wants to consume is nearby, the customer will perform consumption behaviours to satisfy his consumer demand. However, suppose the demand cannot be satisfied for various reasons. In that case, the customer temporarily suppresses the demand and does not interrupt attention to information related to the demand, waiting for the next time when there is an opportunity to consume again (Wiesner et al, 2021). There are three main channels through which customers obtain information: personal channels, from family, friends or colleagues and other personal social channels. Social sources, from the network, radio, television, newspapers and magazines and other public communication media channels to obtain information, social channels, a wide range of information, fast dissemination speed (Arisanty et al., 2020), but also the customer to obtain information from the main channels. Experience channel, from the past personal experience, the use of products or experience service process to get the information.
- c) Weighing decisions - When customers receive relevant information from different channels, they will weigh and compare different products and services, then make a personal judgement, and finally make a consumption decision on one or some of them (Bolton, et al., 2022). The main ways in which customers evaluate information about different products or services are as follows:
 - i) Analysing the attributes of the product or service. The attributes of a product or service refer to its ability to satisfy one or more of the customer's needs. Customers usually view a product or service as a combination of several attributes (Ruan & Mezei, 2022). For some familiar products, customers often pay attention to attributes such as speed, screen size, camera pixels and price of mobile phones. Customers do not

pay attention to all the attributes of a company's products or services, and the focus varies from person to person.

- ii) Attribute weighting. This means that customers assign artificial weights to the relevant attributes of the product or service. Some attributes may be forgotten by customers, but when they are mentioned, customers realise their importance. Corporate marketers need to pay more attention to how attribute weights are assigned to products or services than to attribute features (Marcon, et al., 2022).
 - iii) Build brand awareness. Customers will form different perceptions of brands based on the functional characteristics of different (Zia & Mirza, 2021), such as identifying which brand is relatively poor in which function and which brand has an advantage in which function.
 - iv) Make personal judgements. Customers judge the products or services they are going to consume according to their personal situation. In the process of making a judgement, customers often compare the actual products or services with their initial expectations (Hult et al., 2019; Tran et al., 2021).
- d) Consumption decision - If the customer's consumption intention is really put into consumption practice, only let the customer to a brand to produce a good feeling, and consumption intention is still not enough, consumption decision will be mainly affected by the following two aspects:
- i) Attitude of people around. The customer's desire to consume is often strengthened or weakened by the attitudes of people around them towards the product or service. The strength of the influence of the attitudes of the people around the customer on the customer's desire to consume depends mainly on the degree of social closeness between these people and the customer. The closer the relationship between the surrounding people and the customer, the greater the influence of their attitudes (Arslan, 2020). For example, if a customer wants to consume a travel product and his or her family is strongly opposed to the idea, the customer is likely to abandon the consumption plan.

- ii) Uncertain and unexpected situations. When the customer intends to implement the consumption action, there are some unexpected circumstances, such as job changes, income decrease, price increase or other products or services to better meet their needs, etc., and the customer's consumption intention of the generation of expected income, the expected price of the product and the expected satisfaction from the product or service, etc., there is a big difference between these circumstances will make the customer to change or give up the original consumption plan (Maurya, 2022) .
- e) After-sales behaviour - After the customer completes consumption, he enters the after-sale stage, and at the same time, the company's after-sale work begins. After consumption, through their own use and the evaluation of people around them, customers will compare what they feel with their own expectations and show a certain degree of satisfaction or dissatisfaction. Customer satisfaction S can be expressed as a function of perceived performance P and expectation E and of the product or service: $S = f(E, P)$, If $E=P$ it means the customer is satisfied, if $E<P$ it means the customer will be very satisfied, but if $E>P$ it means the customer is not satisfied. Customers form expectations about a product or service from information they receive from other sources, such as themselves, friends around them, and sellers. The customer's satisfaction with this consumption experience affects subsequent consumption behaviour. If the seller overstates the benefits of the product or service, the customer will have high expectations, and if these expectations are not met, the customer will be dissatisfied. If E is greater than P and the gap between the two is greater, i.e., expectations are much greater than reality, the customer's psychological gap will also be greater, and when the psychological gap reaches a certain threshold, there will be complaints, requests to return products, and certainly not to buy the product at the same time, or even to advise friends not to consume this product or service (Fennis & Stroebe, 2020).

2.4.3 Buying Behaviour Related Research

Western scholars' research on corporate purchasing behaviour covers many aspects, such as the corporate purchasing centre, the stages of the corporate purchasing process, and the types of corporate purchases. There are three well-known models: the "corporate buying process" and the "buying framework" model proposed by Dangi (2020); Han, (2021) "General Model for Understanding Organisational Buying Behaviour"; and Roy (2022) "Model of Business Buying Behaviour". Although there are significant differences between these three models in terms of the buying process and specialisation, there are many similarities in terms of the many factors that influence organisational buying behaviour. Firstly, all three models include external influences such as politics, economics, suppliers, culture, competitors, technology, law and globalisation (in Sheth's model these variables are referred to as environmental influences); secondly, all three models include organisational influences such as size, structure, positioning, technology, rewards, commitments and goals; and finally, all three models include individual participant (buyer) characteristics including education, motivation, perception, personality, risk appetite and experience. Finally, all three models include individual participant (buyer) characteristics, including education, motivation, perception, personality, risk preference, and experience.

Subsequently, many scholars have conducted exploratory and extensive research based on these three basic models, on the one hand verifying the correctness of some of the factors in the above three models, and at the same time exploring some new factors, enriching the classical model, and proposing a more comprehensive, objective, and realistic model. Hair et al (2021) of Babeş-Bolyai University, after summarising the factors influencing corporate buying behaviour listed in the above three models,

made significant changes and extensions to them, and added four structural variables: decision rules, role pressure, buyer-seller relationship, and communication, etc., based on their research, and proposed the Integration Model. As can be seen from the various models above, there are many factors that influence the buying behaviour of companies. Supplier marketers should pay special attention to how these factors affect customers' purchasing decisions and, more importantly, how they can be used in formulating marketing strategies to fully exploit the positive effects of these factors.

2.4.4 Buyer Product Satisfaction

According to Waluya (2019), customer satisfaction is a psychological reaction of customers after they are satisfied, it is a judgement of customers on the characteristics of products and services or the degree to which the products and services themselves satisfy their needs, and the judgement is based on the degree to which such products or services satisfy the needs of customers. According to Ashfaq (2019), "customer satisfaction depends on the comparison between the actual consumption effect of the goods and the consumer's expectations, and if the actual effect of the goods meets the consumer's expectations, it leads to satisfaction. Otherwise, it leads to dissatisfaction". According to Jasin, (2023), satisfaction is the state of feeling of pleasure or disappointment that an individual develops by comparing the perceived effect of a product with their expectations. If the customer's perception does not match expectations, the customer will be dissatisfied and disappointed; if the perception matches expectations, the customer will be satisfied; if the perception exceeds expectations, the customer will feel "value for money" and will be very satisfied (Ahmed & Abid, 2024). Dell, the president of Motorola, believes that customer satisfaction is the result of successfully understanding the preferences of a particular

customer or part of the customer and making appropriate efforts to satisfy the customer's needs (Weinstein, 2024).

Stylidis and Söderberg (2020), "Customer Expectations, Product Performance, and Perceived Product Quality". Eckert 's (2022) article "Customer Dissatisfaction: The Effect of Inconsistency between Expectations and Perceived Quality" explored the basic framework of expectancy inconsistency theory which, together with Cardozo's experimental study a little earlier, formed the basis of the model. According to the expectation model, there are three basic variables in the expectation model: pre-purchase expectations, post-purchase inconsistency, and the difference between actual performance and expectations. Expectation is the customer's expectation of product performance and inconsistency is the difference between performance and expectation, where performance is the benefit received by the customer and satisfaction is the final attitude and evaluation of the customer. Strübel and Tylka (2020) found that different categories of products have different degrees of conformity to the expectation model, for example, non-durable goods are more in line with the expectation model, for durable goods, there are two significant features, the impact of expectations becomes smaller; the impact of performance increases significantly, so people began to explore other types of models based on the expectation model.

Kai 's (2021) article "Components of Measuring Fairness in the Marketplace: "Perceptions of Inputs and Outputs by Satisfied and Dissatisfied Customers" is one of the earliest in the literature. It was followed by a series of studies by Zhang (2022); Sambo (2022) and others which showed that customer satisfaction with a product depends not only on the comparison between expectations and performance, but also

on whether the customer perceives the transaction as fair and reasonable. Customers feel fair and satisfied when they feel that they receive the same ratio of benefits to inputs as the product provider. The higher the level of fairness, the more satisfied the customer is and, conversely, the lower the level of fairness, the less satisfied the customer is. Although the importance of fairness has been recognised theoretically, it is difficult to quantify such a highly abstract concept (Li et al., 2023) and therefore to generalise it in practice. Some scholars have studied one aspect of fairness, such as Dolata (2022), who introduced “payment fairness” to study the effect of price fairness on satisfaction. Compared to the expectation model and the performance model, the equity model focuses more on the input component of customers, so that the concept of customer satisfaction is closely related to “value”.

In addition, there are many other models, some of which introduce new variables such as norms, usage, etc. and study their effects on satisfaction, such as Torabi et al., (2022) who used desire as an antecedent variable of satisfaction, while others modify and develop the traditional model, such as Grégoire and Mattila (2022) proposed a model of satisfaction that includes service failure and recovery. Others have conducted in-depth studies on the content and nature of satisfaction itself, such as Shin (2023), who classified satisfaction into five levels: satisfaction, pleasure, novelty, relief, and surprise. This shows that with the continuous deepening of satisfaction research, the satisfaction model based on cognitive science has begun to add the more difficult to grasp emotional content, thus adding an emotional component to the rational model, which will undoubtedly make the satisfaction model more perfect and closer to human nature. However, there is still a gap in the analysis of corporate purchase satisfaction,

and this paper argues that corporate customer satisfaction is influenced by product demand and preference.

2.5 Chinese Company Product Demand Analysis

Product requirements are the requirements for the functions, features, performance, interface and other aspects of a product or service designed and developed to meet customer needs. Product requirements are usually determined by the product manager based on user needs, market analysis, competitive product comparisons, and other factors. Product requirements reflect the specific form and value of the product or service and provide the basis and guidance for product development.

2.5.1 The Importance of Product Requirements Analysis

Kabir et al., (2024) that requirements analysis is to achieve a comprehensive description of the function of the software, to help users judge the correctness, consistency and completeness of the implementation of the function, prompting the user to start the software design before the start of a thorough, comprehensive thinking about the software requirements for the software design, validation and verification of the software to provide a baseline; for the software management personnel to carry out the cost of the software and the preparation of the software development plan to provide a basis.

Zhu et al., (2021) studied the demand and supply of bit products, highlighting the balance and coordination between demand and supply in the process of product demand transformation. Product demand transformation requires a comprehensive consideration of market demand, technical feasibility, and cost-effectiveness to

determine the functions and specifications of the final product. Saleem et al., (2022) proposed a study on demand management system and key technologies for electronic products for Original Design Manufacturer (ODM), which indicated the need to establish an effective get management system and master key technologies in product demand to meet customer-specific needs and requirements. Xu and Qu (2025) focused on the demand acquisition and conceptual design of electromechanical products. It suggests that product demand transformation involves the process of acquiring demand information from users and markets and transforming it into specific product concepts and design solutions. By understanding user requirements and market trends, the product development process can be better guided to ensure product competitiveness and market acceptance.

Yu (2018) argues that the goal of requirements analysis is to analyse and collate the 'requirements' or 'needs' of the users of the software to be developed, and then to confirm the formation of a complete description of a complete, clear, and standardised document to determine what the software needs to achieve. Functions. Complete what work. In addition, some non-functional requirements of the software (such as software performance, reliability, response time, scalability, etc.), the constraints of the software design, the relationship between the runtime and other software, etc. are also the goal of software requirements analysis. According to Wong et al., (2018), requirements analysis is an important activity in the software planning phase and an important part of the software life cycle, which is to analyse what the system needs to "achieve" functionally, rather than considering how to "achieve" it. Lu et al., (2019) studied the production planning of multi-product, multi-stage manufacturing systems, implying that product demand shift not only involves the product design and development

stages, but also requires reasonable planning and scheduling in the production process. In the process of product requirements conversion, factors such as supply chain, production capacity and resource allocation must be considered to achieve efficient production planning.

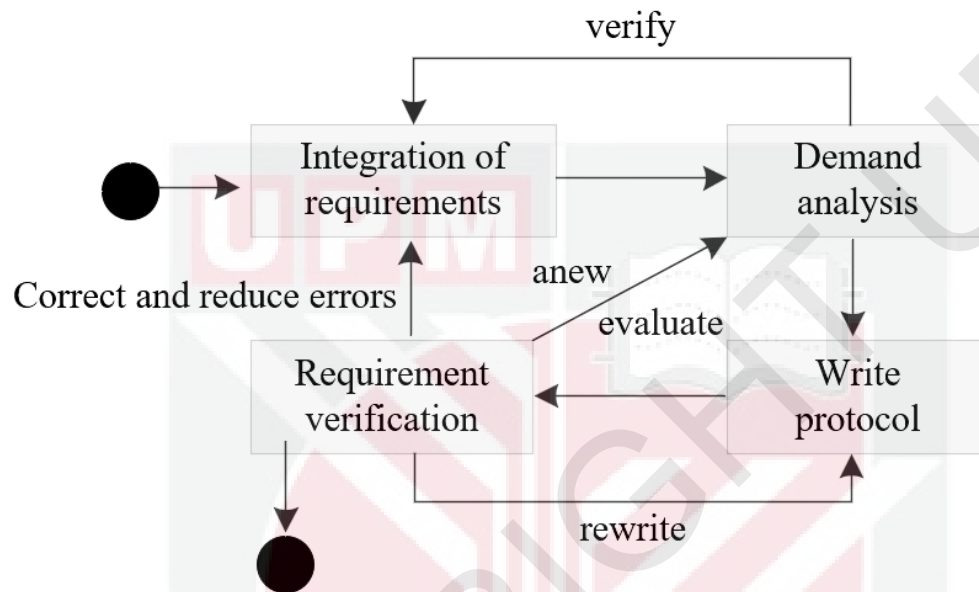


Figure 2.3 : Requirement Analysis Definition
(Source by Song et al., 2021)

Song et al., (2021) defined four steps in requirements analysis: requirements acquisition, which refers to the sources of software requirements and the methods used by software engineers to collect these software requirements; requirements analysis, which produces a table of operational specification parameters, specifies software interfaces with other system components, and identifies constraints that the software must satisfy; and requirements definition, which refers to the preparation of a statement of requirements specification for software (see Figure 2.3). Requirements validation means checking requirements for correctness, completeness, non-duality, internal and external coherence.

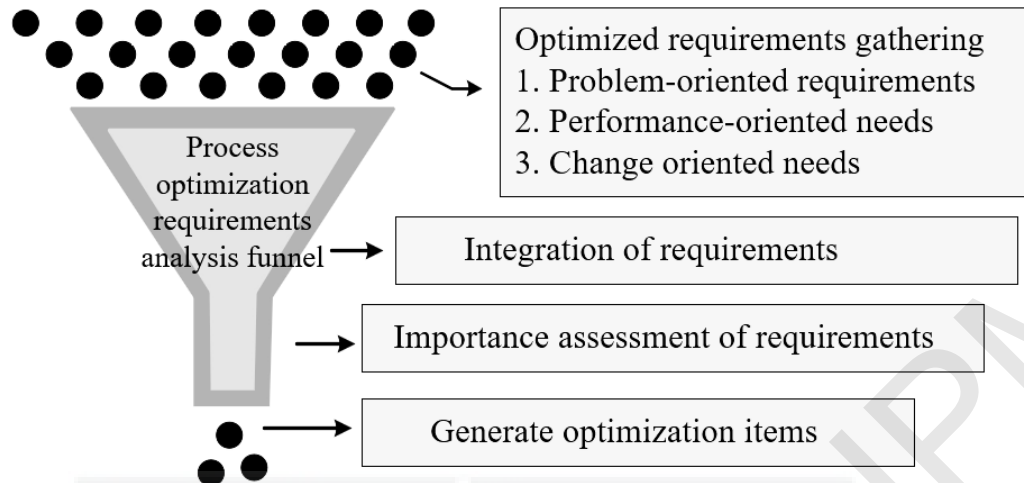


Figure 2.4 : Funnel Model
(Source by Zhang, 2023)

Zhang (2023) The whole process from obtaining process optimisation requirements to completing the optimisation analysis is like a “funnel”, so the “funnel model” has become a common model for process optimisation requirements analysis (see Figure 2.4). First, problem-oriented requirements, performance-oriented needs, and change-oriented requirements are collected, and these requirements are integrated for analysis and critical assessment. Then, a project team was set up to confirm the requirements and further develop the design and implementation of the process optimisation plan. After the new process is successfully launched, the finance department needs to solidify it. The process manager outputs standardised process documentation, conducts process releases, and organises relevant training if required.

2.5.2 Company Product Demand Characteristics

Enterprise product development is a comprehensive activity, enterprise product development is not easy, need to go through a series of scientific, systematic process which includes six stages: Planning, Concept Development, System-Level Design,

Detail Design, Testing and Refinement and Production Ramp-up, the main description is as follows (Roscoe & Handfield, 2023).

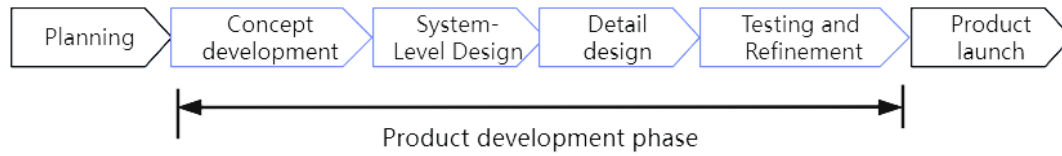


Figure 2.5 : Requirement Analysis Definition

(Source by Lanzotti et al., 2023)

As refer to Figure 2.5, planning is the process of developing an overall plan for a product development project, including defining the goals and scope of the project, developing a timeline and resource allocation, assessing risks, and developing countermeasures (Lanzotti et al., 2023). In the Concept Development phase, the team brainstorms and conducts market research to generate different product concepts, assesses their feasibility, and selects the most promising concepts for further development (Gama et al., 2023). System-Level Design translates the selected concepts into a specific system design, determines the functional and performance requirements of the product, and designs the overall structure and system architecture of the product (Tavory et al., 2023). Detail Design Phase, where the team refines the system-level design into more specific design solutions, including technical solution design, business rules, and interface design in preparation for the next phase of manufacturing (Uusitalo et al., 2019). The Testing and Refinement (T&R) phase involves performing various tests on the product, identifying, and resolving problems to ensure that the performance and quality of the product meets expectations, and modifying and optimising the design where necessary (Gebizli & Sözer, 2017). Production Launch is the last stage is to prepare for the launch of production and to

gradually increase the output of the product to meet the market demand and to ensure the stability and controllable quality of the production process.

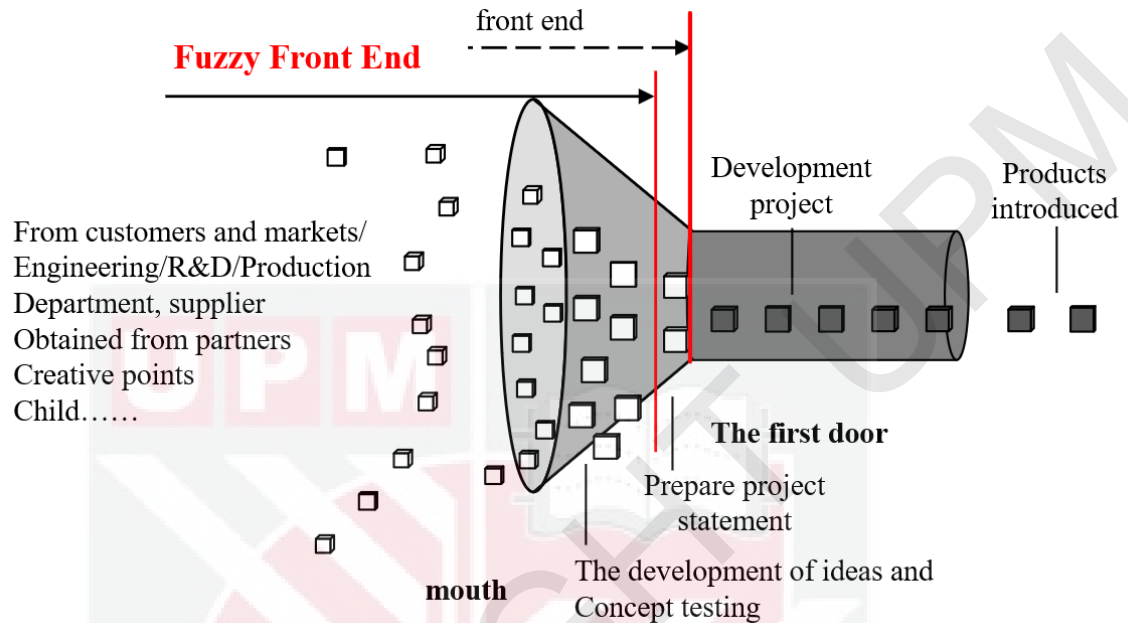


Figure 2.6 : The Fuzzy Front End of Mainstream NPD
(Source by Wheelwright & Clark, 1992)

According to Wheelwright and Clark (1992, many scholars refer to the concept development phase as the opening phase or the “fuzzy front-end” (see Figure 2.6). Serugga (2021) refers to the position of the fuzzy front-end in new product development. Demand fuzzy problem elicits characteristics and difficulties, mainly in the following aspects.

- a) Difficulty in determining the problem. The complexity of the application domain and business changes, it is difficult to determine specifically; user needs involved in multiple factors caused by, such as the operating environment and system functions, performance, reliability, and interfaces (Peksa & Mamchur, 2023).
- b) Requirements change over time. Software requirements often change with time and business throughout the software life cycle. Some users’

requirements change frequently, and some enterprises may be in a period of change and growth of institutional reform and enterprise reorganisation, and their enterprise requirements are immature, unstable and unstandardised, resulting in dynamic requirements (Han et al., 2024).

- c) Communication is difficult to achieve consensus. Requirements analysis involves many human things and related factors, and when communicating with users, business experts, requirements engineers and project managers etc., different background knowledge, roles and perspectives etc. make it difficult to communicate consensus (Yan et al., 2024).
- d) It is difficult to achieve completeness and consistency in the requirements gathered. Because different people have different perceptions of the requirements of the system, the problem is not formulated accurately enough and there may be contradictions in the requirements of different parties. It is difficult to resolve the contradictions and form a complete and consistent definition (Bickhart et al., 2022).
- e) Requirements are difficult to analyse and refine in depth. Understanding requirements based on incomplete and inaccurate analysis, changes in customer environment and business processes. Changes in market trends etc. It is also subject to in-depth refinement as it is analysed, designed, and implemented, with software requirements possibly being revised at the end. Analysts should recognise the inevitability of changing requirements and take steps to reduce the impact of requirement changes on the software. Requirements for necessary changes should be carefully considered, tracked, and comparatively analysed before implementation (Dalkin et al., 2021).

2.5.3 Product Requirements Change Analysis

Requirements changes are common in the product development process and can be due to a variety of reasons related to market changes, technical constraints, customer feedback, and so on. However, requirement changes are often accompanied by an

increase in cost and time, so the cost of change needs to be fully analysed. In order to effectively manage requirement changes, it is necessary to establish a comprehensive change management system, including determining the priority of changes, evaluating the impact of changes, and monitoring the progress of change implementation. At the same time, choosing the most appropriate change path is also crucial, and the urgency, cost-effectiveness, and customer value of the change need to be considered to ensure that the project runs smoothly and is ultimately successful.

- a) Analysis of the reasons for requirements changes - There are many reasons for business requirements changes the following are some common reasons (Errida & Lotfi 2021; Kanike, 2023):
 - i) Business process adjustment: As business processes change, the original requirements may no longer be able to meet the needs of the new process, so they need to be adjusted. This usually happens when an organisation grows or changes its business scope.
 - ii) Technical constraints: As technology evolves and improves, the original requirements may not be supported by existing technology. For example, the original software version used may be too old to handle more complex data, or a particular technology may have been discontinued and new technology is required to meet the requirement.
 - iii) Competitive pressure: The market is becoming increasingly competitive and to keep up with the competition or gain an edge, companies need to adapt their requirements and introduce new features and services.
 - iv) User feedback: User feedback is also one of the most important reasons for changing requirements. By collecting user feedback, companies can understand users' needs, adjust their products and services, and improve the user experience.
 - v) Changes in the external environment: Changes in the external environment, such as policy, market, and international situations, can

also lead to changes in enterprise requirements. For example, policy changes lead to adjustments in related requirements, market changes lead to adjustments in product positioning or functions, and so on.

- b) Cost analysis of requirements changes - Changes in requirements are often accompanied by increased costs and time. These costs may include the cost of redesign, the opportunity costs associated with delayed delivery, as reflected in the following (Yin et al., 2022; Jayatilleke & Lai, 2018).
 - i) Time costs: Changes in requirements require replanning and re-scheduling of development time, which leads to delays and overtime in the original plan, thus affecting the progress of the whole project.
 - ii) Labour costs: Changing requirements means that more human resources such as requirements analysts, developers, testers, etc. need to be involved. This will increase the company's manpower and training costs. This will increase the company's manpower and training costs.
 - iii) Financial costs: Changing requirements usually requires more money to support the new development process, such as purchasing new software or hardware equipment, paying extra salaries, training costs, etc.
 - iv) Communication costs: Changing requirements requires communication and coordination with customers or other team members to ensure that everyone understands the new requirements and that there is no unnecessary disruption to the development process.
 - v) Risk costs: Changes to requirements can introduce new risks and uncertainties, such as technical difficulties, security issues, etc., which can add additional challenges and stress to the overall project.
- c) Analysis of product design change management - Requirements management is sometimes considered the most complex requirements engineering process (Laplante & Kassab, 2022). Requirements changes can have a large impact on the developed system, which is difficult to estimate. Hutchinson (2021)

developed requirements management tools to manage unstable requirements, and the large amount of data collected during the requirements engineering process. For each change, costs and redevelopment efforts must be considered before the change is approved. After the requirements are refined, they can be further incorporated into the software development process. Requirements change management is closely related to baselining (Liu, et al., 2022). Requirements management is a complex process involving many different phases, processes or steps, and different stakeholders. Typically, product management, especially product managers, are responsible for the requirements management process, and they work with various stakeholders, which include business teams, customers, users, developers, testers, regulators, and quality assurance personnel (Spillner & Linz, 2021).

- d) Analysis of change path preference methods - In 1997, IEEE clarified the requirements change path (see Figure 2.7). First the initiator initiates the change requirement, and the team makes the choice of change method (Zhang & Yang, 2020). If the change is to be made, it may bring certain impacts and must analyse the impacts. If the impact is too big to change, or if it can be changed, must communicate with the relevant people. After some communication, the results of the decisions are merged for version iteration and contract management. Although this is consistent with the natural laws of human understanding of the problem, but frequent and unmanaged requirements change is very easy to lead to complex, intangible software in the changing circumstances out of control, exacerbating the instability of the software development process, resulting in multiple losses. So how to effectively control and manage the requirements change, to ensure the progress, cost, and quality of software development, has become a software development process worth thinking about (Qian, et al, 2023). In response to the problem of updating product configuration, enterprises lack a systematic response method, and often designers and manufacturing personnel will modify the configuration of the configured product to meet new customer requirements based on their own experience and re-organise production according to changes in customer requirements (Pollini et al., 2022).

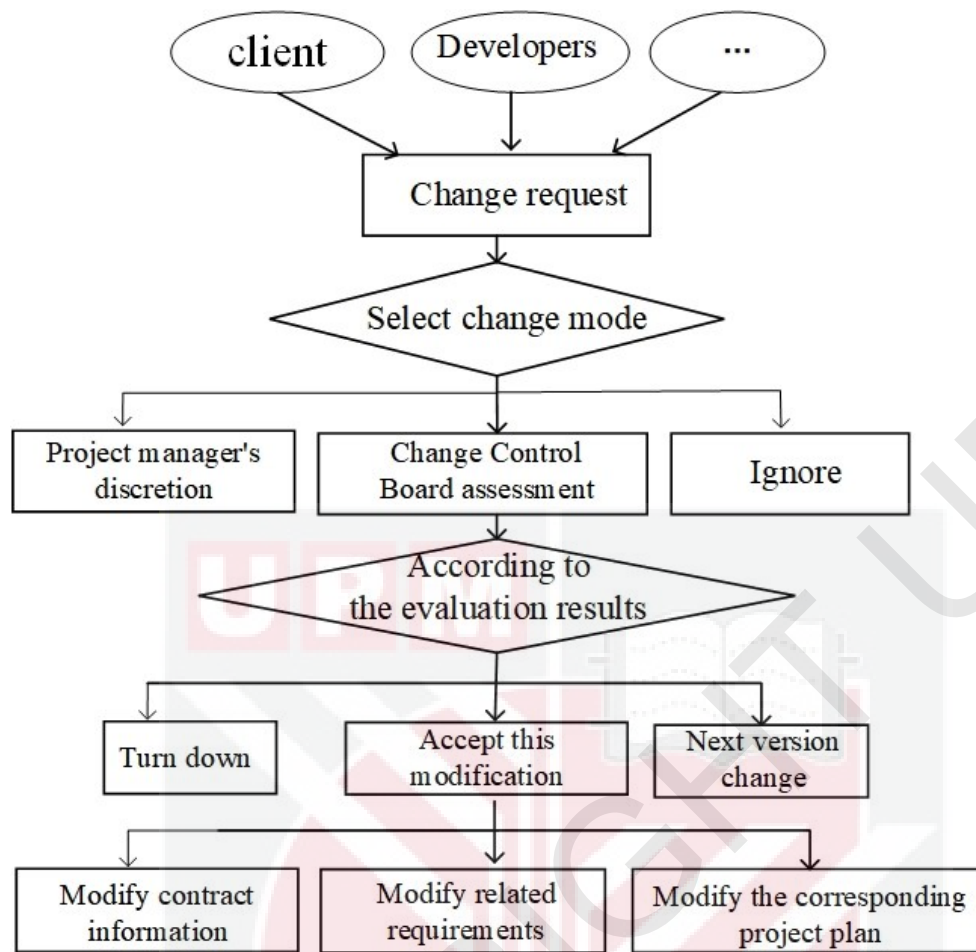


Figure 2.7 : IEEE Requirements Change Process
(Source by Zhang & Yang, 2020)

2.5.4 Product Resource Allocation Requirement

Response to customer demand changes in product design is a complex systematic project (Dong et al., 2022). When in the process of product design response to customer demand changes, the key issues include the assessment of the impact of demand changes, the improvement of the efficiency and optimality of programme reconfiguration, as well as the reallocation of design tasks, the rescheduling of design resources, and the handling of design resource scarcity. In order to have a reasonable get to allocate resources to respond to customer demand, it is necessary to carry out an in-depth study of its key issues.

- a) Impact assessment of the demand change - At present, meeting customer needs and improving customer satisfaction is a necessary way for enterprises to gain market share and improve competitiveness (Arslan, 2020). However, the design capability and production capacity of enterprises are limited, and the requirements of customers' demand changes based on their own interests will inevitably exceed the production capacity or cost budget of the enterprise, and if this time also blindly aim at meeting customer needs, it may affect the enterprise's. If we blindly aim to satisfy customers' demands at this time, it may affect the enterprise's own operation efficiency. Therefore, when a customer requests a change in requirements, the decision makers and designers should first carry out a change assessment (Andersen & Magnusson, 2022).

Changes in localised features of customer requirements are often due to correlations between product modules spreading to other components, and their corresponding design tasks caused by change diffusion chain reactions, which, together with the coupling between task iterations, ultimately makes it very difficult to assess the impact of changes in customer requirements (Hong et al., 2023). Depending on the contextual choices, the study proposes several approaches. Evaluating the costs and benefits caused by demand changes and comparing them between costs and benefits, this cost-benefit analysis method can help determine whether demand changes are worth implementing and their overall economic impact on the project (Socorro et al., 2022). Impact matrix analysis helps to identify and understand the scope and magnitude of the impacts of demand changes by producing an impact matrix that lists the aspects that could be affected by demand changes, and then evaluating and scoring these aspects (Villa et al., 2025). Evaluate the risks caused by demand changes, including risks in terms of project schedule delays, cost increases, quality reductions, etc., and the risk assessment methodology helps to identify potential risk factors and develop appropriate risk responses (Al-Mhdawi et al., 2025). Analyse the impact of changes in requirements on various stakeholders, including the client, project team, management, etc., and find solutions to maximise the satisfaction of all parties (Rehan et al., 2024). Seek advice from domain experts or project team

members to assess the possible impacts of changes in demand. Their experience and expertise can help identify and understand the impacts of demand changes (Bankins et al., 2024). Making sound decisions about demand change requests to ensure that the interests of both the company and the customer are maximised is a key issue in achieving customer demand change response in product design.

- b) Product reconfiguration efficiency - If an organisation accepts a change in customer requirements, it is how the reconfiguration of the product is accomplished that determines the costs associated with the organisation's design. A reasonable and fast configuration scheme is an effective way to shorten response time and reduce reconfiguration costs. At present, product reconfiguration is mainly divided into two kinds: one is based on the rapid configuration of module combination, and the other is based on the rapid configuration of parameter adjustment. And the product has thousands of components. In the case of changing requirements, the modules affected or needing to be adjusted may come from different modules. When heterogeneous modules are combined, coupling or conflict bet.

Product reconfiguration efficiency and solution optimality improvement methods are key technologies to improve the efficiency of response to changes in customer demand and reduce the cost of product design. Zhang et al., (2023) proposed a set of empirical engineering change propagation path prediction methods based on the use of information theory, semantics, and the similarity of the impact of changes; Haibing et al., (2021) proposed an integrated change propagation scheduling method to plan for design changes to obtain the shortest execution time and the most probable propagation path; Campos et al., (2022) proposed a joint optimisation model for complex product variant design that responds to changes in customer demand with the goal of maximising customer satisfaction and minimising cost; Brahma et al., (2023) proposed a mathematical planning model for path change propagation based on design attribute networks, using an improved ant colony optimisation algorithm to find the propagation path with minimum change impact; Bowen et al., (2023) dynamically analysed the impact of changes in

different features on their upstream and downstream features by constructing a complex product feature correlation network, and searched for the change propagation path with minimum impact on the design of a complex product from a global perspective; Zhou et al., (2025) proposed a complex product propose a multi-source design change path optimisation method based on a directed additive network model, using an improved ant colony algorithm to search for the optimal propagation path that minimises the cumulative change propagation intensity; Li et al., (2021) propose a multi-objective optimisation method based on a multi-network for design change propagation paths by taking into account the impacts of design change propagation, the execution time of the change task and the cost of the change.

- c) Product resource scarcity disposal - When the product reengineering programme is completed, the design task reassignment programme should be completed in as timely a manner as possible (Poudel & Moh, 2022). If the completion time of product redesign tasks is difficult to determine accurately, resulting in the lack of sufficient reliable data support for subsequent design resource scheduling (Sandelic et al., 2022), it may lead to the lengthening of the R&D cycle. In this case, the higher the design cost of the product itself, the higher the operating cost of the firm, and naturally the profit will be reduced (Zhang et al., 2022).

Various studies have been conducted by researchers to enhance design task reallocation programmes. Establishing effective teamwork and communication mechanisms to promote cooperation and information sharing among team members to improve the efficiency and quality of product design (Wang et al., 2021). Establishing a performance evaluation and feedback mechanism to assess team members' performance in a timely manner and provide effective feedback and suggestions for improvement to optimise the effectiveness of task reassignment (Agustian et al., 2023). Allocating product design tasks and project resources appropriately based on the skills and experience of team members to ensure that everyone is working to their maximum potential (Chen et al., 2024). Adapting task allocation and resource planning strategies flexibly to meet new challenges and opportunities as the

project progresses and team member profiles change Nguyen, 2024). A comprehensive assessment of team members' skills, experience, and abilities to determine their adaptability and value of their contribution to the product design process (Shet, 2024).

- d) Solve the Problem of Scarce Design Resource - As changes in demand may lead to an increase in new design tasks, new design task resources may also generate new resource demands, resource scarcity, may occur, and for this resource shortage, it is important to rationally schedule such resources to minimise changes in customer demand and to improve the stability of the design process (Wu & Zheng, 2024). Improving the efficiency and resource utilisation of the design process through technological innovation and automation. The use of advanced design tools and technologies, such as computer-aided design (CAD) and simulation software, can reduce the need for human resources, speed up the design process, and improve the accuracy and quality of designs (Adediran et al., 2024). By streamlining the design and simplifying the process, the demand for resources is reduced and the efficiency and effectiveness of resource utilisation is improved (Špírková et al., 2024). Prioritise resources based on the needs and objectives of the project to ensure that limited resources are allocated to the most critical tasks and activities, and schedule the project efficiently develop a project schedule (Kerzner, 2025). Sharing resources that have been used to other projects or teams to meet the needs of other projects while avoiding idle and wasted resources. Strengthen team training and skill enhancement to improve team members' overall competence and professionalism to meet the challenges posed by resource scarcity. Training can cover project management skills, innovative thinking skills, and technology application skills (Wei et al., 2024). Future directions in design project resource management research should include developing more effective resource allocation models and optimisation algorithms, integrating multiple optimisation methods, and incorporating artificial intelligence and big data technologies (Dong et al., 2020).

2.5.5 Purchase Risk Perceived Needs

“Perceived risk” is a concept derived from psychology by Bauer (1960) of Harvard University. Perceived risk is shaped by judgements about two factors: the uncertainty of the decision, i.e., the subjective probability that the customer has of whether something will happen; and the danger of the consequences of the decision, i.e., the risk of the outcome if something happens. Clients perceive risk because they are faced with something that may have unsatisfactory consequences. Thus, perceived risk is a combination of the danger of decision consequences and decision uncertainty, and it is an important factor influencing firms’ purchasing decisions (Handoyo, 2024; Cicek et al., 2025).

- a) Perceived risk of individual behaviour - Cunningham (1967) pointed out that when the outcome of an individual’s behaviour is unhappy or feels detrimental to him or her, perceived risk refers to the magnitude of the potential loss of such an outcome. Perceived risk has also been defined as a consumer’s subjective perception of the expected loss of a target behavioural outcome. Kaur and Arora (2020) argue that perceived risk is a combination of relative advantage and negative consequences. Bae (2021) argues that perceived risk is an individual’s subjective and expected loss of the potential consequences of a behavioural outcome. Bauer introduces the theory of perceived risk into the field of consumer behaviour, with a particular emphasis on the subjectivity of Bauer introduced the theory of perceived risk into the field of consumer behaviour, placing particular emphasis on the subjective nature of perceived risk rather than focusing on the objective risk that really exists, i.e., perceived risk is the consumer’s subjectively assessed perceptions of the various objective risks that they may face in the course of performing a particular behaviour (Bianchi et al., 2023). Perceived risk is not a single variable, most scholars believe that consumers’ perceived risk is a multidimensional variable. In earlier studies, researchers classified perceived risk into financial risk, functional risk, social risk, physical risk, privacy risk

and time risk. Kang and Hwang (2022) focused on functional risk and financial risk in the acceptance behaviour of wearable devices.

- b) Data security and customer privacy security - Customers need to be confident that their personal information will not be misused or leaked; therefore, companies must take appropriate measures to protect this information (Ren et al., 2023). If there is non-compliance in the purchasing process, it may trigger customers' concern and dissatisfaction. This concern not only affects the customer's trust in the organisation but may also lead to legal risks. Violation of regulations may lead to lawsuits, fines, and even damage the reputation of the business. Therefore, process compliance is not just about meeting legal requirements, but also about maintaining customer trust, reducing risk, and ensuring the sustainability of the business (Adeniran et al., 2024). Customers are eager to understand the features, performance, advantages and characteristics of products or services to judge whether they meet their needs and expectations (Kassemeier et al., 2022). This transparency helps customers make informed purchasing decisions and reduces the likelihood of regret. Instructions for safe use are also crucial. Customers need to know how to use a product or service properly and safely to avoid potential dangers or problems. Providing clear and understandable instructions for use can help customers avoid incorrect handling, reduce the likelihood of accidents (Gabbar et al., 2021), and ensure the safety of the product or service.
- c) Early Warning of risks in the business environment - Firms need to have the ability to identify and manage potential risks in a timely manner to reduce customers' risk perceptions. Di Vimercati (2012) examines the impact of perceived risk on consumer e-commerce adoption intentions from five perspectives: privacy, functional, financial, temporal, and psychological risk. This process may include monitoring supply chain risks, identifying potential security breaches, and guarding against risks such as data leakage (Chen et al., 2023). By establishing an effective risk warning system, companies can better protect their customers' interests, improve customer satisfaction, and avoid negative repercussions. These measures not only help to reduce risks,

but also enhance customers' trust and increase their loyalty to the company. When customers feel that their rights and interests are protected and that post-purchase support and warranty policies are fair and flexible, they are more willing to establish a long-term relationship with the enterprise (Zheng et al., 2020). Meanwhile, through an effective risk warning system, companies can better respond to potential problems and reduce the negative impact of potential risks on customers.

2.6 Analysing the Impact of Company Product Preferences

Customer preferences or customer needs are the results, or pain points that user want to achieve from their own point of view. Customers often put forward the demand, from their point of view are correct, but more from their own situation, for a certain function of the product has its own expectations, does not necessarily mean that the product demand. Most of the customer preference is to consider personal hobbies, habits, cultural background, personality traits and other factors. For example, a customer may like the simple design style, so he will choose the simple style when buying products.

2.6.1 The Importance of Product Preference Analysis

As the marketplace becomes increasingly competitive, product preferences are of great importance to both consumers and businesses. Companies need to identify customer needs more accurately to meet customer expectations. Identifying customer needs is particularly critical in the enterprise market, where the complexity and diversity of customer needs are more pronounced. Consumers' product preferences have a direct impact on their purchasing decisions and experiences, and companies need to understand and satisfy these preferences to provide more competitive products

and services. Due to the different industries, stages of development, management characteristics, regions and cultures of customers, each customer's business has a set of unique characteristics and a set of unique business processes. So, an enterprise product does not make any changes to adapt to each enterprise is very difficult, many enterprise products before use must go through a customisation (implementation staffing) process to meet the product service preferences.

Tang and Mantrala (2024) proposed that customers need to be analysed through multidimensional analysis, marketing and product planning process, different factors, different weights to analyse customer needs, market segmentation, customer demand analysis, to achieve the implementation of differentiated competitive strategies and create blue ocean value. Conventional researchers mainly use questionnaires, in-depth interviews, and other methods to explore the customer demand of enterprises. For example, Nand, et al., (2023) studied corporate customer demand in the logistics industry through in-depth interviews and data analysis, combined with a variety of analytical tools; Xin et al., (2020) measured corporate customer demand in the express delivery business through questionnaire surveys and factor analysis. Tannady and Purnamaningsih (2023) used questionnaires sent to corporate customers to understand their needs and preferences. However, these studies suffer from shortcomings such as sample selection bias, incomplete information collection, and single method of data analysis (Karunarathna et al., 2024).

In order to address the above issues, researchers have proposed some possible solutions. For example, Huang et al., (2017) proposed to combine various methods such as market research, user feedback, and data analysis for enterprise customer

demand identification to comprehensively understand customer needs and develop appropriate solutions. Furthermore, Deng et al., (2018) proposed a knowledge graph-based enterprise customer demand identification method to better understand customer demands by constructing a knowledge graph. Furthermore, Zhu et al., (2020) explored a federated learning-based approach for enterprise customer demand identification under the premise of privacy and commercial confidentiality, which improves data utilisation by sharing models across different enterprises. However, in real life, there are often problems such as missing data, noise, and inconsistency, which can seriously affect the effectiveness of customer demand identification. Customer demand identification methods are characterised by diversity and complexity. The work of customer demand identification should be integrated to identify customer preferences from multiple perspectives, such as psychological perspective, social responsibility, user feedback and data analysis, to better meet the needs of different customers. Although the method can improve accuracy and efficiency, it needs to deal with a large amount of text data and requires specialised staff for model training and tuning.

Data mining is a technique that has been widely used in recent years to identify the needs of business customers. Huang (2018) analysed and mined a large amount of data to find patterns and infer the needs of business customers. Although this method can improve efficiency, it requires strong statistical and computational support. Machine learning is another technique that is widely used to identify the needs of business customers. Li et al., (2020) automates the identification of business customer needs by training machine learning models to transform unlabelled data into labelled data.

In the context of identifying business customer needs, access to data is often restricted by factors such as privacy and commercial confidentiality (Zhu et al., 2020).

Customer needs are at the heart of how organisations do business but capturing the needs of business customers is challenging. Research has shown that the needs of business customers are often vague, involve multiple people, and the content composition is relatively complex (Sun et al., 2023). However, there has been little research on practical methods for capturing the needs of business customers. Some scholars have proposed qualitative research methods to analyse business customer demand (Lai, 2016), while others have used web surveys and interviews for data collection (Katuščáková et al., 2019). In addition, there are scholars who have applied data mining techniques in corporate customer demand collection (Huang et al., 2018). It should be noted that there are also differences in the methods of corporate customer demand acquisition in different industries and companies. For example, in the high-tech industry, enterprises usually adopt the user experience design (UXD) approach to understand customer needs (Zheng et al., 2018). On the other hand, in the financial services industry, firms prefer to use data analytics methods to acquire customer needs (Islam et al., 2017).

In addition, some companies have begun to use open innovation to capture customer needs. By collaborating with customers, suppliers, partners and other parties in the development and design of products or services to gain broader and deeper information about customer needs (Chesbrough, 2010). In addition, some researchers have highlighted some issues that need attention. For example, it is necessary to pay attention to different levels of needs (e.g., basic, and additional needs) and different

roles (e.g., user needs, and decision maker needs) when conducting customer needs acquisition in companies (Katuščáková et al., 2019). It is also necessary to pay attention to the feasibility and acceptability of customer needs to ensure that the product or service offered meets customer expectations and can be realised (Sun et al., 2021).

2.6.2 Customer Preference Influencing Factor

Consumers' purchasing decisions are not only closely related to the product itself but are also influenced by customer preferences. Consumer preferences are influenced by objective factors such as age, income level, gender, education level, etc., which are manifested as the degree of interest in the same product; therefore, consumer preferences affect consumer choice and then change the demand for products. Adequate access to the habits and preferences of customer groups can better meet consumer demand, improve customer satisfaction, so that marketing activities are targeted and invincible in business competition.

2.6.2.1 Enterprise Customer Role Segmentation

In fact, for enterprise products, users are based on the enterprise organisational structure of the relevant personnel, there are different levels. Usually can be divided into leadership, management, executive role. They are in different levels of positions, responsibilities are different, so the requirements for the product, hope to have the same features and get different results.

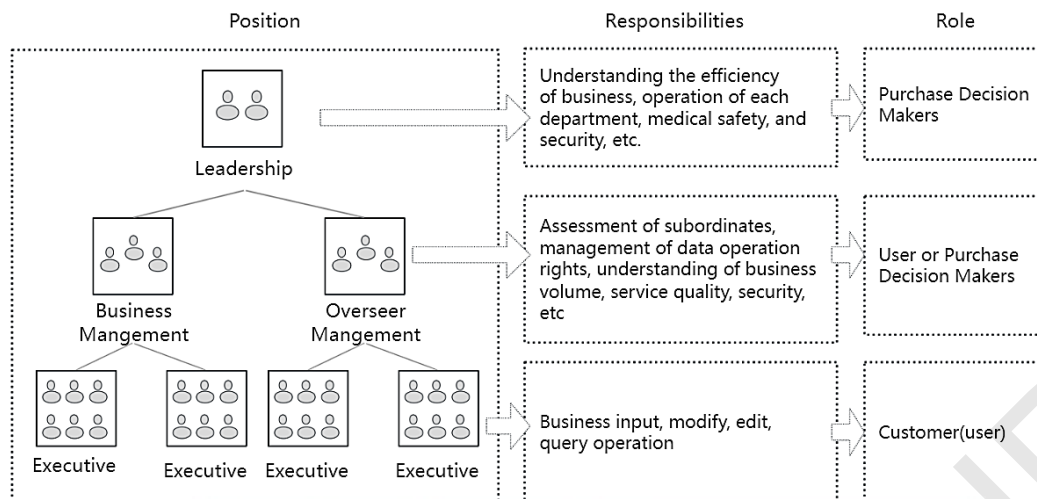


Figure 2.8 : Requirements Change Process
(Source by author)

- a) **Executive level** - The executive level is the user whose needs are usually the specific operation of the business. The management, usually the person in charge of the business department, its needs may be the statistics of business data and part of the management operation functions. The executive layer, usually need to complete some specific operational work, so will be more concerned about the product can make them more convenient, faster to complete the work, as well as the operation, mastering the degree of difficulty. Therefore, the executive layer is also the main group of people who give feedback on the product experience, with a higher degree of perception of the product experience, so when designing the relevant interaction methods and styles, it is necessary to do so based on their perceptions and habitual preferences.
- b) **Management** - The management level can be summarised as: downward management and upward reporting. It can be analysed in terms of the job content of the manager's position, performance indicators, and so on. Is it clear which management is to be managed downwards? For the results of subordinates' work, what data need to see, what functions are involved in the operation, usually related to the management of personnel rights, information security and the progress of subordinates' work. Then report to the superior,

focus on what to report, such as what key data statistics, usually includes the impact of business completion, progress, and business benefits.

- c) Leadership - Leadership, belonging to the company's big boss, senior managers, often only need to see the core data to understand the business profile, do not need specific operations. The leadership needs to understand the management of the business is usually more comprehensive, our products involved in the business, perhaps only a small part of his work. So, for the leadership, he is not like the management need to understand the business situation in depth and comprehensively, only need to know the core of a few data, key results to understand the overall business profile. The core data and key results here are also related to the management performance indicators, so for the leadership it is also downward management to understand the results of the work of subordinates and possible problems. On the other hand, it is to report to the outside world, i.e., to show the results of the work of the team they lead. This role is usually fulfilled by several large digital screens. Therefore, the visual effect requirements for the big screen will also be higher, need to make the leader feel good, show face, willing to take the initiative to present to others. So, it is also important to understand what kind of visual presentation is good and quality for the leader.

Customer needs are influenced by a variety of factors, including lifestyle, economic and cultural factors, which are three important influences on customer needs. Lifestyle refers to the characteristics of a person's daily habits, values, and the environment in which they live. Economic factors are also the different income levels, consumption habits and economic expectations that influence customer demand. Cultural factors refer to the cultural background, religious beliefs, values, and social customs that influence people's demand for and choice of goods and services. Companies need to conduct market research and analysis on these factors to better meet customer needs.

2.6.2.2 Personal Characteristics of Customer

Individual characteristics play a decisive role in consumers' decision to purchase goods is the key analytical element. Business units have clearer objectives, and regional characteristics are more obvious. According to Zettler et al., (2023), personal factors are mainly manifested as stable, random, and psychological factors. In the business sector, business customers usually refer to the business customers of a company, and there are significant differences in their individual consumer preferences (Kawa et al., 2013; George, et al., 2023).

- a) Stability factors - Liu et al., (2002) argued that stability factors mainly refer to similar characteristics of individuals such as age, gender, colour, ethnicity, salary, family, culture, lifestyle, occupation and so on. Yao (2010) Women may pay more attention to the atmosphere of the dining environment, the quality of the service and the taste of the food, and they tend to look for restaurants that are warm and comfortable. Whereas men may be more concerned about food variety, portion size and price, and they may be more willing to try new culinary experiences. Female travellers may be more concerned about the safety, comfort, and cultural experience of their trip, and they may be more willing to participate in cultural activities and shopping (Ejupi & Medaric, 2022). In contrast, male travellers may be more interested in adventure and sporting activities, and they may be more inclined to outdoor adventure and sports tourism. These gender differences can influence the market positioning of tourist destinations and the planning of activities (Lozano-Oyola et al., 2012). In addition, social roles influence individual expectations and behaviours, further reinforcing gender differences (Lina et al., 2023). Women from different ethnic and cultural backgrounds may have different priorities when shopping. In addition, age and salary may also influence shopping decisions, with younger people likely to be more focused on fashion trends, while higher paid individuals may value brands more.
- b) Random factors - Stochastic factors refer to the variations in a customer's choice to purchase or use a product or service. Zhu et al., (2016) suggested

that stochastic factors have some conditions on the specific scenarios that consumers face and have when they start to decide to buy. For example, a particular female customer may choose takeout during lunch time on weekdays because she has a busy work schedule, whereas on weekends she prefers to go to a restaurant to enjoy the dining experience (Lu et al., 2022). Meanwhile, customers' emotional state plays a key role in customer experience. Emotional factors can influence customers' perception and evaluation of products or services. Emotional factors can also lead to gender-differentiated customer experiences when a particular female customer may have a more positive attitude towards service quality due to a better emotional state on that day (Xia et al., 2023).

- c) Psychological factor - Cognitive differences refer to the different ways in which men and women process information, make decisions, and solve problems. Research has shown that women tend to process information more meticulously, with attention to detail and emotion. In contrast, men may be more focused on practical problem solving and quick decision making. These cognitive differences can lead to different needs and expectations of customers of different genders for the same product or service (Deng et al., 2015). Emotional differences refer to the differences in emotional expression, empathy and emotional experience between men and women. Women tend to be more inclined to express emotions, share experiences and focus on interpersonal relationships. In contrast, men may focus more on practical problem solving and rational thinking (Ablikim et al., 2019). Attitudinal differences refer to possible differences in attitudes and perceptions between men and women towards specific products or services. These differences can be influenced by cultural, social, and individual factors. For example, one study found that women are often more concerned with sustainability and environmental issues and may be more willing to support brands and products that are environmentally conscious (Kumar et al., 2021). Men, on the other hand, may be more concerned with performance and price factors. These attitudinal differences may influence purchase decisions and brand loyalty (Dandis & Al, 2022).

2.6.2.3 Customer Behavioural Impact

Customer behaviour is influenced by choices and practices in work organisation, time, environment, working with others, and using product tools and technologies. Understanding these factors can help improve software user satisfaction, increase productivity, and create a better working environment for software development and use.

The different time zones of globalised teams also need to be considered, so the software should provide support for multiple time zones to ensure seamless collaboration (Jiang et al., 2015). Modern working environments have become increasingly diverse, with users potentially working from home, in the office, on the road or in a coffee shop. As a result, cross-platform and cloud sync capabilities have become critical. Users need to be able to access their work on different devices and operating systems without compatibility issues. In addition, the software should also support offline working as not all locations have a reliable internet connection (Furfar et al., 2021). Users' working habits can also play an important role in the use of software. Some users may prefer keyboard shortcuts and customisation options, while others may prefer a graphical interface and intuitive drag-and-drop functionality. The software should offer these options to accommodate different user preferences. In addition, some users may prefer to multitask, so the software should support split-screen and multi-window functions to improve efficiency (Aristides & Lubis, 2023).

The design of page layouts is critical for information-intensive applications, as users may need to customise the size, position, colour, and display of windows to suit their work needs. The software should allow users to create personalised work

environments that can help improve productivity. For example, one user may prefer to group related work windows together to make it easier to switch between tasks, while another may prefer to highlight important information for quick access. By allowing users to customise page layouts, software can adapt to different working styles and provide a more personalised experience (Jiang et al., 2020).

Resolution differences can also affect the user's visual experience. Different devices have different screen sizes and resolutions, from mobile phones and tablets to desktop computers and large-screen monitors. Software must be able to adapt to these differences to ensure a consistent user experience across devices. This includes adapting font size to ensure text is readable at different resolutions and adapting icons and interface layout to accommodate different screen sizes. This helps to ensure that users can seamlessly access and operate the software regardless of the device they are using, without being plagued by visual barriers or clutter (Xiao et al., 2014). Park et al., (2007) A study systematically compared the effectiveness of different adaptive menus with that of self-adaptive menus. The study found that adaptive menus were highly effective and were preferred by users over other menus. In a limited and competitive market, web designers should pay more attention to web design attributes such as web layout (e.g., navigation bar design and page alignment) and performance (Dianat et al., 2019). Hu et al., (2022) found that repeat calls to understand the call centre are likely to be initiated when the customer's previous contact call centre fails to provide a satisfactory response, at which point the customer's preference for service quality and service speed makes a clear demand.

2.6.2.4 Customer Value Perception

Customer value perception is one of the key factors for business success and includes several aspects such as psychological feeling, business process rationality, performance reliability and service timeliness, etc. Together, these aspects form the customer's overall evaluation of the product or service, which in turn influences customer loyalty and purchase decisions.

Psychological feelings play a crucial role in customer value perception. Customers' feelings and emotions play a crucial role in their purchase and loyalty decisions. When customers feel satisfied and delighted when using a product or service, this positive emotional experience can profoundly influence their attitudes. This emotional connection not only makes customers feel close to you, but it also builds their trust in your brand or company. When customers feel satisfied, they are more likely to return to purchase your products or services. This is because they have already experienced positive emotions and expect to experience that satisfaction again. Not only will satisfied customers return, but they may also become loyal brand advocates and willing to share their positive experience with others, helping you to grow your market share. In addition, delighted customers are more likely to be loyal to your brand. Not only will they make repeat purchases, but they will also be less interested in competitors because they have developed an emotional connection to your brand or service. This emotional connection goes beyond a purely transactional relationship and allows customers to feel a deep emotional bond with your brand, which is the foundation of brand loyalty (Wang et al., 2020).

Business process efficiency plays a critical role in the customer experience, not just in the way a product or service is delivered, but as a key component of the overall impression and value that the customer perceives of the organisation. When customers decide to buy or use a product or service, they want a smooth, convenient, and hassle-free experience. If business processes are not logical enough, overly complex, or confusing, customers may feel confused, dissatisfied, or even frustrated. This dissatisfaction not only affects the current transaction but may also lead to customer churn in the future (Bhattacharyya et al., 2021). Customers have higher expectations for continuous improvement in their lifestyles and workflows, and these expectations often include processes that are efficient and seamless. If companies fail to meet these expectations, customers may turn to competitors for better alternatives. Therefore, to ensure a positive experience in terms of customer value perception, organisations need to continually focus on and improve their business processes. This includes streamlining processes, reducing redundant steps, increasing automation, and optimising every aspect of a customer's interaction with the company. Only by continuously optimising business processes can organisations ensure that customers are consistently satisfied with the purchase and use of their products or services, increase customer loyalty, and drive business growth (Rane, 2023).

Performance reliability is one of the most critical factors in the customer experience. Customers do not just buy products or services; they buy trust and reliability. Customers need to be confident that your product or service will perform consistently in a variety of situations and deliver excellent value as promised. When customers use your product or service, they expect high quality performance that is consistent, predictable and meets their needs. If there are problems with the performance of a

product or service, customers may lose confidence, question your commitment, or even turn to competitors (Tijjang et al., 2023).

Timeliness of service is also critical. Customers need to be able to get help or support immediately when they need it. Whether it is to solve a technical problem, provide information or resolve a complaint, customers expect their needs to be met quickly (Bell et al., 2021). If customers experience delays in their interactions with a company, they may feel dissatisfied, and this dissatisfaction can build up and affect their overall experience. Maintaining the performance reliability of a product or service and providing timely support is not only the responsibility of the organisation, but also to ensure a positive value perception for the customer (Paulose & Shakeel, 2022). This will help to build strong customer relationships, increase customer satisfaction, promote customer loyalty, and ultimately drive business success and growth. In a competitive marketplace, the reliability of performance and timeliness of service will be the key factors in customer choice, determining their willingness to continue working with your organisation (Xiong et al., 2009).

2.6.3 Factors Influencing Decision-Makers' Preference

Before making any business decisions, it is essential to understand the client's industry, objectives, and needs. It is also necessary to understand the organisational structure of the client's business, how it operates, and the decision-making process to better understand the client's needs and make targeted recommendations (Simeone & Caggiano, 2021).

2.6.3.1 Purchase Decision Factors Research

The pressure to survive as a business is increasing and business growth has become the core business proposition. The consumer purchase decision is the closest link to business conversion, and it is also the link that all marketers pay the most attention to. In the digital era, the key factors influencing consumer decision making have changed dramatically. Factors such as consumer sovereignty, social media word-of-mouth and the live streaming bandwagon have become new variables.

When an organisation deploys an enterprise product, it is generally difficult to change the original business process to accommodate the product. A small change in the enterprise requires high-cost investment. Especially as some key business processes, management processes, change a little can involve a lot of internal and external users, resulting in high-cost investment, and the business, the enterprise has a big impact. For example, the procurement process, the company will be based on their own business scale and characteristics, procurement of different materials, and so on, and the use of different procurement processes. Therefore, our usual practice is to make the product more configurable and flexible to adapt to the company and improve the user experience. In today's competitive business environment, the production and operation activities of enterprises must be time-efficient, the enterprise's purchasing activities are in the upstream stage of its business chain, only timely and cost-effective completion of product purchasing activities to ensure that the downstream production, marketing and service activities are carried out smoothly and according to plan, so the time pressure is an important factor affecting the enterprise's purchasing decision. In the limited time available to make purchasing decisions, the decision-makers themselves have access to very limited information. This also means that the

traditional marketing thinking of the past cannot be adapted to the current market environment.

Lewin et al., (1996) of Georgia State University, after summarising the influences on firms' purchasing behaviour listed in the above three models, made significant revisions and extensions to them by adding four structural variables to their study: decision rules, role pressure, buyer-seller relationship, and communication, etc., and proposed the Integration Model. From the above models, there are many factors that influence the buying behaviour of companies. Supplier marketers should pay special attention to how these factors affect customers' purchasing decisions, and more importantly (Yan & Zhao, 2022), how to use them in the formulation of marketing strategies to bring these factors into play. Previous scholars have conducted some research on the role of human resources in the purchasing decision process and have found that personal resource variables such as expert power, information power, legitimacy power, etc. have an impact on purchasing, and have conducted some discussions on them.

2.6.3.2 Environment Related Factors

Environmental factors are factors outside the control of the entity. Current or expected factors in the economic environment (level of market demand, economic outlook, interest rates, etc.) have a significant impact on buyers of inputs. Economic factors have a significant impact on customer demand. According to Bianchi et al., (2019), in times of recession, producers usually try to scale down their investments and reduce the level of inventories, whereas in stable economic conditions, if the government

adopts a policy of reducing lending rates, firms will consider increasing their purchases of means of production due to the reduction in the cost of capital.

Fu et al., (2020) research, government policies and laws and regulations will have an impact on business activities, investment decisions and so on. Enterprises need to adjust their business strategies in a timely manner according to the changes in policies and laws and regulations. According to Marakova et al., (2021), market competition has an important impact on the sales and profits of enterprises. Therefore, product design must consider market competition and adjust product pricing and marketing strategies, and customers can make decisions based on market trends and competition. Lu et al., (2022) research, organisational variables have a special significance in producers' purchasing decisions. Each purchasing organisation has its specific objectives, purchasing policies, organisational structure, systems, and operating procedures. These factors act as constraints on purchasing behaviour. Some companies often have their own purchasing policies, such as: buying locally whenever possible, consulting higher levels when purchases exceed a certain amount, and comparing suppliers' terms and conditions through multiple consultations.

2.6.3.3 Expert Power Impact

Alon-Barkat (2023) argues that decision makers tend to follow expert advice because they believe it will lead to a better decision, not because it leads to an independent result or because it stems from a formal or informal responsibility. In procurement centres, experts are often important influencers in the decision-making process, their professional background is essential to make the right decision to ensure that the decisions made by business decision makers often have a very close relationship with

the expert's opinion, especially under the pressure of time, cost, environmental and other factors, the power of experts often provide the most powerful basis for decision makers to make decisions (Miller et al., 2023). In view of this, this paper argues that the power of experts is a direct factor influencing corporate purchasing decisions.

2.6.3.4 Product Service Quality

Based on the definition of customer satisfaction as the extent to which customers' expectations are met, Ma and Wang (2021) distinguish between individual and business customers and examines their customer satisfaction. The study concludes that individual customer satisfaction is influenced by five factors: innovation, company image, price, product performance and convenience, while business customer satisfaction is influenced by four factors: innovation, company image, price, and product performance. The results of the model test for different types of users showed that there is a difference in the sensitivity of customers to each factor, while management advice was given on how to run the business. In China, companies are very concerned about the level of service, which includes the quality of service in the pre-sales, sales and after-sales processes, and corporate customers pay more attention to the value of the product rather than the price itself. Therefore, firms need to provide better quality products, services, and brand image to increase customers' perceived value while maintaining reasonable prices (Harisandi & Purwanto, 2022). Firms need to meet customers' time requirements when delivering products or services. Extending the delivery cycle may affect customer satisfaction and trust, so firms need to control the delivery cycle to ensure customer satisfaction.

Zhang et al., (2023) pointed out that manufacturing companies should incorporate service innovation elements into product innovation, so that service becomes a standard feature of the product. Zhou et al., (2022) pointed out that due to the complexity and diversity of technology products and solutions, customers often find it difficult to complete the purchase decision in a short period of time. Therefore, technology companies need to build a comprehensive pre-sales service system to ensure that customers fully understand the products and solutions before purchase. For example, Internet companies can provide online technical services for intelligent matching and application optimisation; industrial control equipment companies can send technicians to the site to assess the customer's environment and propose personalised solutions. Professional and caring pre-sales services can win customers' trust and recognition.

Adel et al., (2019) suggested that companies can take the initiative to disclose the quality standards of products and services to address customers' concerns about service quality, and these initiatives can help circulate positive word-of-mouth and leave a positive impression of branded services in consumers' minds. Chen (2023) proposed a strategy to improve the service quality of tax software products. Wang et al., (2022) studied the service quality evaluation and improvement strategy of H Company. Ma et al., (2022) studied the digitalisation of automobile pre-sales services in 4S stores. Ren et al., (2022) investigated dynamic pricing and service quality decision making in product-service supply chains. Shang et al., (2023) argued that the products and services of design enterprises will be increasingly integrated in the future, and service design will become a new direction for the business development of design

enterprises, which can stand out in the fierce market competition by providing differentiated and specialised support services.

2.7 Research GAP and Strategy

Through literature analysis and product analysis of Chinese enterprises, we can further clarify the theoretical framework and target research strategy of customer demand oriented. Figure 2.9 below presents the research gap and strategy for further research. The purpose of this section is to analyse the product needs and preferences elements for the customer purchase decision process and to increase customer purchase satisfaction. The figure below shows the rationale for the new design approach to characterise high customer satisfaction with purchase decisions. In essence, it blends the characteristics of successful product needs (objective needs), customer and purchase decision maker preferences (subjective needs) for the product. The proposed new approach is called Customer Buying Decision Framework (CBDF).

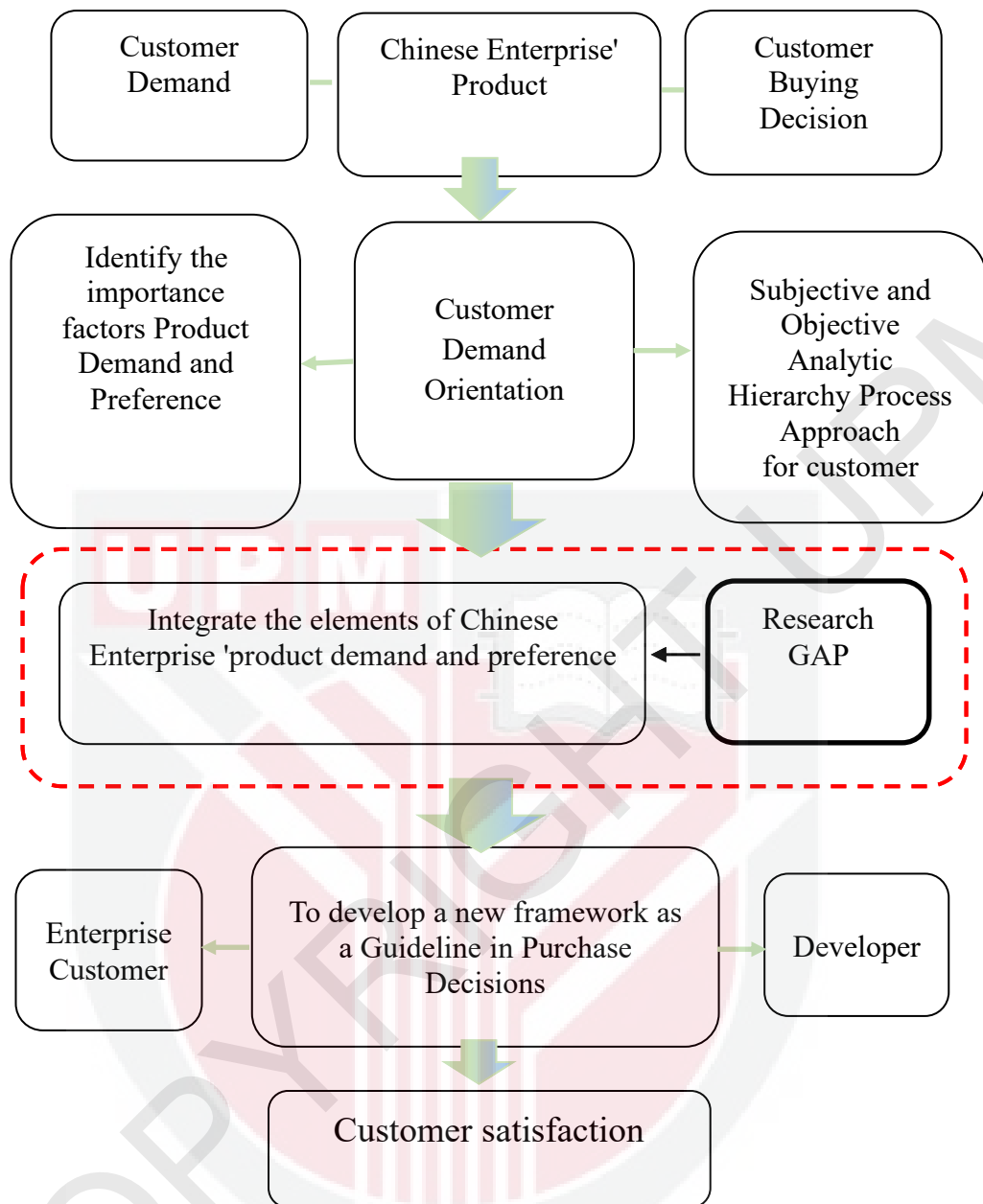


Figure 2.9 : Research GAP and Strategy
(Source by author)

CBDF is designed for Chinese enterprise customers as a decision support tool to help product developers accurately identify product features related to customer satisfaction and quickly validate product design specifications. The methodology incorporates market demand analysis at the product definition stage to ensure accurate positioning of the product design, thus increasing the success rate of product

development. By reinforcing the long-term partnership between developers and their customers, CBDF helps Chinese companies build a sustainable customer value system in a highly competitive market. No previous research has explored the application of this methodology, and the new design methodology is innovative and groundbreaking.

At the same time, the theoretical framework is centred around pre-purchase customer satisfaction and relies on existing product and customer data. This framework is suitable for data-driven business development needs for assessing customer characteristics and optimizing product and marketing strategies. However, the framework has limitations in product development in completely new markets, which may lead to biased product positioning. Therefore, it needs to be further optimized on this basis, combined with forward-looking market research and demand analysis, to more accurately identify the needs of different customer groups, improve the success rate of product innovation, and enhance the competitiveness of enterprises in new markets.

2.8 Conclusion

The theory of customer demands involves psychology, marketing and product design, which helps companies understand and satisfy customer needs precisely. In psychology, Maslow's hierarchy of needs reveals the motivation of needs, and Kano's model distinguishes the types of needs to optimize customer satisfaction; in marketing, the 4Ps-4Cs-4Vs-4Rs model helps to enhance value; and product design focuses on the core motivation of the user to promote product innovation. Enterprises can integrate these theories to accurately market and optimize products to enhance competitiveness. Customer orientation covers cultural and behavioural influences at

the individual level, as well as market research and data analysis at the enterprise level and can be used to enhance market responsiveness and achieve sustainable development through mainstream orientation (to meet existing demand) or emerging orientation (to explore potential markets). However, while customer demand orientation has formed a certain framework in the field of C-end consumer products, there is little systematic research in enterprise customer analysis, especially in enterprise practice, where there is still room for combining theory and practice. Chinese products are mainly for enterprise users, which are highly specialized, logically complex and accountable, with greater emphasis on performance over user experience, strong customisation needs and high requirements for overall quality. The core demands of enterprise customers for products and services include price competitiveness, perfect supply chain, accelerated technological innovation and localization support. Suppliers need to have higher development capabilities, be able to adapt to the national purchasing decision-making process, complex business scenarios, reduce product losses due to changes, and must have an in-depth understanding of customer needs and preferences to provide accurate solutions at all times at the lowest cost and with the highest level of satisfaction.

Therefore, It is necessary to clarify the role boundaries of each participant in the corporate product purchase decision by combing the literature related to customer orientation and Chinese corporate product development to deeply analyse the behavioural characteristics of different customer groups. Based on customer demand orientation theory and enterprise product demand analysis, the key factors affecting customer satisfaction are explored from the two directions of enterprise customers' product demand and preference. On this basis, the core elements of product demand

and preference are clarified by combining the literature review and the analysis of related research on enterprise customers. Derive the degree of influence of different customer groups in the purchase decision to improve customer satisfaction and purchasing power.



CHAPTER 3

RESEARCH METHOD

3.1 Introduction

This chapter aims to explain the research approach adopted in the research study. It explains in detail how the research was conducted. It begins with defining the method, followed by collecting data for empirical research. The first section of this chapter outlines the research approach of this study, which comprises the worldview approach, the research design, and the research methods sections. This is followed by the research rigor and the researcher role section, which concludes the chapter.

3.2 Research Strategy

Research strategy refers to the methodology and operational plan adopted in a specific research project or research question. It is the actual implementation strategy that defines the operational steps and plan of the research based on the research question and research methodology. Research strategy includes the plan of the study, data collection methods, data analysis strategies, sample selection methods, timetable, etc. Research strategy helps the researcher to translate the research methodology into practical research actions (Lavarda & Bellucc, 2022).

With the rapid development of science and technology, the concept of “Internet Plus” and the extensive and in-depth application of artificial intelligence technology, massive, high-dimensional, multi-source data from different fields of various industries, such as health care, media, transport, agricultural production, and so on, continue to emerge, and the data elements to empower management decision-making

is gradually becoming the main direction of research and application (Bousdekis et al., 2021). In production management, a collection of data of diverse types and complex structures has been formed, and China's reliance on medical big data to achieve fine management and regulation of safety production is gradually becoming an important direction of research by scholars at home and abroad. Cao et al., (2020). With multi-source data, researchers can use the advantages of one method to make up for the shortcomings of another method, and these different data elements can be used in a variety of ways. The different sources of data can provide different perspectives and information that can help to provide in-depth insights into the object of study or phenomenon, and can increase confidence in the results of the study; multiple sources of data can provide in-depth insights, avoiding under-utilisation of the data, and more comprehensively capturing the multiple aspects of the object of study or phenomenon, and reducing selective bias due to the limited number of sources of data; Topuz and Delen (2021) argued that multisource data can not only be cross-validated for mutual validation of research findings, drawing similar conclusions from data obtained from different sources; Ahmed et al., (2021) found highlighted a potentially powerful tool for yield analysis in crops using multi-source data and machine learning, which can reduce prediction bias. Cao et al., (2020), through the use of multiple sources of data, the researcher can use the strengths of one method to compensate for the shortcomings of another, these different sources of data can provide different perspectives and information to help provide in-depth insights into the object of study or phenomenon, which can increase confidence in the results of the study; multiple sources of data can provide in-depth insights to avoid underutilization of data, capture multiple aspects of the research object or phenomenon more comprehensively, and reduce selectivity bias due to the limited nature of data sources; Yager (2004) argued that multiple data

sources can not only be used to cross-validate research findings, but also to reach similar conclusions through data obtained from different sources; Ding et al., (2023) found highlights a potentially powerful tool for using multi-source data and machine learning in crop yield analysis, whereby prediction bias can be reduced.

In this study, the data mainly comes from survey through questionnaire. The questionnaire data is mainly based on multiple categorical data, which involves subjective factors such as user needs and preferences, and the data types include unordered nominal variables (e.g., product characteristics, purchase decision factors) and ordered variables (e.g., importance ranking). Conversions such as OHE or Label Encoding are required before data analysis. On the other hand, raw data mainly come from multiple databases, such as ERP, SCADA, IoT, MES, etc. The data types include structured data (SQL tables) and semi-structured data (JSON logs), which usually require ETL processing, normalisation, and missing value filling to ensure data consistency. In actual analysis, questionnaire data and production data are often used in combination, such as optimising production design through user feedback or adjusting the supply chain to match market demand, so the integration needs to be compatible with the data format, time dimension alignment, and matching of different data sources (e.g., user ID, product model) to ensure the accuracy of the analysis and the scientificity of decision-making. In addition, the target customer groups in this paper are categorised into users (customers) and purchase decision makers. Customer segmentation is the process of dividing a large group of users into multiple “subgroups”, where the characteristics of customers within each subgroup are similar, while the characteristics of different subgroups are different (Zhang et al., 2021). It is useful to gain insight into customer needs by summarising, visualising, and

interpreting data to understand characteristics, trends, and relationships (Lee et al., 2020). Statistical descriptive methods are usually simple to use and can be easily applied to various types of data sets. They do not require complex mathematical theories or advanced techniques and are applicable to a wide range of user groups, helping people to better understand data sets and derive useful information and insights from them. In a customer's daily routine, a lot of user operation data and feedback data are recorded every day, so a large amount of multidimensional raw data can be obtained from customer behavioural data for product preference analysis. These behavioural data features include discrete event data, continuous event data. The role of customer features in data mining is to allow companies to see the customer groups clearly and can speculate on their behavioural characteristics from the characteristics of different groups, so the decision tree is the most applicable method based on the demand for multi-class data features and customer segmentation (Hair et al., 2019).

Random Forest is an integrated learning method for mixed data with a collection of numeric and character types for building multiple decision trees and combining them for classification or regression tasks. Compared to XGBoost, LightGBM, and CatBoost, Random Forest is more suitable for machine learning algorithms for enterprise scenarios with smaller data sizes and can be used to deal with classification and regression problems, as well as feature selection. In particular, the randomness and integration strategy of Random Forest enable it to reduce the risk of overfitting and improve the stability and accuracy of the model (Bennet, et al., 2024). Jones and Abualigah (2022) propose an exploratory and substantial analytical explanation for practical applications. Moreover, Random Forests can detect interactions and nonlinearities without pre-specification, have low performance generalisation errors

in simulations and many practical problems, and can be used for many relevant predictor variables, even if there are more predictor variables than observations. Importantly, random forests can be used with variable importance metrics and can perform dichotomous influence weighting analyses of customer product preferences and buyer factors (Kuncoro & Kusumawati, 2021).

Figure 3.1 above illustrates the research methodology used by the researcher to conduct the research work. Phase I: Literature Review and Formulation of Research Questions This study analyses the process of consumer purchase decision-making through the literature review, compiles existing research results, and explores the key factors influencing consumer purchasing behaviour, with a special focus on the role of Chinese companies' product demand and preference in this process. Based on theoretical analysis, this phase combines the experience of experts with preliminary research to conduct an exploratory survey on the key factors influencing customers in their purchase decisions, to validate the hypotheses put forward in the literature review and to provide data support for subsequent in-depth research. The core research includes: (1) What are the importance factors of China's enterprise product demand and preference in buying decision process toward customer satisfaction? (2) Does the factors of product demand and preference for buying decision process significance toward customer satisfaction?

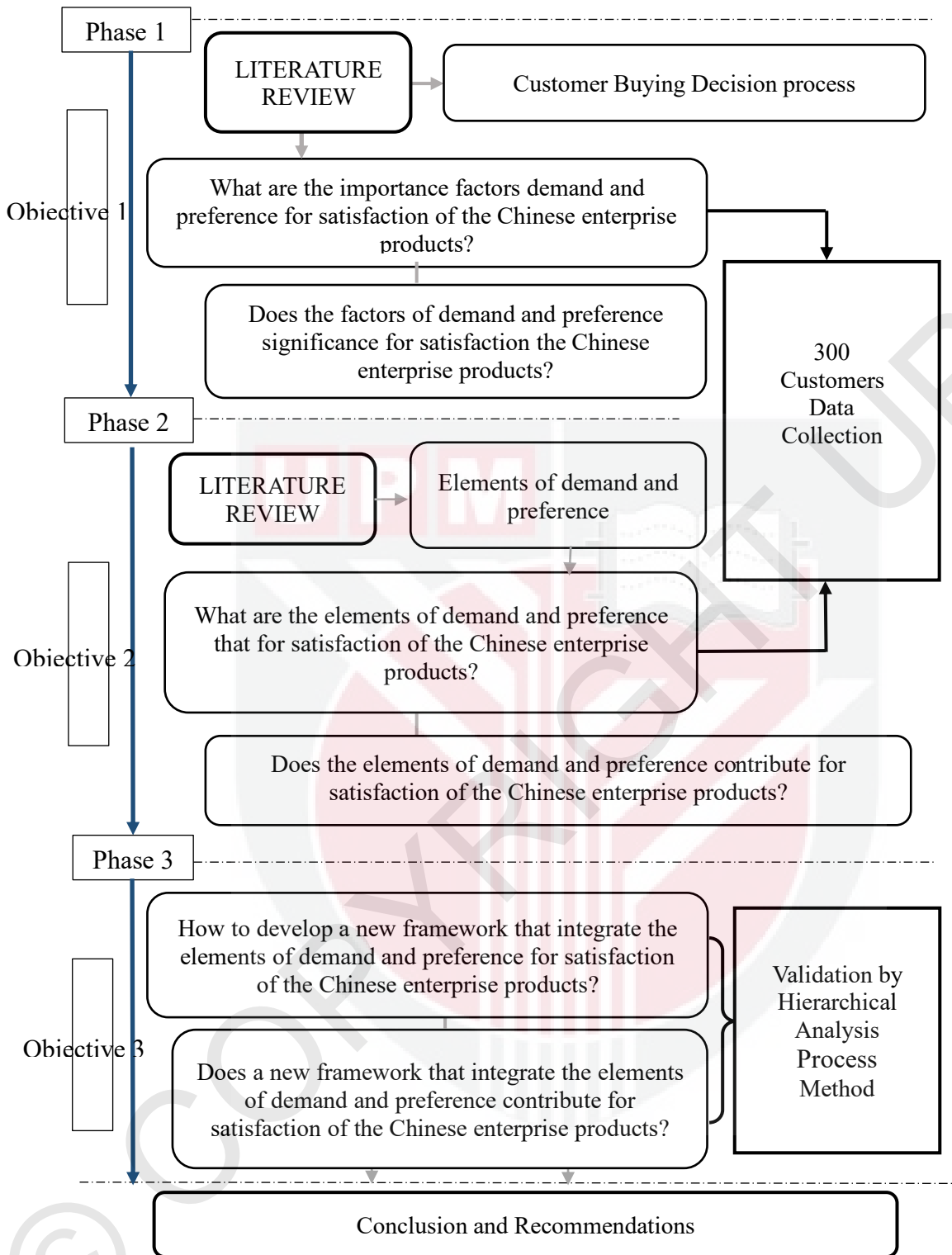


Figure 3.1 : Research Methodology Framework
(Source by author)

Phase 2: Further Research and Hypothesis Verification. Based on the previous literature review and preliminary research, the specific elements of product demand and preference are further clarified, and large-scale customer research (300 users, 300 purchasing participants) is used for data collection to analyse in-depth the impact of different product demand and preference on the purchasing decision. In this phase, the questionnaire survey method is used in conjunction with statistical analysis methods to quantitatively study customers' purchasing preferences, decision-making process and satisfaction, with a focus on testing the hypotheses put forward in the first phase. The core research in this phase includes: (1) What are the elements of product demand and preference that influence in buying decision process toward customer satisfaction? (2) Do the elements of product demand and preference contribute toward customer satisfaction?

Phase 3: Framework Construction and Validation. Based on the theoretical analysis and empirical findings of the previous two phases, a new framework is constructed for integrating product demand and preference elements to optimise the consumer purchase decision process and improve consumer satisfaction. To address the characteristics of the framework such as ambiguity, multi-group, business complexity, and variability. Based on Hierarchical Analysis Method (AHP), this study combines fuzzy synthesis algorithm and K-Mean to quantitatively validate the framework, determine the relative importance of different factors, and evaluate the effectiveness of the overall framework. The core content of this phase includes: (1) How to develop a new framework that integrate the elements of product demand and preference for buying decision process toward customer satisfaction? (2) Does a new framework that

integrate the elements of product demand and preference for buying decision process toward customer satisfaction?

3.2.1 Research Design

A research plan is one of the key steps in conducting academic research, and it is essential to ensure the validity, scientific validity, and credibility of the research. A well-thought-out research plan helps to clarify the goals and direction of the research, increase the efficiency and quality of the research, reduce the risks involved in the research process, and facilitate resource management and communication (Saunders et al., 2019). Firstly, a research plan establishes clear research directions and objectives that guide researchers to work in an informed manner during the research process (Kunisch et al., 2023). Secondly, it provides a framework to help researchers rationalise their time and resources to complete their research tasks more effectively. In addition, by identifying and solving possible problems in advance, the research plan helps to reduce the risk of unnecessary errors and mistakes during the research process (Pomaza et al., 2023).

Table 3.1 : The Relation of Research Question and Research Method

Research Questions (RQ)	Type of Research	Data Collection	Data Analysis and Tools
RQ1: What are the importance factors of demand and preference for satisfaction of the Chinese enterprise products?	Quantitative Research	Survey and Raw data	Questionnaire (Closed-ended Questions)
RQ2: What are the elements of demand and preference for satisfaction of the Chinese enterprise products?	Quantitative Research	Survey and Raw data	Questionnaire (Closed-ended Questions)
RQ3: How to develop a framework that integrate the elements of demand and preference for satisfaction of the Chinese enterprise products?	Quantitative Research	Integrated data	AHP Method

(Source by author)

Table 3.1 summarises the correspondence between the research questions and the research methodology, covering the type of research, data collection methods, and data analysis tools. RQ1 and RQ2 use quantitative research through closed-ended questionnaires and analysis of the primary data to systematically explore the impact of product needs and preferences on purchase decisions and customer satisfaction. RQ3 uses quantitative research through comprehensive data analysis and methodological modelling in conjunction with AHP (hierarchical analysis) to construct a methodology that integrates product needs and preferences on purchase decision and customer satisfaction. RQ1 and RQ2 are quantitative studies that analyse closed-ended questionnaires and raw data to systematically explore the effects of product needs and preferences on purchase decisions and customer satisfaction. RQ3 is a quantitative study that analyses comprehensive data and combines AHP (hierarchical analysis) with methodological modelling to construct a framework for purchase decisions that integrates product needs and preferences.

The Figure 3.2 shows the design of the data collection method, which is divided into two stages: questionnaire data collection and raw data collection. Since enterprise customer data usually involves customers' personal privacy information, such as family members' situation, background information, identity information, medical history, etc., these special data need to be strictly protected. Therefore, there are high requirements for data security, compliance and quality in product design. Based on this background, the design logic of this data collection method mainly centres on scientific, systematic and data quality assurance to ensure the accuracy, reliability and usability of data. The process is described below:

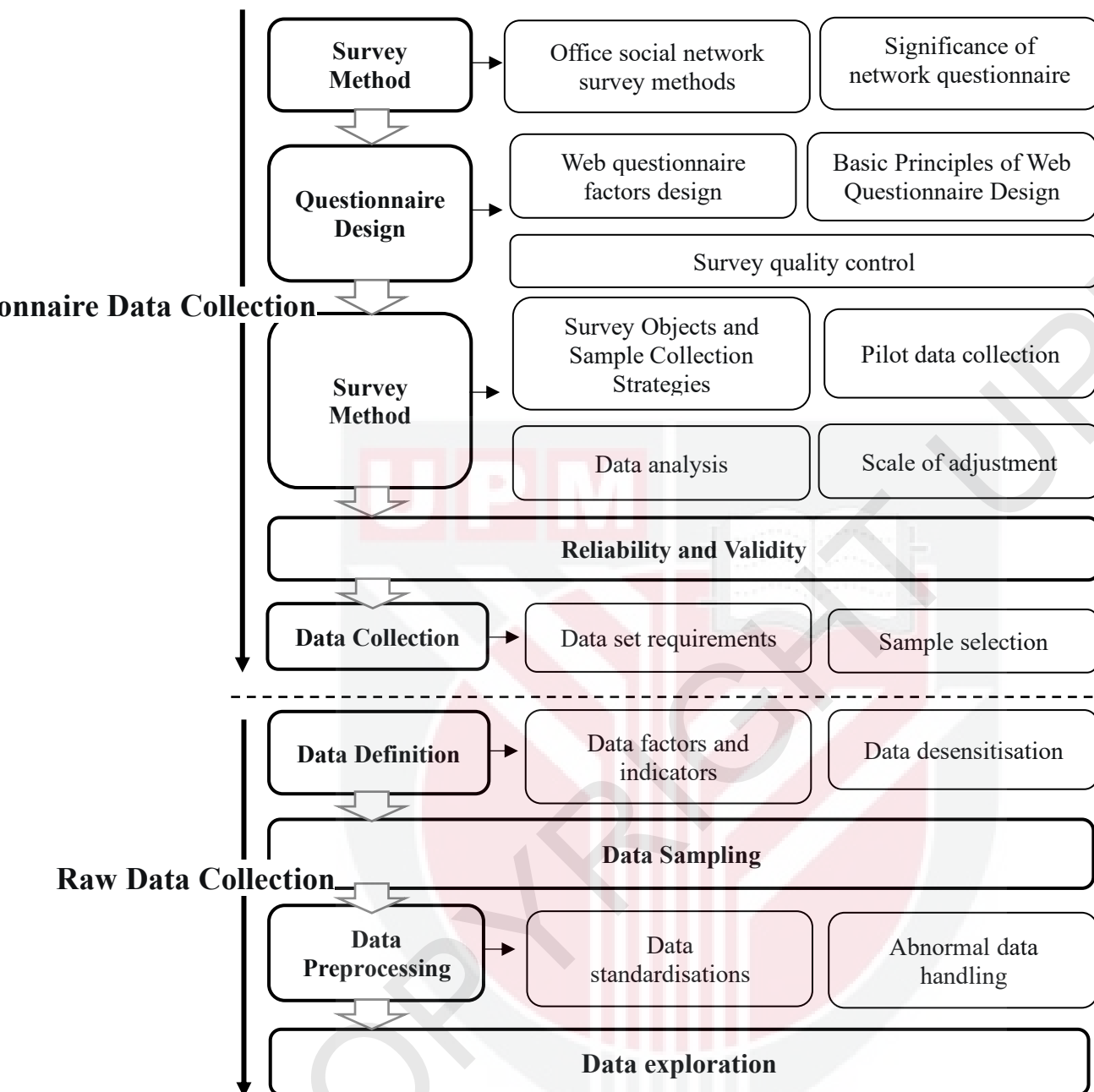


Figure 3.2 : Data Collection Process
(Source by author)

- a) Questionnaire data collection to ensure scientific validity of data sources - In the questionnaire data collection, the first to determine the survey method, including social network surveys and their importance, due to the daily work of the enterprise customer population need to use are dedicated intranet. The questionnaire collection must also ensure the security and convenience of personal data, in the whole collection process to limit illegal access rights,

prevent information leakage, personal data desensitization and so on. Therefore, this paper adopts the internal social network of the enterprise as the questionnaire data collection platform, which can reduce external interference, increase customer participation, and ensure the reliability of the data source.

Then, the questionnaire design was carried out, covering webpage questionnaire factor design, basic principles and quality control. As product development is a complex process, the questionnaire factor design involves key factors of product demand and preference, which are comprehensive product factors, each of which is vital and indispensable. These factors are set from the comprehensive needs of different participants, including customers, developers, markets, etc., to ensure the comprehensiveness and scientificity of the data. Then, sample collection, pilot data collection, data analysis and questionnaire adjustment are performed based on the industry product characteristics, and finally, the reliability of the questionnaire is ensured.

- b) Raw data collection component: ensuring data quality and validity of analysis
- Also, because each enterprise customer behaviour data is stored in a separate database for security protection. Therefore, there is a need to safeguard the data desensitization process along with multi-database extraction of data. The first step is to determine the dataset requirements and sample selection, then define the data factors and set the data desensitization and extraction rules. Next, data sampling is performed to ensure data standardization and deal with anomalous data, and finally, the data exploration phase is carried out to prepare the data for subsequent analysis.

3.2.2 Research Method

Research methodology refers to the overall approach and methodology used by researchers in conducting scientific research. It includes the overall theoretical and methodological framework of the research and is used to guide the direction and

methodological choices of the research. Research methods include quantitative research methods, qualitative research methods, mixed research methods, etc., as well as philosophical perspectives and methodological orientations related to research. The selection of an appropriate research method is essential to address the research questions and achieve the research objectives (Taherdoost, 2021).

In this thesis, to be able to conduct effective behaviour and preference analysis of customer groups, it is necessary to carry out multi-source data collection (Wang et al., 2024), which involves the questionnaire research and the original system data to obtain effective product demand, preference data of customer groups. Relevant quantitative data analysis methods include status quo descriptive data analysis, descriptive statistical analysis of the original customer database and questionnaire data, including data distribution, importance, etc. This can help to understand the current situation and where the problem lies. Quantitative analysis can effectively quantify the relationship between variables, integrate data, make predictions, and make decisions more accurate, so the choice of quantitative analysis is a reasonable choice (Emon, et al., 2024). The following is an analysis and explanation of the use of quantitative research methods, risks, and advantages and disadvantages, so that it can be used effectively in the follow-up.

- a) Quantitative research - Quantitative research, or quantitative research, is a research method as opposed to qualitative research. It refers to the use of quantitative methods to analyse and compare data or information to draw valuable conclusions. Quantitative research is an objective and specific research method, to a certain extent, it can not only eliminate people's bias and subjective awareness, or quantitative analysis and study of things, focusing on revealing the various essential problems under the numerical description (Scharrer & Ramasubramanian, 2021). However, since the result

of quantitative research is usually a report containing a large amount of data, if these data are not well utilised and analysed, the results of quantitative research can only be a pile of data with little practical guidance. Quantitative analysis has three features: First, in quantitative research to use variables, hypotheses, the establishment of control groups, operationalisation, testing and other methods of social phenomena. Second, quantitative research needs to select samples, emphasising the random sampling. Third, quantitative research is to recognise different phenomena, to provide accurate numerical evidence to describe the phenomenon, through many numerical analyses to understand the nature of things or analyse the relationship between the number of elements of a phenomenon (Ghanad, 2023).

- b) Quantitative research risk assessment - Quantitative research, shown in Table 3.2 provide objective and precise results, and numerical data can be used to describe phenomena, which reduces the scope for subjective interpretation and increases the scientific validity of the research; quantitative research results can be used to explore a variety of issues using similar methods in different research areas, and are suitable for large samples of people, which can increase the statistical validity and reliability of the results; the results of quantitative research can be used to support policy development and decision making; data and methods are often explicit and replicable; quantitative data can be used to provide evidence-based recommendations to improve organisational or societal efficiency and effectiveness.

Table 3.2 : Quantitative and Qualitative Research Methodologies

Aspects	Qualitative research	Quantitative research
Support for Decision-making	Weak capacity to support major decisions	Strong capacity to support major decision-making
Theoretical Foundations	Rooted theory, bottom-up	Positivism, top-down
Research Design	Only framework assumptions need to be established. Less structured	A careful set of assumptions needs to be established. High degree of structure
Measurement	Less standardised; High flexibility; Lower	High degree of standardisation. Low flexibility.

Table 3.2 : Continued

	confidence and low repeatability; Common measurement tools: projection techniques, etc.	Higher reliability; high repeatability; and Common measurement tools: scales, etc.
Analysis	The analysis of differences in kind or quality; With their understanding of and insight into information, researchers Inferring relationships between things	An analysis of the degree of variation. Use of numbers or data or empirical models to explain relationships between things

(Source by Queirós et al., 2017)

The limitation of quantitative analysis is its breadth of data (Queirós et al., 2017). Among the many factors, it is crucial to be able to determine the causal, logical relationship between two variables, but the quantitative depth is insufficient and lacks an analytical understanding of the deeper motivations and processes (Miller et al., 2022).

- c) Quantitative method - Understanding the characteristics and scope of application of commonly used quantitative methods can help researchers match the research question to the most appropriate method and ensure that the research method is effective in addressing the research question (see Table 3.3).

Table 3.3 : Comparison among Quantitative Methods

Method	Advantages	Disadvantages
Field Experiments	- Works in natural setting - Larger scale research - Subjects are not influenced by the observations of the experiments	- Difficult to control variables - Difficult to replicate the same conditions of the study - Ethical problems can arise
Simulation	- Used to study complex systems - Compress a time frame, which allows to study the behaviour of the system	- Model building requires deep knowledge of the field - Time consuming and expensive - May require specialised hardware and software tools

Table 3.3 : Continued

	more quickly	
	- “What-if” questions can be tested and answered	
Surveys	- Low development time	- Reliability of data is very dependent on the quality of answers and on the survey’ structure
	- Cost-effective	
	- Easy data collection and analysis using statistical methods	- Rigidity of the structure
	- Can reach high audiences	- Don’t capture emotions, behaviour, and changes of emotions of respondents
	- High representativeness	
	- Not affected by the subjectivity of the researcher	
Correlational Study	- A lot of information and different domains can be explored	- No direct cause and effect can be inferred
	- Degree of association between two variables can be easily calculated	- May lacks internal/external validity
	- No manipulation of behaviour is required	- Doesn’t provide a conclusive reason for the existence of a correlation between two variables
Multivariate Analysis	- Several statistical tests and techniques can be used	- Complex of the employed techniques
	- A lot of information and different domains can be explored	- Requires the use of specialized statistical software
	- Technical rigor of the process	

(Source by Queirós et al., 2017)

- i) **Field experiments** - Field experiments take place in real life settings. It involves the isolation and manipulation one or more variables to test the effect (Fisher et al, 1960). It allows the researcher to observe more natural behaviour, but he/she will have a lot more variables to consider. This approach is also common in sociology and applied science like bioengineering and medicine. Campbell et al., (1963), field experiments offer significant strengths when compared to lab experiments. It offers a natural setting rather than an artificial lab setting. It is suitable to observe large groups of people, which are generally better representativeness. On the other hand, it is more difficult to control variables and, therefore, replicate the same conditions is very challenging. Additionally, and because it is difficult to control the environment, unanticipated actions can appear, which can adversely affect subjects and participants.

- ii) Simulation - The simulation consists in the adoption of certain mathematical techniques, used in computers, which allow imitating the operation of almost any type of operation or process of the real world. Therefore, it represents the behaviour of real systems through the exercise of models. Simulation can be used to describe the behaviour of the system, construct theories and hypotheses considering the observations made, or use the model to predict future behaviour. Looking at the correlation coefficient, we can easily quantify observational data. At the same, we can collect a wide range of information from many domains at one time and it is possible to study the interrelations among those variables. However, correlation does not indicate causation, because the association between two variables could potentially be explained by a third variable.
- iii) Survey - Surveys are a research technique that allows the collection of data directly from a person involved in the research through a set of questions organised in a certain order. It is one of the most used quantitative techniques, since it allows obtaining information about a given phenomenon, through the formulation of questions that reflect the opinions, perceptions, and behaviours of a group of individuals. Surveys offer several benefits. Two of those most important benefits include the high representativeness of the entire population and the low cost of the method when compared to other alternatives. On the other side, the reliability of survey data is very dependent on the survey structure and the accuracy of answers provided by the respondents.
- iv) Correlational study - Correlational research is essentially an exploratory technique that seeks to determine whether there is a relationship between two or more variables. There is no manipulation of variables, but only an investigation of the extent to which the variables are related. The strength and direction of the relationship are two characteristics highlighted by a correlational study.
- v) Multivariate analysis - Multivariate analysis consists of a set of methods that can be used when multiple measurements are made for each individual or object of one or more samples. The methods typically

applied are included in the large group of descriptive statistics and inferential statistics. These techniques can be applied in a wide range of situations, such as market research, process optimisation and quality control. Multivariate techniques allow researchers to explore relationships between variables using the most appropriate methods for each situation. The statistical process to be adopted should be adjusted to suit the characteristics of the environment under analysis. However, these techniques are generally complex and require the use of specialised statistical software, which is generally expensive.

- d) **Data forecasts conditions** - In data predictive analytics and classification tasks, common methods include decision trees and their variants (e.g., Random Forest, Gradient Boosting Tree), rule learning (e.g., CART, ID3, C4.5), and other machine learning algorithms (e.g., Plain Bayes (Charbuty & Abdulazeez,2021), K-Nearest Neighbor, Support Vector Machine). Decision trees and their integrated methods (e.g., XGBoost, LightGBM) perform well in classification and regression tasks and are suitable for complex data structures and high-dimensional feature analysis, while methods such as KNN and SVM can be complementary in specific scenarios (Madanchian, 2024). Choosing appropriate algorithms in combination with data characteristics can help improve prediction accuracy and generalisation ability. Due to the discrete data characteristics of this paper, this paper uses the decision tree algorithm with high compatibility for data mining analysis, which can synthesize the analysis results of the original customer database and questionnaire data to find out the common points and contradictions, and can analyse the key factors affecting the satisfaction of the purchase decision to get the improvement of the product or service in-depth, and provide the corresponding recommendations and decision support.
- e) **Limitations analysis** - While quantitative research can provide data-based evidence to support policy and decision-making, its limitation is that it lacks in-depth analysis of the deep logical relationships and causal mechanisms among variables. To remedy this deficiency, machine learning methods can be combined, and multiple data sources can be used to enhance the

comprehensiveness and accuracy of the analysis. For example, fusing structured data (e.g., statistical surveys, transaction records) with unstructured data (e.g., text, images, sensor data) can provide a more comprehensive understanding of the interactions between variables. In addition, integrated analysis of cross-industry or cross-geographic data helps capture dynamic changes in complex systems, further enhancing the explanatory and predictive power of quantitative research.

3.3 Questionnaire Survey

Questionnaire design was invented by Sir Francis Galton, a British anthropologist, researcher, and statistician, in the late 1800s. Questionnaire design is a tool for collecting information in social survey research in the form of a printout that systematically documents the content of the survey in the form of questions, which are essentially a series of questions designed to collect information about people's attitudes behaviours, characteristics values opinions or beliefs about a particular issue (Stantcheva, 2023). The objective of this thesis is to understand the characteristics, behaviours, attitudes, and preferences of the group of decision makers to obtain basic information about the group of respondents, which helps to reach the analytical process between the decision makers and the key elements, which is related to the second objective of the study.

In order to ensure the perfection and scientific validity of the questionnaire, the questionnaire design is divided into three stages: First, the questionnaire design stage, to determine the basic questions and answers to be studied, and consult a number of teachers, and in the enterprise product research and development group to jointly discuss the feasibility of the formation of the first draft; Second, the pilot study (a

small-scale survey) stage, to determine the object and scope of the questionnaire through the feedback from respondents to the questionnaire to be modified. To help respondents to eliminate the difficulties in understanding the problem, in favour of respondents to provide true answers as far as possible. At the same time, the reliability and validity of standardized products need to be verified, considering the geographical differences of customers. Reliability verification methods include Internal Consistency Reliability and Test-Retest Reliability to verify the reliability of the standard product to ensure stable and reliable measurement results. Third, the questionnaire implementation (large-scale survey) stage, the collection of data for statistical analysis and model testing.

3.3.1 Survey Method

Questionnaires are inexpensive to design and administer, but time is an important resource that is maximally consumed by questionnaires. Questionnaire research needs to protect the privacy of the participants as they will only answer honestly if their identity is hidden and confidentiality is maintained, corroboration in the form of questionnaires can be a useful confirmatory tool when corroborated with the results of other studies that have the resources to implement other data collection strategies (Garrido et al., 2024).

- a) Office social network survey methods. The office social office network is gradually becoming a form of network environment that businesses rely on for almost all their work and socialisation. The Internet is an interactive platform for mutual exchange, communication and participation, the development of the Internet has long exceeded the original QQ chat purpose. Social networking has expanded the Internet from a platform for research, schools, government, and business applications into a tool for human social communication (Cheng et al., 2021). Nowadays, social networking has

even expanded its scope to the field of mobile phone platforms, with the help of the universality of mobile phones and the application of wireless networks, and the use of a variety of dating/instant messaging/email transceivers and other software, making mobile phones the carrier of a new social network. Office social network surveys, which are a quick method of data collection according to Rawat (2021); Whittaker et al., (2024); Huang (2023), on the advantages and disadvantages of questionnaire analysis are summarised in Table 3.4, the comparison of characteristics of office social network surveys and traditional questionnaire completion.

Table 3.4 : Comparison of Characteristics of Office Social Network Surveys and Traditional Questionnaire Completion

Content	Office Social Networking Questionnaire Research	Traditional Questionnaire
Response Rate	Higher response rates because researchers are in the same work environment	General
Coverage	Wide coverage, service clients can be contacted for a more comprehensive sample	Coverage cannot be guaranteed
Answer Scenarios	Low social proximity. Low social situational more	High social proximity Low social situational cues
Interpersonal Interaction	Performs real-time interpersonal interactions to explain issues, clarify concerns, and remind respondents to participate	
Rejection	Allows for better access to data	Denial cannot be controlled
Degree of Anonymity	Higher	Low
Questionnaire Topics	Sensitive, private topics get more open questionnaire responses	Sensitive, private topics get more conservative questionnaire responses
Psychological Feelings	Anonymity, security, but computer anxiety	Observed by researcher

(Source by author)

Office social network questionnaire studies offer several advantages over traditional questionnaire methods (see Table 3.4). Office social network questionnaire studies typically achieve higher response rates because the researcher is in the same work environment as the participants, facilitating direct contact and interaction. In addition, office social network questionnaire studies have a wider reach and can easily contact service clients within the office network, resulting in a more comprehensive sample. For sensitive and private topics, office social network questionnaire studies tend to receive more open responses as participants perceive a higher level of anonymity and security. Office social network questionnaire studies have demonstrated clear advantages in increasing response rates, expanding coverage, and promoting more honest responses.

b) Significance of the office social network questionnaire study

- i) Relatively real, free from virtual constraint - Human interaction and collaboration typically occur within groups. These groups are formed around common relationships, goals, or projects. Teams need the ability to interact with other teams and share their knowledge and expertise to be successful and innovative. The advent of computer networks and the Internet has made group interactions possible regardless of geographic location or time zone, and the subsequent combination of Web 2.0 technologies has made such interactions and collaborations more fluid, cost-effective, and easy to maintain (Syed et al., 2022). Instead of being isolated, opposing sides of the real-life interaction needs and the online world, they can be extended on the office network to better realize the ultimate purpose of interpersonal interaction through dual offline and online encounters (Li et al., 2021).
- ii) Managing boundaries and the realisation of free communication - For geographically dispersed teams and remote workers, the Office Social Networking Platform provides an online collaboration platform where customers can solicit feedback and discussion at any time through text,

image, voice, and online voice and video, promoting the efficiency and effectiveness of remote questionnaire research work. The Office Social Networking Platform can initiate temporary groups at any time to facilitate respondents to share information, while supporting individual units to answer questionnaires, companies can implement security measures such as encrypted access on the platform to ensure the protection of sensitive information and employee privacy. From the advantages and implications specific to office social networks described above, the use of office social networks as a questionnaire tool is more feasible and has some research implications.

3.3.2 Questionnaire Design

Questionnaires are the foundation of any survey, and their success lies in their design. The right questions, the right order of questions, the right scale, or a good questionnaire format can make a survey valuable because it can accurately reflect the views and opinions of the participants. To design a good questionnaire, it is necessary to first conduct a thorough study of the background of the survey questions. Ensuring the validity and reliability of the survey, good reliability and validity is the basis for the subsequent statistical analysis of the questionnaire data (Cheung et al., 2024). In this thesis, to be able to conduct effective behaviour and preference analysis of customer groups, it is necessary to carry out multi-source data collection, which involves the questionnaire research and the original system data to obtain effective product demand, preference data of customer groups. Relevant quantitative data analysis methods include status quo descriptive data analysis, descriptive statistical analysis of the original customer database and questionnaire data, including data distribution, importance, etc. This can help to understand the current situation and where the problem lies. Quantitative analysis can effectively quantify the relationship

between variables, integrate data, make predictions, and make decisions more accurate, so the choice of quantitative analysis is a reasonable choice. The following is an analysis and explanation of the use of quantitative research methods, risks, and advantages and disadvantages, so that it can be used effectively in the follow-up.

- a) Web questionnaire factors design - Very little research has been done on Enterprise (organisation) decision maker preference analysis, and the decision maker questionnaire design is summarised based on the analysis of project practices. The first part of the questionnaire covers the demographic characteristics of the respondents (decision makers), including their gender, age, work experience, and educational status. According to Rattray and Jones (2007) proposed to design and determine the demographic characteristics of the sample, gender is categorised as male and female, age should be 18 years old in terms of the law, and all age groups. The second part of the questionnaire is the Enterprise (organisation) business information, generally Enterprise (organisation) business planning belongs to the internal environment factors, through the acquisition of business attributes, we can know the basic information characteristics of the enterprise and have a preliminary understanding of the enterprise. The third part of the questionnaire analyses the software key factors in the supply chain such as reliability, service level, cost structure, and the external environment to understand customer needs, preferences, behaviours, and feedback. Only in locating its own decision-maker label, it will better understand the decision-maker's scope of operations and the customer's purchase choice preference label, these dimensions are designed to help companies fully understand their business environment, risks, and opportunities to support the purchase decision impact optimisation, to improve the product or service and increase customer satisfaction. The fourth part of the questionnaire is the respondents' feelings about the service of the software purchase, in which 1 satisfaction overall supervisor scoring, the score is set from 1 to 10 points (can be set as a grade: 8-10 very satisfied, 6-7 satisfied, 4-5 general, and 1-3 failed) side to reflect their own needs preferences.

Table 3.5 : Factor Design of Product Demand and Preference Questionnaire

Composition	Factors	Goal Description	Quantity	Objects
Part I User Information	Basic Information	The respondents were divided into different subgroups according to different underlying information dimensions such as age, gender, education level, etc., and the differences between these subgroups were compared. It contributes to a deeper understanding of opinion behaviour among different groups of people.	6	Buying participants Customer
	Job Information	Collect information about the position and work experience of the respondents to describe and identify the interviewed organisations, to better understand the organizational environment to which the respondents belong.	2	
Part II Product Requirements	User Goals	A specific goal or purpose that a user expects to achieve when using a product, service, or system. When designing and developing a user interface, application, or website, understanding the goals of the user is essential to provide a good user experience.	3	
	Technical Requirements	Specific technical requirements or technical aspects required in the design, development, or implementation of a project, product, or system. These requirements are often required to ensure that the system can meet specific functional, performance, security, and maintainability requirements.	3	
	Product Resources	Are various resources used to design, develop, produce, and support products, which can cover both material and non-material aspects.	3	
	Impact of Purchase	Factors related to consumer interactivity and so on will affect the consumer's purchase intention	4	

Table 3.5 : Continued

Part III Product Preference	Security Aspects	Prevent potential hazards and protect the ultimate interests of customers from harm	4	Buying Participants
	Functional Aspect	Functional design can meet the needs of users and improve the practicality and value of products or services	4	
	Design Aspect	It aims to optimise the user's interaction with the product or service	3	
	Response Aspect	A response to or response to a stimulus or event	3	
	Brand Aspect	The branding aspect deals with the unique identity and image of a product, service, or company in the market	2	
	Economic Aspects	Economic activities involving the production, sale, and consumption of goods	3	
Part IV Comprehensive Assessment	Service Aspect	Through the service evaluation, the respondents' overall evaluation of the research object can be obtained, which helps to understand the overall quality and performance analysis of the respondents for the product, service, or event.	5	
		Comprehensive assessment of satisfaction is based on a scale of 1-10, with scores based on dimensions such as product quality, usage experience, service experience, value for money and overall satisfaction	1	

(Source by author)

Some of the questions in this questionnaire were based on a five-point Likert scale (Tanujaya et al., 2022), as shown in Table 3.5. The survey respondents only need to tick under the corresponding score; in the third part function, design, response, brand, and economic aspects from low to high scores represent the actual perception of the survey respondents on the service are very unimportant, not too important, moderately

important, relatively important, and very important, where 5 is the most important, and 1 is unimportant; in the fourth part from the five levels represent the survey respondents' expectations of the quality of the service. In the fourth part, from five levels representing the survey respondents' expectation of this service quality gradually increasing, a question is set for decision makers to score the overall service quality of HMC organisations on a 5-point scale, where the higher the score, the better the service quality (see Table 3.6).

Table 3.6 : Likert Five-Point Scale

Very Unimportant	Not Very Important	Medium Important	Fairly Important	Very Important
1	2	3	4	5

(Source by author)

- b) Basic principles of web questionnaire design
 - i) All questionnaire questions should be related to the survey topic - The wording must be clear and specific, avoiding ambiguous words such as probably, possibly, sometimes, usually, etc.; it should be sincere and friendly, avoiding embarrassing, taboo, and sensitive questions for decision makers, such as personal income, etc.; it should be appropriately easy to understand and comparable to the decision maker's vocabulary; and it should avoid inducing questions. In addition, the answer design should follow the completeness, mutual exclusivity, and clarity of answer levels, and the answers can be in the form of binomials, multiple choice, sorting, and so on. In addition, to reduce the sense of discomfort and unfamiliarity of TMC decision makers, the questions in the questionnaire should be arranged from simple to complex, general to specific, factual to expository, and closed to open-ended.
 - ii) Survey design has a direct impact on survey return rates - The so-called questionnaire response rate refers to the percentage of the number of

questionnaires returned in a questionnaire survey compared to the number of questionnaires sent out, i.e.,

$$\text{recovery rate} = \frac{\text{Questionnaires returned}}{\text{Questionnaires sent}} \times 100\% \quad (3.1)$$

The response rate is one of the most important indicators of how representative the results of a questionnaire are of the population. If the response rate is low (for example, less than 50.0%), it is difficult to ensure that the results are representative of the population. Therefore, ensuring a high response rate is one of the basic requirements for conducting a questionnaire survey. And the response rate of the questionnaire is largely influenced by the design of the questionnaire, in addition to the content of the topic under study, the literacy level of the sample under study, and other factors (Lietz, 2010). A well-designed questionnaire not only attracts respondents, but also mobilises their motivation and responsibility, and can make them complete the questionnaire carefully and return it on time.

- iii) Questionnaire design has a direct impact on the final survey results - Since questionnaires are difficult to change once they have been sent out (Long, 2024), the researcher's considerations and requirements for collecting survey data must be decided at the questionnaire design stage before the start of the formal survey, and all work must be completed at the questionnaire design stage. In fact, questionnaire design becomes the last hurdle for the adequacy, accuracy, appropriateness, and conformity of the survey data with the research requirements. Once the questionnaire is issued, the researcher can only "stand by and watch", cannot change the direction of the data collection process, content, scope and problems, and any negligence in the design of the questionnaire, any point of sloppiness, any point of perfunctory, any point of course, will be in the investigation of the information and even the investigation of the results of the survey will leave obvious traces, resulting

in irreparable damage. traces in the information and the results of the survey, resulting in irreparable losses.

- iv) Survey quality control - Thirty (30) local customer service staff from HMC institutions who have received unified training serve as investigators, and another 10 remote service staff are responsible for supervision. One investigator from each institution conducts a questionnaire survey on decision-makers and customers, and remote service staff take shifts among the 30 institutions to avoid investigator bias. The survey was conducted anonymously, and the investigator promised to the decision-makers and customers participating in the survey that participating in the survey would not have any influence on receiving pre-sales and after-sales services in the future and would keep the survey results confidential. The time of filling in the questionnaire should be during the work break of the institution, and the staff of the institution should not influence other people to fill in the questionnaire at the same time. The questionnaire should be filled in by the decision-maker himself. If the participant needs the help of others to answer the question, the investigator should ensure that the answer reflects the view of the decision-maker and can be explained online, rather than the view of the person providing help, to avoid information bias. The questionnaire is distributed and collected on the spot.

3.3.3 Pilot Test

All aspects of the questionnaire as a survey instrument must be pilot tested before the survey is conducted (Roopa & Rani, 2012). The purpose of pilot testing is to identify and eliminate any problems that may exist in the design of the questionnaire (Leon et al., 2011) and to check the reliability and validity of the measures used in the questionnaire. In this study, two pilot tests were conducted with two different groups of participants.

- a) Survey objects and sample collection strategies - If the purpose of the pilot test is to identify potential problems, test the feasibility of the survey instrument, or determine the effectiveness of the testing process, a smaller sample may be sufficient (Bagozzi, 1994).

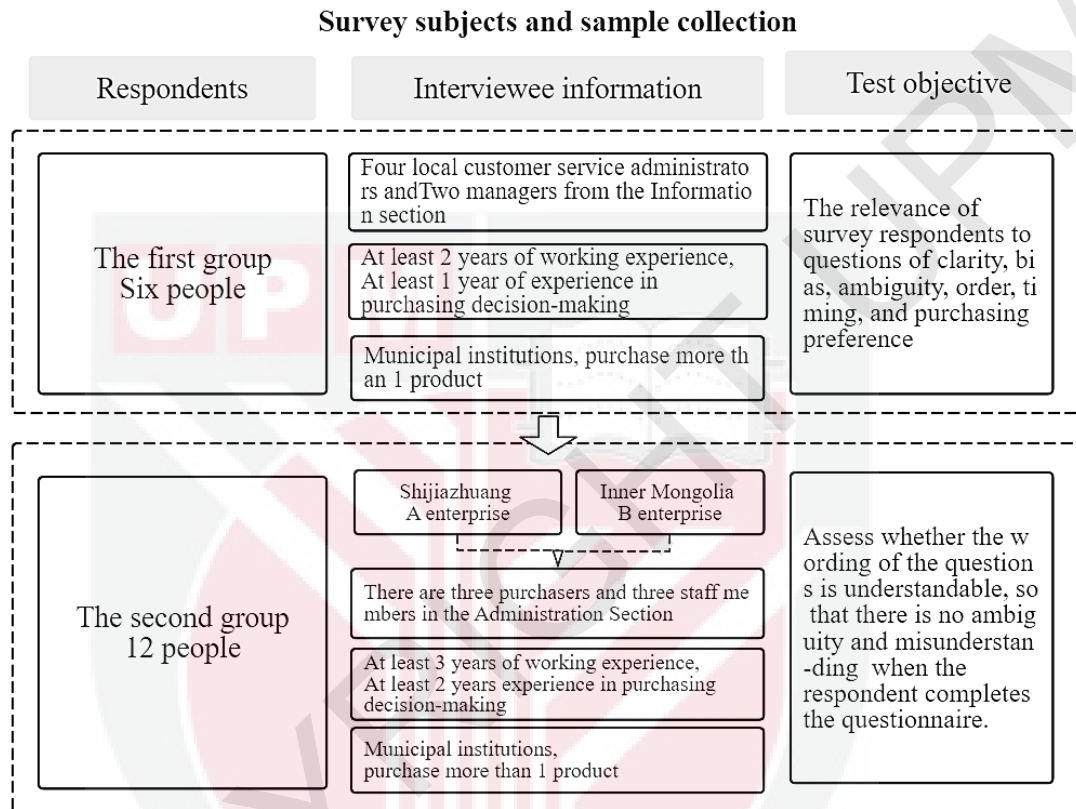


Figure 3.3 : Survey Subjects and Sample Collection
(Source by author)

As shown in Figure 3.3, the first group consisted of four local customer service administrators from the centre and two managers from the information department. The second group consisted of three purchasers from Enterprise A in Shijiazhuang and Enterprise B in Inner Mongolia, and three employees from the administrative section. The second group was selected based on the recommendation of Hair et al., (2017), who stated that when the scale used in a study is based on a previous study, it is

recommended to conduct a pilot test with respondents like the population to be studied to check the appropriateness of the items.

In the first phase of the pilot study, the first group of respondents was asked to evaluate the first version of the questionnaire based on the following aspects: clarity, bias, ambiguity, order, timing, and relevance of the questions on purchasing preferences. Based on the feedback from the first group, some of the questions were rewritten to minimise the risk of confusing respondents, and the order of some of the questions related to the background of the company and the respondent was increased. The modified questionnaire was then tested on the second group, which consisted of six respondents from the same population as the actual survey; in other words, they had similar characteristics, attitudes, and behaviours as the population being studied (Mason et al., 1995). The second phase, the second group was asked to assess whether the wording of the questions was understandable so that there would be no ambiguity or misunderstanding when the respondents completed the questionnaire. In addition, the pilot test for the second group was also designed to assess the time taken to complete the questionnaire. The pilot test confirmed that the final questionnaire used in this study could be considered an appropriate instrument for its intended purpose.

- b) Pilot data collection - When distributing the questionnaires, the researcher first identified the customers who were already registered in the office social network DingDing. Second, it was necessary to obtain recommendations from the product development centers of HMC organisations, especially the core medium-sized customers. These organizations totalled 120, and at that time there were 120 MedTech customers, 12 of which were individually contacted by the researcher using DingDing remotely online, with the ability to set appointment times and timed reminders. Finally, the researcher conducted an office social networking survey with the pilot respondents (n=6)

at a mutually convenient location. The questionnaire was administered in two ways: one was sent to the respondents for direct self-completion; the other was completed by the respondents themselves after a remote video presentation by a centralised team of researchers. There are many advantages of this model, the exclusive office social network allows access to a computer or cell phone at any time, the ability to initiate a voice at any time in case of doubt, etc., and it increases the likelihood that respondents will complete the questionnaire voluntarily (Buckley & Zamora, 2007). In addition, the disadvantage of this model is that it is time consuming because the researcher must access in take time to fill out the completion.

- c) Data analysis - At this stage, the data collected through the questionnaire were coded and converted into a two-dimensional matrix form in excel software. This allowed the data to be analysed for reliability and validity using the statistical package SPSS. The quantitative method of data analysis was carried out in different stages: data preparation and screening, descriptive statistics, and significance analysis. The results of the quantitative data analysis of this study are given in chapter four.
- d) Revision of the Scale
 - i) Organisation expert events - In order to see if the designed questionnaire is reliable enough to be distributed in the statistical society, it is important to distribute it to some experts first. The questionnaire will be distributed to three managers of HMC R&D Product Center along with two (2) Associate Professors of UPM to see if the questions are well designed and if they will yield enough data. The questionnaire was approved by the Supervisory Board for safe use.

Table 3.7 : Profiles of Assessment Expert

	Type of Expert	Designated Expert	Activity Objective
E01	Operational	Operations Product Manager	Elicit the logic of the questionnaire, the extent to which the key elements of the question are covered. Provide clear descriptions and definitions for questions to help respondents understand the context and meaning of the question. Avoid complex sentences and lengthy descriptions to improve respondent understanding and engagement.
E02		Sales Product Manager	
E03		R&D Product Manager	
E04	Research-oriented	PhD Tutor	Review the questionnaire design for logic, systematicity, accuracy, and completeness, and suggest changes based on the opinions of business-oriented experts to ensure that the entire survey can be successfully completed.
E05		PhD Second Tutor	

(Source by author)

Through the division of labour in Table 3.7, different types of experts can provide targeted advice and guidance for the questionnaire design and survey process based on their own areas of expertise and experience, ensuring that accurate and complete survey data are ultimately obtained. Business-type experts include O&M, sales, and R&D product managers. O&M product managers and sales product managers have in-depth knowledge of product operations and user requirements. Their main task is to review the logic and question content of the questionnaire to ensure that it covers key aspects and provides clear explanations and definitions to ensure that respondents understand the context and meaning of the questions. In addition, they can provide input to simplify complex sentences and descriptions to improve questionnaire comprehension and engagement. R&D product managers are tasked with reviewing the design, content, and structure of the questionnaire to ensure that it collects accurate

and useful data. Based on their expertise and experience, they can suggest improvements to ensure that the questionnaire questions are reasonable, as well as perform quality control of the questionnaire before its official release. Research experts are mainly doctoral supervisors whose task is to check the logic, systematicity, accuracy and completeness of the questionnaire design. Based on their research experience and professional knowledge, they can suggest modifications to ensure that the questionnaire can successfully fulfil the survey objectives and produce valid research results. At the same time, they can also provide suggestions for further improvements to enhance the quality and credibility of the questionnaire based on the inputs from the business-oriented experts.

- ii) Revision of scale dimensions and items - Revising the dimensions and entries of the scale is a critical step that determines the reliability and validity of the scale. The results of the revision can be found in Appendix A.

Table 3.8 : Revisions by Assessment Expert

Category	Practices	Advantages	Weaknesses	Suggestions for Improvement
Home Design	Include brief instructions on how to complete the questionnaire on the welcome page.	Invite participants to fill out the questionnaire in a friendly way.	Too much content on the page, which makes participants feel that the task is too difficult and may cause them to quit.	Add the instructions before each type of question.
Layout Design	Consistent formatting with traditional surveys	Make participants fully adapt to the network questionnaire, to avoid the feeling of discomfort should be felt	Single page layout that does not take full advantage of the Internet and computers	Set up paged questions, skip-answer questions
Navigation and Continuation	Use graphical icons to indicate the	Automatically display the number of	Graphics and animations require a high	Replace graphical icons with text

Table 3.8 : Continued

Design	progress of the questionnaire and ensure that participants can resume the questionnaire after interrupting their answers.	currently answered and unanswered questions, avoiding active operation by participants, which is more humanised.	level of browser performance and may not be displayed properly if participants are using a lower version of the browser.	indicators
Selection and Design of Questions	Be careful with the use of check-all and open-ended questions, which can lead to errors, and set up a mandatory response feature.	Improve the accuracy of data and effectively reduce the rejection rate of a question.	May lead to higher abandonment rates for the entire questionnaire.	Provide a “do not answer” option for truly sensitive questions, allowing the next question to be answered directly.
Privacy Statement	Privacy Statement	Eliminate participants’ doubts as much as possible	None	Encrypt all data in web surveys before sending it over the network.

(Source by author)

In Table 3.8, the evaluation experts suggested improvements to the design of the questionnaire, covering the design of the homepage, layout, navigation and continuation design, selection and design of question types, and privacy protection statement. For the design of the homepage, it is recommended to add a welcome page and short instructions to invite participants to fill in the questionnaire in a friendly way, and to add the instructions before each question type to reduce the content of the page. For the layout design, it is recommended to keep the same layout format as the traditional questionnaire and add paged questions and skip-answer questions to improve the ease of use and attractiveness of the questionnaire. For the navigation and refill design, it is recommended to change to text-based indicators to ensure proper

display in different browsers. As for the selection and design of question types, experts suggested that question types that may lead to errors should be used cautiously, and that a mandatory answer function should be provided, while a “no-answer” option should be provided for questions that are sensitive to increase the flexibility and response rate of the questionnaire. Finally, the experts also made recommendations on encrypting data transmission to enhance the privacy protection of online questionnaires. These recommendations consider all aspects of questionnaire design and aim to improve the efficiency, usability, and data accuracy of the questionnaire.

3.3.4 Reliability and Validity

Since the research respondents come from enterprises of different sizes and there are certain differences in the business models, product functions, operational processes and market environments of each enterprise, different respondents may have different understandings of the same issues, and this business complexity will have an impact on the consistency and reliability of the data. Therefore, to ensure the accuracy of the data and the scientific validity of the research conclusions in a complex business environment, it is crucial to ensure the Reliability and Validity of the research data. In order to ensure that the questionnaire has high reliability and validity, this paper analyses the reliability and validity with the help of SPSS and Excel respectively. If the reliability and validity of the questionnaire are better, it proves that the data reliability of the questionnaire is higher, and the internal consistency of the questionnaire data is higher, which can be used to do the subsequent modelling analysis, on the contrary, if the reliability and validity are not high, the questionnaire needs to be re-modified to design the questionnaire and issue the questionnaire again.

- a) Analysis of reliability - Reliability refers to the consistency, reliability or stability of the results of measurement experiments. Depending on the focus of the researcher's concern, it can be divided into Internal Consistency Reliability and External Consistency Reliability. Internal Consistency Reliability refers to whether a set of questions in a questionnaire measures the same concept, and the commonly used analytical methods are Cronbach's. External Consistency Reliability is mainly Test-Retest Reliability, which refers to the consistency of the results of the measurement of the same research subject for the same questionnaire, repeated measurements of the same research subject at different times, the degree of consistency, which can be calculated again by SPSS to complete.
- b) Internal consistency reliability measure - Internal Cronbach (1951) proposed Cronbach's Alpha, which became the classic measure of content consistency. Internal Consistency Reliability is currently the most used measure of a scale's internal reliability. Whether the items have high internal consistency with each other. As shown in Table 3.9, it is usually considered that the reliability coefficient should be between 0 and 1. If the reliability coefficient of the scale is above 0.9, it means that the reliability of the scale is very good; between 0.8-0.9, it means that the reliability of the scale is acceptable; between 0.7-0.8, it means that the scale needs to be revised; and under 0.7, it means that the scale needs to be discarded.

Table 3.9 : Credibility Coefficients

Cronbach's alpha	Internal consistency
$\alpha \geq 0.9$	Excellent
$0.9 > \alpha \geq 0.8$	Good
$0.8 > \alpha \geq 0.7$	Acceptable
$0.7 > \alpha \geq 0.6$	Questionable
$0.6 > \alpha \geq 0.5$	Poor
$0.5 > \alpha$	Unacceptable

(Source by Cronbach)

Cronbach's alpha coefficient is a commonly used measure of reliability, but it has its limitations, for example, it may be less applicable when the number of questions is small or the correlation between different questions is low. Therefore, other methods and factors need to be considered when conducting reliability analyses to ensure the accuracy of the reliability assessment. The internal consistency reliability measure for this paper is through SPSS (Jalolov, 2024), importing the dataset. Click on Analyse → Scale → Reliability Analysis. Select all measured variables and select "Alpha" as the reliability model, "Standardised Scale Alpha" (Standardised item Alpha), run the analysis and view the Cronbach's Alpha values. The results were as follows:

Table 3.10 : Buyer Pilot Test Reliability Analysis Results

Item	Sample Size	Number of Items	Alpha
Test 1	20	41	0.863
Test 2	20	41	0.872

(Source by author)

According to Table 3.10, the following information can be derived: Alpha value for Test 1: 0.863, indicating that this test has good internal consistency and can be considered reliable. The Alpha value for Test 2: 0.872 shows a slightly higher internal consistency than Test 1, again indicating good reliability.

- ii) Test-retest reliability measurement - Charles Spearman (1904): as one of the founders of Classical Test Theory (CTT), he introduced the basic concepts of reliability, including the effect of measurement error on test consistency, laying the foundation for the subsequent development of retest reliability. a sample of subjects - Select a group of subjects or respondents who are relevant to your research objectives and who can be measured at two different points in time, making sure that the measurement instrument is consistent at both points in time without modification. The time interval can vary

depending on the nature of the study and the requirements of the research question, and can typically be a few days, weeks, months, or longer. At the first time point, the selected sample is measured and their scores or responses are recorded, and at the second time point, the same subjects are measured with the same instrument and their scores, or responses are recorded. The values of the common correlation coefficients and statistical significance are important indicators used to assess the consistency and reliability of a measurement instrument between two (2) measurements (see Table 3.11).

Table 3.11 : Test-Retest Reliability Measurement Strategy

Strategies	Content
Survey Objects	Pilot Test Group II Subjects
Measurement Method	Web Questionnaire Scoring
Measurement Content	Appendix
Time Interval	1 week
Number of Measurements	2 times
Strategy Method	Pearson correlation coefficient
Test Tools	SPSS

(Source by author)

In Test-Retest Reliability sample strategy is to assess the correlation between the second group of objects of the pilot test by two measurements, the web-based questionnaire and scoring were used for data collection, Pearson correlation coefficient was used as a measure, and the data were analysed and processed with the help of SPSS. The specific steps are as follows: first, make sure that the dataset contains 20 copies of each of the two measured variables. Open the SPSS software and load the dataset. Click on Analyse → Correlate → Bivariate. Select Company A (Test1) and Company A (Test2), and Company B (Test1) and Company B (Test2) in the Variable box. In the Correlation Coefficients option, check the Pearson correlation. Select Two-tailed for significance testing. Run the results as follows.

Table 3.12 : Test-Retest Reliability Test Results

Object	Content	A Company	B Company
A. Company (Shijiazhuang)	Pearson correlation	1	.943
	Significance (two-tailed)		.004
	Number of cases	20	20
B. Company (NeiMenggu)	Pearson correlation	.943	1
	Significance (tw-tailed)	.004	
	Number of cases	20	20

At the 0.05 level (two-tailed), the correlation is significant.
(Source by author)

In Table 3.12, the correlation coefficients between firms A and B analysed from the data of the 20 cases are 1 and 0.943 respectively, with a significance level of 0.004, which indicates the p-value of the correlation coefficient. This implies that there is a high positive correlation between enterprises A and B and that this correlation is statistically significant.

b) Internal validity - Validity test is to test the validity of the questionnaire, is to determine whether the design of the questions is reasonable, whether it can effectively respond to the researcher's research objectives. Validity analysis is only for scale data, non-scale questions such as multiple choice, single choice gender and other questions cannot be analysed for validity. Validity is used to reflect the extent to which the actual measurements match the expected results. Because the true value of the targets cannot be determined, assessing validity is complicated and often requires comparison to external standards. If reliability analysis is not up to standard, validity analysis will inevitably not be up to standard either. Content validity analysis and structural validity analysis are common among researchers.

i) Internal validity - Internal validity refers to whether the experimental results obtained in a scientific study can correctly reflect causality, i.e., whether conclusions about causality can be accurately inferred. Internal validity focuses on factors in the research design and experimental process that ensure the accuracy and credibility of the study's results. Experts believe that in health care services, the security of user operations is more

relevant to the satisfaction of the organisation's ability to reliably provide health care services, and therefore should be attributed to the content reliability dimension: it is necessary to add a security reminder, "violation of the warning and blocking". However, experts believe that health care organisations as a social public welfare and career-oriented units, software effective service time is a mandatory requirement, should also be placed in the reliability dimension: and "economic considerations" must be based on the rational allocation of health care resources and to ensure the effectiveness of treatment, and the general service industry is different from that cannot be used alone as a bargaining chip to increase customer satisfaction, therefore, should be attributed to the content reliability dimension. Unlike the ordinary service industry, "economic considerations" alone cannot be used as a bargaining chip to increase customer satisfaction, so the subsequent correlation validation is more appropriate. Experts believe that the customer is proficient in the medical profession, but not very familiar with the terminology of information technology, so it is suggested that "local support" should be changed to "on-site service", in which the customer is more concerned about ease of use, and to avoid ambiguity, "interaction design" should be changed to "visual design". To avoid ambiguity, thus improving the wording of the entry.

In the respondent interview, only the wording of the item was complete according to the medical care services and no new items were required. So compared with the original scale, the dimension of the scale has not changed, but the number of items, content, and distribution of some changes, this is after the literature research, expert evaluation and customer interviews on the initial entry deletion and adjustment, the remaining 41 items, including eight user information, 13 product requirements, product preference 24 revised scale for formal investigation.

- ii) External validity - External validity refers to whether the results of a study can be generalised to other contexts, samples, or groups, that is, the generalisability and applicability of the results of the study. This paper is a

questionnaire for business units in different provinces and cities mainly in North China, therefore a cross-sectional study of external validity is used. A cross-sectional study compares the differences between different groups of people or places to assess external validity. For example, data from different regions are compared to determine whether the results hold across geographic settings.

In this study, to reasonably calculate the validity value, in the rank variable (such as education, importance) has a clear order relationship, usually using incremental assignment (such as 1-5 points), the calculation of the cumulative sum calculation. Categorical variables (e.g., gender) have no fixed order, and are commonly used in binary assignment (e.g., male=1, female=0) and multicategorical assignment (e.g., area A/B/C is 1/2/3 respectively) for calculation. Categorical variables were calculated using the sum method to assess differences or impacts between categories. The results of the comparisons are presented below:

Table 3.13 : External Validity Score Comparison

	Enterprise A (Shi Jia Zhuang)	Enterprise B (Bao Ding)	Difference (A-B)
User Information	4194	4087	+107
product Demand	10946	10892	54
Product Preferences	23950	24700	-750
Sum	39090	39779	690
This paper compares the results of Group 2 data from the pilot test by (Source by author)			

In Table 3.13, the terms of user information and product demand, enterprise A's external validity score in terms of user information is slightly higher than that of enterprise B in Inner Mongolia the difference is 107 and 54, respectively. in terms of product preference, enterprise B's external validity score in terms of product

preference is slightly higher than that of enterprise A the difference is 750, with a composite deviation of 689, and the external validity scores of the two (2) enterprises in the different aspects are slightly different, but the difference is not very significant.

3.3.5 Data Sample Collection

Prior to data collection, it is necessary to define the characteristics of the data required, including the type of data, data sources, data quality, etc., to ensure that the data collected can meet the needs of the study. The determination of the sample size should consider the complexity and variability of the phenomenon under study, as well as the required statistical analysis methods. The larger the sample size, the more accurate the estimation and inference of the overall. However, rather than pursuing an increase in sample size, the appropriate sample size should be determined according to the specific circumstances of the study to ensure the reliability and validity of the findings.

- a) Data set requirement - HMC enterprise belongs to the leader of medical field services, business covers 87 percent of China, of which the standard products and services occupy 70 percent, the standard products include more than 10 products such as business platform, collaborative office, merchant management, etc., which is a typical representative of Chinese enterprise products. The largest and earliest group of customers is concentrated in North China, for which we choose North China as the main source of sample data. In addition, since this study uses random forest to solve the regression and classification problems, the total samples are randomly divided into 80 percent training set and 20 percent test set, to ensure the performance and reliability of the model, the number of samples in the sample training set samples is at least 300 or more in the small-scale data.
- b) Sample selection - Since there are a total of 120 healthcare-related business customers in North China and scattered in different regions, regional sampling was used to select respondents. Firstly, all the enterprises in North

China were analysed by CEOs, product development managers and business professionals through product characteristics and business scale, and finally, all enterprises were divided into three regions: (i) service region (large-scale enterprises), (ii) service region (medium-scale enterprises), and (iii) service region (small-scale enterprises). Next, a quarter of the system, i.e., 30 SMEs, were sampled proportionally across the three regions, based on statistical data analysis and demographic representation requirements. Of these, 12 were required to have decisions expected to have been involved in the purchase and 12 customers in each business customer, and it was planned that 360 valid questionnaires would be required for each, with 300 expected to be received for each after removing the loss data.

Table 3.14 : Statistics on the Return of Questionnaires

	Buying decision maker (Demand and preferences) Online questionnaire	User (Demand) Online Questionnaire
Number of questionnaires distributed/copy	320	320
No. of questionnaires returned/pc	315	318
Number of valid questionnaires/copies	308	306
Effective recovery rate/pc	97.0%	96.0%
Valid Sample Alpha	0.868	0.869

(Source by author)

Table 3.14, the statistical table, shows the final questionnaire recovery, which includes two types of survey data: purchase decision makers (demand and preference) and customers (demand). Both groups of questionnaires were distributed 320 copies, and 315 and 318 copies were recovered respectively, among which the number of valid questionnaires was 308 and 306 respectively, corresponding to the valid recovery rate of 97 percent and 96 percent, which indicates the high quality of data. In addition, the results of Cronbach's alpha were 0.868 and 0.869, which indicated that the

questionnaires had high internal consistency, and the data were reliable and could be used for subsequent analysis.

3.4 Source Data Acquisition

In acquiring customer source data, this paper is through the most direct method is to communicate with managers to clearly express the intention and purpose of data analysis, as well as the details that need to be confirmed. Data privacy is ensured through an agreement with the decision maker, and SQL queries are initiated from the database with the help of the company's operation and maintenance engineers to collect the results of queries and aggregate the data.

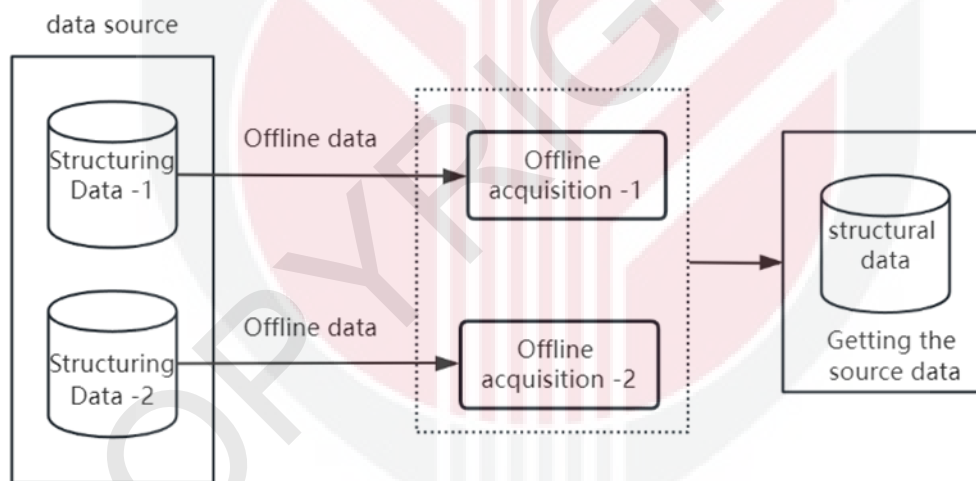


Figure 3.4 : Source Data Acquisition Strategy
(Source by author)

The data acquisition strategy in this paper, through on-site operation and maintenance engineers, offline collection of local data from a single enterprise and aggregation according to pre-set field identifiers to obtain the final data source. Medical offline data exists in the same organisation, the same system, different regions of the data are

stored independently of each other structured data; because of the complexity of the business led to the complexity of the table structure, which produces structured data and business activities generated by the semi-structured data fields are filled in all corners of the database. In the face of the above similar structure of the database characteristics, the design of suitable collection methods to achieve the unified collection of multi-source data, and to ensure that all types of data in the collection of not repeated and not lost. It is the difficult point of data collection research.

3.4.1 Data Situation

The selection of customer preference dimensions and metrics usually depends on the business model of the organisation and the type of product or service offered. Ensuring that sensitive information is not easily identifiable and accessible, while retaining the usability and analytical value of the data, is an important consideration when collecting and analysing customer preference data.

- a) Customer preference dimensions and indicators - According to Table 3.15, “Dimension” refers to the attributes of the data, is a certain characteristic of things or phenomena, such as gender, region, time, etc. are dimensions. “Indicator” is a unit or method used to measure the degree of development of things, it also has a common name in IT, that is, metrics. Examples include population, revenue, users, profitability, retention, reach, etc. Many organisations have their own system of KPI metrics, which are a few key indicators to measure how well the business is doing. Indicators need to be summed, averaged, and otherwise summarized, and there are certain prerequisites for summarisation, such as time, place, and scope, often referred to as the Caliber and scope of the statistic. Not every indicator can be used for every dimension. In most cases, it only makes sense to combine dimensions and indicators that belong to the same scope.

After consulting with three experts in the Medical Product Development Center, the following customer satisfaction preference dimensions and indicators were identified. Users can manage the user system by registering an account in the human resource management system, and then maintain personal information: gender, age, education, department, seniority, and other information. Users can help companies achieve standardisation and automation of process management through the business office system. Through the system's process settings can be set up for different types of processes such as business approval, task creation, reimbursement applications, etc. In a standard process template, employees in the daily office system will follow the prescribed process steps to implement the program; the user can be based on personal preferences and needs of the system theme, colour, and other personal settings, etc. The system can automatically identify the user's operation of the time, location, type and personal selection and other characteristics of the record, the above information will generate the operation log records, and save at least 6 months or more, to help software product managers to effectively analyse customer preference information to improve product service level.

Table 3.15 : Correspondence of Customer Data Characteristics, Meanings

No	Feature Name	Attribute Meaning	Indicator
1	ID	Unique user identification	
2	Address	Workplace	
3	Terminal	Terminal equipment	
4	Teamwork	Co-working	
5	Keyboard	Average number of shortcut keys per month	
6	Speech	Average number of voice actions per month	
7	Touch Screen	Average number of touch screen operations per month	
8	Task Failure	Monthly average number of task failures	≥15 exceptionally
9	Access	Monthly average total visits	<6 exceptionally
10	Stay	Monthly average page dwell time	≥20 exceptionally
11	Theme	Common themes	
12	Colour	Common theme colours:	
13	layout	Common layout	

Table 3.15 : Continued

14	Rate	Commonly used resolution	
15	Robot	Monthly average intelligent customer service usage	
16	Robot Times	Monthly average smart customer service response time	
17	Field Service	Monthly average live service frequency is	≥30 exceptionally
18	Field times	Monthly average response time for live customer service	
29	Remote Service	Monthly average remote customer service usage frequency is	≥30 exceptionally
20	Remote Times	Monthly average response time of remote customer service is	
21	Satisfaction	User satisfaction (Comprehensive assessment of satisfaction is based on a scale of 1-10, with scores based on dimensions such as product quality, usage experience, service experience, value for money and overall satisfaction)	

(Source by author)

- b) Data de-identification - Data desensitisation (data de-identification) is a privacy technique used to protect the privacy of individuals when sharing or distributing sensitive data (see Table 3.16). The goal of desensitisation is to remove or obscure personally identifiable information from data to prevent individuals from being identified. Data security and privacy protection measures in Enterprise (organisation) are very important because the system usually contains a large amount of sensitive information and company secrets. The following are the data desensitisation methods used in this paper:

Table 3.16 : Data Security Protection Desensitisation

Project	Description
Delete	Removes all personally identifiable information contained in the dataset, including names, addresses, phone numbers, e-mail addresses, etc. This is the most thorough method of desensitisation.
Substitution	Replace personally identifiable information with falsified information. For example, replacing a real name with a randomly generated name. This method preserves the structure of the data without revealing the identity of the individual.
Fuzzy	Modifying values in the data to reduce precision. For example, changing age from a precise value to an age range. This method preserves the utility of the data to some extent.
Hashing	Use hash functions to convert personal identifiers, such as IP addresses,

Table 3.16 : Continued

	into unique hash values. This method protects the data but allows for matching to verify the consistency of the data.
Sampling	Share only a portion of the data, not the entire dataset. Random and stratified sampling are common methods. This reduces risk but may reduce the representativeness of the dataset.
Data Aggregation	Aggregate data to higher levels to hide individual records. For example, aggregating daily complaint data into monthly complaint data. This helps protect individual privacy.
Differential Privacy Protection	This method protects individual privacy by comparing the differences between two or more datasets. Differential privacy protection techniques can be used to identify anomalies or sensitive patterns in data.
Restricted Access	Access to sensitive data is restricted so that only authorised personnel can access the raw data, while the data is monitored and audited.

(Source by author)

Table 3.16 summarises the data security protection desensitisation methods in this paper, including deletion, substitution, fuzzification, hashing, sampling, data aggregation, differential privacy protection and restricted access. These methods can be selected based on specific needs to ensure data security and privacy protection. Access to data must be done with care to ensure that the desensitised data remains sufficiently useful and accurate while protecting individual privacy. Data desensitisation is often an important part of privacy protection and compliance, especially where personally identifiable information is processed or regulated by laws and regulations.

3.4.2 Data Sampling Extraction

Stratified random sampling method is to first divide the total units into several types according to certain criteria, and then according to the ratio of the number of units of the type to the number of units of the total to determine the number of sample units from each type, and finally according to the principle of random sampling from each

type. Stratified random sampling is characterised by stratification and then random sampling in each stratum. The data used in this paper comes from a quarter of the proportional systematic sampling in three regions, which is 30 SMEs (the same as the questionnaire survey), in order to ensure the reliability of this analysis, we extracted a total of three (3) months of data from November 2022 to January 2023 in the system, In the case of ensuring that each customer in the three months of the existence of the record, a total of 300 randomly selected data that meet the criteria, in order to eliminate the chance of the data, we use the average of the three (3) months as our sample data.

Table 3.17 : Sample Source Data Stratification

Region	Num. of Enterprise	Data volume
(i) Service Area	10	110
(ii) Service Area	10	110
(iii) Service Area	10	110
Total	30	330

(Source by author)

In this Table 3.17, the source data is stratified according to service area, with each service area containing 10 businesses and 110 data points per business, for a total of 30 businesses and 330 data points.

3.4.3 Data Pre-Processing

Data pre-processing is the process of cleaning, transforming, and preparing raw data before it is analysed or modelled. This includes data normalisation, processing of missing values, outliers, duplicates, etc. to ensure data quality and reliability.

- a) Data standardisation
 - i) Considering this analysis, i.e., the need for intuitiveness, add or subtract data from the fields in the above table as follows.

- ii) Use the first 4 letters of the keywords of the feature name as the name of field.
- iii) The existence of independent unique value of the customer ID is long, not conducive to analysis, more Arabic numerals sorted from 0001.
- iv) Customer age to age group “18-25 years old, 26-35 years old, 36-45 years old, 46-55 years old, 56 years old or older” replaced by “1, 2, 3, 4”.
- v) Work experience is calculated by subtracting the entry time from the current time and is expressed in years.
- vi) Working hours are converted from specific values to time intervals: “A.M.: 01:00:00 - 04:59:59, A.M.: 05:00:00 - 07:59:59. Morning: 08:00:00 - 10:59:59, Noon: 11:00:00 - 12:59:59, and Afternoon: 13:00:00 - 16:59:59, Evening: 17:00:00 - 18:59:59, Night: 19:00:00 - 22:59:59”.
- vii) Replace “Quiet Mode, Large Font Mode, Game Mode, Office Mode” name with 1, 2, 3, 4. Common theme colours name: “Green, Red, Black and White, Blue, Gray” is replaced by 1, 2, 3, 4.
- viii) Common layout: “single-column layout, F-type layout, Z-type layout, split-screen layout, list” replaced by 1, 2, 3, 4.
- ix) Common resolution: “1024*768, 1280*72, 1366*768, 1920*1080, 2560*1440” is replaced by 1, 2, 3, 4.
- x) Monthly satisfaction scores are recorded according to indicator scores.

Comprehensive assessment of satisfaction is based on a scale of 1-10, with scores based on dimensions such as product quality, usage experience, service experience, value for money and overall satisfaction. After the above transformation, the field is extracted and deleted to obtain a new data table.

	Time	Address	Terminal	Access	Wayboard	Speech	Touch	Failure	Access	Stay	Theme	Colour	Layout	Rate	Robot	Not	Time	Service	Time	Remote	Time	Satisfaction
001	4	2	1	2	5	3	3	2	5	2	2	3	3	4	4	2	4	3	5	5	6	
002	3	2	2	1	2	1	5	2	1	4	4	2	2	5	4	3	2	5	3	2	4	
003	1	2	4	1	1	3	2	2	4	2	4	1	1	3	3	5	5	3	5	2	7	
004	4	3	3	1	4	3	2	2	3	4	3	4	5	5	5	1	2	2	5	3	7	
005	1	2	2	1	2	5	2	3	4	3	1	5	4	4	4	4	3	3	3	1	7	
006	2	3	4	1	2	3	4	5	1	3	1	4	4	4	3	2	2	3	3	1	7	
007	3	2	2	2	2	4	5	3	2	3	3	4	3	4	5	2	3	2	4	2	4	
008	1	5	3	1	5	1	5	2	1	2	1	2	4	5	3	3	4	5	5	4	3	
009	4	4	3	2	3	3	2	4	2	2	4	4	4	5	2	5	2	4	3	3	6	
010	1	5	2	1	4	3	3	2	5	4	1	3	4	5	3	4	2	3	3	4	7	
011	3	2	3	1	3	1	3	2	3	5	1	5	1	2	3	5	4	3	3	3	6	
012	4	1	1	1	3	3	4	1	2	3	3	4	4	3	3	4	4	2	2	1	7	
013	4	5	1	1	4	1	4	3	2	1	2	4	2	3	3	3	5	2	2	2	3	
014	4	4	3	1	2	3	5	2	4	5	3	1	3	5	2	3	5	2	2	1	5	
015	4	1	1	1	4	4	1	2	2	3	4	3	4	4	1	2	5	3	4	2	4	
016	1	5	1	1	3	5	4	2	2	5	4	4	4	4	3	2	4	3	2	3	7	
017	4	2	3	2	2	3	2	4	4	5	4	4	4	5	1	2	4	5	4	2	6	
018	1	5	1	2	5	4	3	3	4	2	1	3	4	5	2	2	4	3	2	3	6	
019	4	3	3	1	3	3	5	3	2	5	1	4	5	5	5	1	4	4	5	4	7	
020	4	4	1	2	2	2	3	3	5	2	2	2	1	3	1	3	1	2	3	5	7	
021	4	5	3	1	1	1	5	2	4	1	1	3	4	5	3	2	4	4	3	5	3	
022	4	1	1	1	2	3	2	2	2	3	3	5	2	4	4	3	4	5	5	2	4	

Figure 3.5 : Sample Results of User Data Standardisation
(Source by author)

Figure 3.5, after the above transformation rules, the fields are extracted and filtered, and the qualitative data (e.g., categories, options) are numerically transformed so that they are represented in numerical form, and finally 21 columns of data are obtained, which is very important for most machine learning algorithms, and can be used in a variety of machine learning and data analytics models, helping to improve the training efficiency and predictive performance of the models.

- b) **Abnormal Data Handling** - Because in the data acquisition equipment or sensor failure or damage, may lead to part of the data or completely missing; data storage and transmission process may be a problem, resulting in part of the data or all lost; data recording or input, sometimes accidentally omitted or ignored certain information. Use R's first to first use is.na to determine whether the missing value, the missing value is TRUE, not missing value is FALSE; then TRUE/FALSE converted to a numerical value, that is, TRUE -> 1; FALSE -> 0; and finally add up all the 1's and know how many missing values are in the data (Table 3.18).

Table 3.18 : The Source Data Processing Results

Amount of data	Raw data	Processed
Total	310	300

(Source by author)

3.4.4 Data Exploration

Table 3.19 : Simple Statistics for Each Feature

Characteristics	Minimum Value	Maximum Value	Average Value
Keyboard	1	25	11
Speech	3	30	13
Touch Screen	1	33	13
Task Failure	2	25	13
Access	1	26	11
Stay	1	29	12
Robot	3	32	16
Robot Times	2	37	15
Field Service	6	45	19
Field Times	7	48	16
Remote Service	7	49	17
Remote Times	2	39	16
Satisfaction	1	10	6

Table 3.19 reveals that users use the keyboard, voice, and touch screen more frequently, and these three interaction methods are widely popular. Task failures occurred with relatively high frequency, and further analysis and improvement of related functionality is required. Users accessed systems or functions with relatively even frequency but stayed for slightly different lengths of time. Robotics features are used and used relatively frequently and may be one of the preferred features for users. The demand and frequency of use of both on-site and remote services is high, and users are clearly dependent on the services. Overall satisfaction is at a moderate level, but there is room for improvement and further understanding of user needs and improvement of service quality is needed.

3.5 Conclusion

This chapter explains and demonstrates the research methodology by providing an overview of the three main stages of this study: the research strategy, research plan and data preparation. The research methodology includes literature review, questionnaire, source data collection and strategic analysis to increase the reliability and validity of the findings. For buyers, the questionnaire was divided into three parts, questionnaire design phase, pilot study and questionnaire implementation. Considering the advantages and disadvantages of both types of questions, the questionnaire was constructed using closed and open-ended questions. For open-ended questions, it gives the researcher an advantage because it can reveal unexpected findings and reveal the intuition of the respondents. For closed questions, it gives the respondents the advantage of answering the questions easily and quickly. It also gives the researcher the advantage of coding or statistically analysing the responses. The researcher included elements of both closed and open-ended question formats in this survey to help respondents answer the questions quickly and easily with maximum flexibility. Prior to distribution, the researchers conducted a pilot study with several iterations of testing with professional designers and micro-level business experts. Users were targeted through direct access to the source data, the reliability of the data extraction was addressed to ensure the degree of completeness, accuracy, and consistency of the data, and finally the raw data situation was understood through basic statistics. Prepare effectively for the data analysis and forecasting that follows.

CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1 Introduction

This chapter focuses on data analysis and results obtained from the empirical study of data description and prediction to realise RQ1 and RQ2: the important factors of product needs and preferences in the purchasing decision process; identifying the impact of product needs and preferences elements on Customer satisfaction. Specific detailed links include a) First empirical investigation of Buying participants, the purpose of this investigation is to understand the following i) the basic data situation of buying participants in the purchasing decision, ii) The data on target, technology, resource, and service demand factors and related elements that are of concern to buying participants in the purchasing process, iii) Buying participants' concerns about safety, design, brand, economic preference factors and related elements during the buying process, and iv) Buying participants' satisfaction with existing products, followed by b) Second empirical investigation customer, the purpose of this investigation is to understand, i) Customer's basic characteristics, ii) Customer's concern about the goal, technology, resources, service demand factors and related elements of the data situation; (inconsistent with the questionnaire), iii) Customer's concerns about work and operation habits, interface and service preference factors and related element data, and iv) Customer's satisfaction with existing products. While the c) The third empirical investigation the extent of product demands and preferences during the buying process influence satisfaction, i) To predict the influence of product demand and preference elements on product satisfaction and ii) Identify the situations where buyers and Customers have different importance on product satisfaction.

4.2 Reliability of the Research Questionnaire

Before data analysis, to ensure that the questionnaire can reliably reflect the real situation of the respondents, this study used Cronbach's alpha method to assess the measurement stability of the dimensions of Basic Information, Product Demand, and Product Preference in the questionnaire. Mainly in SPSS, select Analyse → Scale → Reliability Analysis. Analysis). Select all measured variables for each dimension and set "Alpha" as the reliability model. If Cronbach's Alpha shows a value of a between 0.65 and 0.95, the reliability of the instrument results will be valid.

Table 4.1 : Reliability of Research Instrument Statistic for Product Survey

	Buyer		Customer	
	Alpha	Items	Alpha	Items
Basic Information	0.881	5	0.913	5
Product Demand	0.912	13	0.897	13
Product Preference	0.882	20	0.894	
Total	0.867	41	0.839	18

Table 4.1 shows the reliability of the research instrument statistics from the survey. The results show that as can be seen from the table, both buyers and customers have high reliability values in different dimensions, indicating good internal consistency of the questionnaire measurements. In the Basic Information dimension, both buyers (0.881) and customers (0.913) have high values, indicating that the measurements of the basic information questions are stable. In the Product Demand dimension, the alpha values of both groups are 0.912 and 0.897 respectively, indicating good consistency of the measurements of the product demand section. In the Product Preference dimension, buyers (0.882) and customers (0.894) have similar values, indicating that the preference measure is stable. Total: buyers (0.867, 41 questions)

and customers (0.839, 18 questions) Taken together, the Cronbach's alpha values of this questionnaire are above 0.8, indicating that the questionnaire's measurements are stable and reliable, and can be used for analysis in subsequent research.

4.3 Buying Participants and Customer Basic Information

Satisfaction in customers' purchasing decisions is influenced by basic and positional information, including gender, age, educational background, positional distribution, and work experience, and these elements directly affect customers' perceived needs, purchasing behaviour, and loyalty. The detailed performance is analysed below.

4.3.1 Basic Information

Table 4.2 : Number and Proportion of Gender

Gender	Buying participants		Customer	
	frequency	%	frequency	%
Male	162	54	143	47.67
Female	138	46	157	52.33

Table 4.2 shows, in terms of overall gender distribution, the proportion of male and female respondents is not significantly different, which may indicate that the sample is relatively gender balanced and helps to provide a more comprehensive picture of the views, attitudes, or behaviours of the group. The balanced sex ratio provides a good basis for the research, allowing the research to reflect the real situation of the group more fully, helping to form more representative conclusions. By ensuring that the proportion of male and female respondents is relatively balanced, researchers can explore the differences and commonalities between the sexes in depth, and thus more fully understand the characteristics and needs of the target group.

Table 4.3 : Age Distribution of Respondents

Age	Buying participants		Customer	
	frequency	%	frequency	%
18-25years old	24	8	27	9
26-35years old	66	22	86	28.67
36-45years old	125	41.67	95	31.67
46-55years old	44	14.67	63	21
Over 56 years old	41	13.67	29	9.67

Table 4.3 shows the age distribution of respondents. Among purchasing participants, the 36-45 years old group has the highest percentage, suggesting that this age group is more active in purchasing participation activities. This may be related to the fact that people in this age group have more management skills and buying needs. Among customers, the 26-35- and 36-45-years old groups have relatively higher percentages, suggesting that people in these two age groups are more likely to be loyal customers. This may be related to the fact that people in these two age groups have more stable needs and loyalty in terms of habits or services.

Among the buyers, there is a higher percentage of the 56+ years old groups, while the percentage of this group among the customers is relatively low. This may indicate that the older age group is more likely to try new products or services but may not have the same long-term loyalty after purchase as the middle age group. The proportion of customers in the 18-25- and 26-35-years old groups is gradually increasing, suggesting that there are potential opportunities for young people to become new customers. Therefore, it may be necessary to pay more attention to the preferences and needs of young people in marketing and product design.

Table 4.4 : Educational Background Distribution of Respondents

Degree	Buying participants		Customer	
	frequency	%	frequency	%
Junior high School and Below	26	8.67	31	10.33
High & Technical Secondary School	82	27.33	49	16.33
College Specialty	89	29.67	106	35.33
University Courses	66	22	74	24.67
Graduate student or above	37	12.33	40	13.33

Table 4.4 shows the educational background distribution of respondents. Education level and purchase tendency: The relatively low percentage of groups with lower education level (junior high school and below) among Buying participants and the relatively high percentage among Customers may indicate that this group is more easily attracted by products or services and susceptible to the influence of other factors. Service demand of highly educated groups: The relatively high proportion of groups with high school or middle school education among buying participants and the relatively low proportion among customers may mean that this group has a greater demand for products or services during the buying process, but there may be some challenges at the customer application stage. College and bachelor's degree groups: college and bachelor's degree groups have a large share in both Purchase and Customer and may be the main audience for the product or service, so the key to marketing and service strategies for these two groups. Relatively low participation of the highly educated group: The relatively low share of the group with postgraduate education or above in both purchase and customer may be because there are fewer highly educated people, or they are more cautious in the purchasing process.

4.3.2 Job Information

Table 4.5 : Position Distribution of Respondents

Position	Buying participants		Customer	
	frequency	%	frequency	%
Management	44	14.67	56	18.67
Technical	160	53.33	115	38.33
Functional	39	13	101	33.67
Operations	52	17.33	26	8.67
Other	5	1.67	2	0.67

In the enterprise job information is generally divided into management class mainly involved in corporate strategy and decision-making; technology class mainly focuses on technological innovation and research and development. The service category refers to the provision of customer support and services. The operation category refers to the management of the daily operation of the enterprise and processes and other (Anglin et al., 2022).

Table 4.5 shows the position distribution of respondents. The distribution of job categories for buying participants and customers shows some significant differences. The management category is higher among customers 53.33 percent, indicating that management is more important in the buying decision and customer relationship. The technical category dominates among buying participants but is lower among customers. It may indicate that technical specialisation is higher in the buying process, while management and other functional categories are more in demand in the Service phase. The service category is more dominant among customers, while the operations category is more dominant among Buying participants, implying that customers value support and relationships more in terms of service. The higher percentage of

operations categories among buying participants and the lower percentage among customers may reflect a greater need for operations in the buying process.

Table 4.6 : Work Experience Distribution of Respondents

Work Experience	Buying participants		Customer	
	frequency	%	frequency	%
Less than 1 year	10	3.33	13	4.33
1-3 years	42	14	79	26.33
3-5 years	83	27.67	103	34.33
5-10 years	121	40.33	83	27.67
More than 10 years	44	14.67	22	7.33

Depending on the length of service, it is possible to show the experience and development of the person in the position. Less than 1 year generally refers to the initial stage, less experience or the project has just started; 1-3 years when you start to accumulate experience, into a stable development period; 3-5 years gradually mature, know the project or enterprise in the optimization and adjustment. 5-10 years will enter a steady development, in the industry with strong competitiveness. More than 10 years the idea is more mature, has rich experience and market base, usually in the industry leading position (Coronado, 2022).

Table 4.6 shows the work experience distribution of respondents. The distribution of the work experience of the buying participants shows that most of the participants are relatively experienced, especially in the segments of 5-10 years and more than 10 years of work experience, with 40.3 percent and 14.7 percent, respectively. This may indicate that a certain percentage of respondents are senior practitioners. From the distribution of clients' work experience, the highest proportion of employees with work experience between 3-5 years is 34.33 percent. This indicates that they have

gained some experience in the workplace and are actively expressing their needs and preferences.

Integrating the data analysis of subsections 4.3.1 and 4.3.2, this result states that customer satisfaction is affected by basic information and position information in purchase decision, including gender, age, educational background, position distribution and work experience. Among them, gender difference affects preference and market match, age determines purchase activity and loyalty, educational background affects product acceptance, position distribution determines purchase role and decision weight, and work experience affects demand maturity and rationality of purchase decision. Therefore, enterprises should optimize product features, marketing strategies and service experience for different customer characteristics to improve overall satisfaction and enhance market competitiveness.

4.4 Buying Participants and Customer Product Demand Analysis

Satisfaction in customer purchase decision is influenced by several demand factors including user goals, technology needs, product resources and purchase impact especially goals, technology and so on. And with these factors, elements such as product quality, price, service and brand image play a key role. These elements affect customer loyalty, repeat purchase rate, and word-of-mouth communication effects by influencing the perceived value of customers, the gap between expectations and actual experience, and ultimately the overall satisfaction of customers. The detailed performance is analysed below.

4.4.1 User Goal

Table 4.7 : The Core User Group of the Product

Core User Group	Buying participants		Customer	
	frequency	%	frequency	%
Grassroots workers	147	49	69	23
Employee managers	92	30.67	132	44
Senior leadership	61	20.33	99	33

Table 4.7 shows the core user group of the product. From the buying participants' point of view, the core user group of the product is grassroots workers, with a percentage of 49.0 percent, which suggests that most of the buyers believe that satisfying grassroots workers have the greatest impact. From the perspective of customers, the proportion of employee managers reaches 44.0 percent, which may indicate that customers are more inclined to services with certain management aspects. This may imply that employee managers are an important group in the process of interacting with customers, and that appropriate service and communication strategies need to be formulated to meet their needs.

Table 4.8 : Application Target

Target	Buying participants		Customer	
	frequency	%	frequency	%
Effective daily work	67	22.33	91	30.33
Meet the policy assessment	54	18	58	19.33
Enterprise strategic planning	83	27.67	57	19
Achieve industry competition	96	32	94	31.33

Table 4.8 shows the application target. From the buying participants' application goals, it was found that most of the participants focused on achieving outstanding performance and achieving industry competition in their application goals with 32.0

percent and 27.7 percent, respectively. This suggests that performance-oriented goals are more prominent and may emphasise the importance of achieving excellence at work for an individual or a team. Looking at customer application goals, there is a greater focus on efficient everyday work and achieving industry competitiveness.

Table 4.9 : Type of Product Need

Type	Buying participants		Customer	
	frequency	%	frequency	%
Functional	49	16.33	30	10
Operational	45	15	85	28.33
Data Oriented	84	28	48	16
Social	54	18	52	17.33
Safe	68	22.67	85	28.33

Table 4.9 shows the type of product need. The distribution of product types among buying participants and customers is highest for social and security, with 25.66 percent and 27.21 percent respectively, indicating that demand for social products is also relatively high among actual Customers. functional, operational, data and security products have a certain percentage of buying participants and customers. This may reflect differences in demand for product types among different users and the need to balance multiple functions in product development and services.

4.4.2 Technology Demand

Table 4.10 : Most Effective Safety Measures

Safety measures	Buying participants		Customer	
	frequency	%	frequency	%
Role permission control	61	20.33	84	28
Data security encryption	62	20.67	123	41
Abnormal behavior warning	99	33	26	8.67
Business process control	78	26	67	22.33

Table 4.10 shows the most effective safety measures. among buying participants, abnormal behaviour warning has the highest percentage of 33.00 percent. this may indicate that buying participants are more concerned about anomaly prevention when considering products. among customer group, data security encryption has the highest percentage of 41.00 percent. this may indicate that in actual customers, there is a relatively high level of concern about data security.

Table 4.11 : The Product Must Have Capabilities

Capabilities	Buying participants		Customer	
	frequency	%	frequency	%
Application of intelligent technology	66	22	88	29.33
Localization adaptation	96	32	66	22
Stable software architecture	56	18.67	91	30.33
Complex business support	82	27.33	55	18.33

Table 4.11 shows the product must have capabilities. Among buying participants, the proportion of localised adaptation was the highest, reaching 32.00 percent. This may indicate that Buying participants pay more attention to the adaptability and localisation characteristics of products in the domestic market, followed by the support of complex business processes and the importance of on-time business. Among the customer

group, 30.33 percent of them think that the stability of basic software architecture is more important, followed by the application of intelligent technology, which indicates that users have diverse requirements for product capabilities and need to consider different technical and application requirements in product design and service provision.

Table 4.12 : The Product Needs to Support the Environment

Environments	Buying participants		Customer	
	frequency	%	frequency	%
On-premise	26	8.67	79	26.33
Deploy in the cloud	19	6.33	53	17.67
Private network deployment	188	62.6	61	20.33
Internet Deployment	67	22.3	107	35.67

Table 4.12 shows the product needs to support the environment. Among buying participants, private network deployment has the highest percentage at 62.6 percent. This means that Buying participants tend to focus more on product requirements in private network environments, probably due to the need for more customised and private solutions. Among the customer group, Internet deployment has the highest percentage at 35.67 percent, which may indicate that among actual customers, more attention is placed on products that support cloud and Internet environments.

4.4.3 Product Resource

Table 4.13 : Important Product Resource

Resources	Buying participants		Customer	
	frequency	%	frequency	%
Hardware Resources	45	15	74	24.67
Human Resources	16	5.33	44	14.67
Technical Resources	123	41	117	39
Financial Resources	110	36.67	50	16.67
Market Resources	6	2	15	5

Table 4.13 shows the important of product resource. The proportion of technical resources in buying participants and customer groups is relatively high, which is 41.00 percent and 39.00 percent, respectively. This suggests that technical resource considerations for a product are critical in both the purchase and actual use phases. In the customer group, the proportion of hardware resources is significantly higher than that of buying participants, probably because in actual use, the demand for hardware resources is more important. On the contrary, the relatively high proportion of financial resources in Buying participants may reflect the consideration of funds in the purchase decision stage. The proportion of human resources and market resources in Buying participants and customers is relatively low. This may indicate that users pay more attention to resources for technical support and financial aspects during product selection and use.

Table 4.14 : Important When Product Resources Are Limited

Resources guarantee	Buying participants		Customer	
	frequency	%	frequency	%
Sound business logic	67	22.33	70	23.33
Complete effective functions	81	27	87	29
Control financial costs	103	34.33	71	23.67
Deliver tasks on time	49	16.33	72	24

Table 4.14 shows the important when product resources are limited. In both groups of buying participants and customer, a certain percentage are concerned with preserving sound business logic. This may indicate that users pay attention to the rationality and consistency of business logic in the process of product design and use. At the same time, a certain percentage of people are focused on ensuring that useful features are completed, and tasks are delivered on time. This indicates the importance of user concerns regarding the effectiveness and on-time delivery of product features in both product development and practical use. A relatively high proportion of buying participants focused on controlling financial costs. This may be because financial cost is a more sensitive consideration in the purchase decision stage.

Table 4.15 : The Most Effective Source of Demand

Demand	Buying participants		Customer	
	frequency	%	frequency	%
User requirements	65	21.67	73	24.33
Adjustment of policy	25	8.33	63	21
Expert feedback	64	21.33	53	17.67
Market Analysis	81	27	79	26.33
Competitor analysis	65	21.67	32	10.67

Table 4.15 shows the most effective source of demand. The proportions of user requirements and market analysis in buying participants and customer groups are relatively high, which are 22.7 percent and 23.61 percent, respectively. This indicates that the actual needs of users and data analysis are important reference sources in product requirements and optimisation. Among buying participants, competitive product analysis accounted for a relatively high proportion of 21.67 percent. This may be because the analysis of competing products has a greater impact on determining product advantages and differentiation in the purchase decision stage. The expert feedback distribution is relatively uniform, accounting for 21.33 percent and 17.67 percent in the two categories, respectively. It is shown that expert opinion has some importance in both contexts. Policy adjustment, accounting for 8.33 percent among buying participants and 21.00 percent among customers. Although the frequency is lower, the effect is more significant in the customer category.

4.4.4 Purchase Impact

Table 4.16 : The Most Influence Group on the Purchase Decision

Group Influence	Buying participants		Customer	
	frequency	%	frequency	%
Grassroots workers	120	40	114	38
Employee managers	113	37.67	57	19
Senior leadership	67	22.33	129	43

Table 4.16 shows the most influence group on the purchase decision. Grassroots workers accounted for the largest proportion of the total purchase decision influence body, which were 40.00 percent and 38.00 percent, respectively. In the two categories of buying participants and customer, grassroots workers have a significant impact on

purchasing decisions, probably because they are more aware of the actual needs and operational details. Employee managers accounted for a large proportion of buying participants 37.67 percent, but the influence of customer dropped to 19.00 percent. This may mean that the role of employee managers is relatively small in larger scale decision making, while they are more important in decision analysis. Among buying participants, senior leaders accounted for 22.33 percent, while among customers 43.00 percent. Customer senior leaders play a more important role in purchasing decisions, probably because they pay more attention to the overall strategy and corporate goals.

Table 4.17 : The Greatest Impact Products Services on Purchase

Services	Buying participants		Customer	
	frequency	%	frequency	%
Product features	13	4.33	61	20.33
Product availability	83	27.67	60	20
Product reliability	57	19	50	16.67
Product performance	72	24	58	19.33
Added value of the product	75	25	71	23.67

Table 4.17 shows the greatest impact products services on purchase. It accounts for 27.67 percent of buying participants and 20.00 percent of customer. Product usability is relatively more important in the buying participants category, probably because purchase decision participants pay more attention to the actual operation and use of the product. Product performance accounts for 24.00 percent in the buying participants category, which is relatively more important, probably because purchase decision participants pay more attention to technical indicators of products. The value added is 25.00 percent for Buying participants and 23.67 percent for customer. The effects are relatively balanced, and the differences are small.

Table 4.18 : Acceptable Purchase Price

Price	Buying participants		Customer	
	frequency	%	frequency	%
Less than 100,000	45	15	56	18.67
110,000-300,000	89	29.67	61	20.33
310,000-500,000	84	28	111	37
510,000-1,000,000	52	17.33	35	11.67
More than 1,000,000	30	10	37	12.33

Table 4.18 shows the acceptable purchase price. Most purchase decision participants and end-users chose to purchase products in the 11-30w price range. In the customer category, more people chose products in the higher price range of 31-50w. Higher price ranges of 51w and above accounted for a smaller proportion of purchasing decisions, possibly because these products have a more limited audience. The high price range 31-50w accounts for a larger share of the customer category, possibly because end-users are more trusting of the services of higher priced products.

Table 4.19 : Acceptable Business Size

Size	Buying participants		Customer	
	frequency	%	frequency	%
10-50 people	40	13.33	43	14.33
51-100	53	17.67	56	18.67
101-200	68	22.67	103	34.33
201-300	106	35.33	38	12.67
More than 301 people	33	11	60	20

Table 4.19 shows the acceptable business size. With 101-200 people accounting for 22.67 percent of buying participants and 34.33 percent of customers, this size of business is more popular in the customer category. 201-300 people, with 35.33 percent

of buying participants and 12.67 percent of customers, is more important for this size of business in the buying participants category. This size of business is more important in the buying participants category.

Summarising the analysis of sub-data in chapters 4.4.1 to 4.4.4, this paper finds that customer satisfaction is influenced by the factors of need differences, technology need differences, and resource constraints in the purchase decision. Differences in user goals affect the degree of demand matching, differences in technology needs lead to different expectations of product features, and resource constraints determine the prioritisation and feasibility of decisions. Together, these factors determine preferences and final choices in purchase decisions.

4.5 Buying Participants Product Preference Analysis

In the process of product selection, purchase participants show different preferences for various aspects of the product, which are mainly reflected in the influence of preference factors such as security, functionality, design, brand, economy and service. For example, when choosing a product, purchase participants tend to pay attention to whether the product complies with national or industry standards, the level of information security, the ease of use and visualisation of the product design, the brand's popularity and credibility, the price budget, the mode of payment, and the responsiveness and quality of after-sales service. Each factor influences the purchasing decision to a different degree according to the participants' preferences, reflecting the purchasing participant's overall consideration of the product. The detailed performance is analysed below.

4.5.1 Security Aspect

Table 4.20 : Product Business Standards to be Met

Normalisation	Buying participants	
	frequency	%
Enterprise-grade standards	35	11.67
Group standards	27	9
Provincial standards	79	26.33
National standards	92	30.67
International standards	67	22.33

Table 4.20 shows the product business standards to be met. Among the buying participants, the requirement for product business specifications is dominated by the national standard 30.67 percent followed by the provincial standard 26.33 percent, which may indicate that the buying participants are more inclined to choose products that comply with the national standard and have higher requirements for product specifications.

Table 4.21 : Minimum Information Security Level

Security	Buying participants	
	frequency	%
Level 1	15	5
Level 2	102	34
Level 3	129	43
Level 4	34	11.33
Level 5	20	6.67

Table 4.21 shows the minimum information security level. In terms of information security level, buying participants are more inclined to choose Level 2 and Level 3 products, with Level 3 accounting for the highest percentage. This indicates that

buying participants have certain requirements for the information security of products and may need to emphasise on the information security features of products.

Table 4.22 : The Importance of Violation Warnings and Blocking Prompts

Alert	Very unimportant (%)	Less important (%)	Moderately important (%)	More important (%)	Very important (%)
Violation alarm blocking prompt	13	8.33	17	35.67	26

Table 4.22 shows the importance of violation warnings and blocking prompts. Buying participants' overall concern for violation alarm blocking prompt is high, with more than half of the participants considering this feature to be more important or very Important. Most notably 35.67 percent of buying participants considered this feature more important. This may reflect buying participants' higher concern for security and breach prevention. A few buying participants (13 and 8.33%) considered breach alerts and blocking prompts to be very unimportant or less important to them. This may be because some buying participants have a lower need for specific security features.

4.5.2 Functional Aspect

Table 4.23 : The Scalability of the Product

Scalability	Very unimportant (%)	Less important (%)	Moderately important (%)	More important (%)	Very important (%)
Integrated	8.33	11.67	21.67	30	28.33
Customization	8.33	13	19.33	30.67	28.67
Compatibility	8	9.67	16.33	39.67	26.33
Updated	9	29.33	31.33	12.67	17.67

Table 4.23 shows the scalability of the product. A relatively high percentage of buying participants consider the integrated, customisation, and compatibility of products to

be more important or very Important, which may reflect the high demand for flexibility and adaptability of products by buying participants. Product compatibility is also valued by Buying participants, with 60.0 percent of Buying participants rating it as more important or very Important, which may indicate that buying participants consider the compatibility of the product with other systems when choosing a product. Buying participants' expectation of the frequency of product updates is average, which may reflect the need for stable and secure product development.

4.5.3 Design Aspect

Table 4.24 : The Importance of Product Design

Design	Very unimportant (%)	Less important (%)	Moderately important (%)	More important (%)	Very important (%)
Visual	8.67	11.67	17.67	27.33	34.67
Usability	6.33	5.33	12.33	34.67	41.33
Personalised	7.67	38.67	18.33	17.33	18

Table 4.24 shows the importance of product design. The visual design of the product is considered more important or very important by 62.0 percent of buying participants, which indicates that buying participants have higher expectations for product appearance and interface design. Product ease-of-use design has a higher level of concern among buying participants, with 76.0 percent of them considering it more important or very Important, which may reflect the fact that buying participants focus on the user-friendliness and ease-of-use of products when choosing products. There are 38.7 percent of people think that the personalised design of the product is Less important, which may indicate that the Buying participants expect the product to meet the personalised needs but prefer to meet the business scenarios.

4.5.4 Brand Aspect

Table 4.25 : Product Brand Related Importance

Brand	Very unimportant (%)	Less important (%)	Moderately important (%)	More important (%)	Very important (%)
Brand impact	5.67	2.33	17.67	34.33	40
Brand concept	4.67	21.0	37	22.67	14.67
Experts recognition	5.67	2.67	18.67	35	38

Table 4.25 shows the product brand related importance. Among the buying participants, 74.33 percent of them think that the brand influence is more important or very important, which indicates that the brand has a greater influence on the buying participants, and the brand plays an important role in the purchasing decision. Brand philosophy has a higher level of concern among buying participants, with 37.3 percent of them considering it more important or very important, which may indicate that buying participants consider the core values and philosophy of a brand when choosing a product. Expert recognition also received high attention among buying participants, with 73.0 percent of buying participants considering more important or very important, which may indicate that buying participants have certain expectations for professional recognition and evaluation.

4.5.5 Economic Aspect

Table 4.26 : The Importance of Budget to Purchase

Project	Very unimportant (%)	Less important (%)	Moderately important (%)	More important (%)	Very important (%)
Budget	7	2.33	10	45.33	35.33

Table 4.26 shows the importance of budget to purchase. Among the buying participants, 80.7 percent of them think that budget is more important or very important in purchasing products, which indicates that buying participants pay more attention to the budget factor in making purchasing decisions. The most significant is that 45.3 percent of the buying participants think that budget is more important in purchasing products, which may reflect the actual limitations and considerations of budget in the process of purchasing.

Table 4.27 : Best Methods of Payment

Payment	Buying participants	
	frequency	%
Lump sum payment	58	19.33
Payment by installments	112	37.33
Pay on demand	80	26.67
Try it for free	48	16
Others	2	0.67

Table 4.27 shows the best methods of payment. Among buying participants, 37.3 percent considered instalment payment as the best method of payment, which shows the prevalence of instalment payment as a prevalent choice in shopping decisions. This may reflect the fact that buying participants prefer to spread the cost of purchase through instalments.

Table 4.28 : The Best Service Life of the Product

Cycle	Buying participants	
	frequency	%
Less than 1 year	28	9.33
1 to 3 years	97	32.33
4 to 5 years	105	35
6 to 8 years	36	12
More than 9 years	34	11.33

Table 4.28 shows, buying participants chose 4-5 years as the optimal usage period, which shows that a portion of the buying participants have some expectations for the long-term stable usage of the product. In addition, 32.3 percent of the buying participants chose 1-3 years, which also reflects the demand for product performance and functionality in the short to medium term. Table 4.27 above shows the best service life of the product.

4.5.6 Service Preference

Table 4.29 : Importance of Product-Related Services

Services	Very unimportant (%)	Less important (%)	Moderately important (%)	More important (%)	Very important (%)
Feedback	9	9.67	16.67	29.33	35.33
Delivery	8.67	13	15.33	28.33	34.67
Intelligent	13	20.67	25.33	24	17
Remote	14.33	21.67	30.33	14.33	19.33
On-site	8.67	14	17.67	26.33	33.33
After-sales	11.67	11.67	16.33	32.33	18

Table 4.29 shows the importance of product-related services. Most users have high expectations for speed of feedback, speed of delivery, and on-site customer service, and consider these service factors to be very important in purchasing decisions. Smart

customer service and remote customer service are considered relatively secondary in purchasing decisions, especially smart customer service. The timeliness of after-sales service was relatively low in importance in purchasing decisions, but still a subset of participants considered it an important factor in purchasing decisions.

Integrating the data analysed from 4.5.1 to 4.5.6, this paper finds that participants with higher security requirements usually have higher trust in the product, further increasing purchase satisfaction. Functionality and design requirements make participants prefer products that are flexible, adaptable and easy to use, and fulfilling these requirements can significantly increase buyer satisfaction. Brand influence is directly related to participants' identification with and loyalty to the product, and meeting brand expectations will enhance purchase decision satisfaction. In terms of affordability, budget constraints force purchasers to pay more attention to value for money, and a reasonable price range improves purchasers' sense of cost-effectiveness. Service quality, especially timely customer feedback and delivery speed, directly affects the buying experience, and improving service quality can significantly increase customer satisfaction and the likelihood of repeat purchases.

4.6 Customer Product Preference Analysis

Customers' product preferences are influenced by four aspects: work habits, operating habits, interface preferences and service needs. Work habit involves customers' working time, scene, terminal equipment selection and team collaboration needs; operation habit covers the frequency of using shortcut keys, voice commands, touch screen operation, etc., as well as the frequency of platform access and residence time; interface preference involves design preferences such as theme colour, font size,

layout and display resolution; service demand includes the frequency of using different types of services and expectations of customer service response time. Service demand includes the frequency of using different types of services and the expectation of customer service response time. The detailed performance is analysed below.

4.6.1 Work Habits

Table 4.30 : Concentrated Working Time

Work Time	Customer	
	frequency	%
05:00:00-07:59:59	81	27
11:00:00-12:59:59	54	18
13:00:00-16:59:59	40	13.33
17: 00:00-18:59:59	59	19.67
19:00:00-22:59:59	66	22

Table 4.31 : Main Occasions to Use the Software

Address	Customer	
	frequency	%
Home	44	14.67
Office	92	30.67
School	58	19.33
In public	66	22
On business	40	13.33

Table 4.32 : Common Working Terminal

Terminal	Customer	
	frequency	%
Computer	122	40.67
Pad	63	21
Phone	87	29
Wearable devices	28	9.33

Table 4.33 : Whether Collaboration Is Required in the Office

Teamwork	Customer	
	frequency	%
Yes	219	73
No	81	27

Most of the customers work in the morning, especially in the period of 05:00:00-07:59:59. Offices and public places are the main working scenarios and computers are the main end devices. Clients mostly expressed the need for teamwork, emphasising the importance of collaboration tools. Revealing customers' work hours, scenario preferences, and device choices underscores the need for team collaboration.

Companies can adjust their product strategies to better meet customer needs based on this information.

4.6.2 Operating Habit

Table 4.34 : Operating Habits at Work

Project	1-5 times (%)	6-10 times (%)	11-15 times (%)	16-20 times (%)	More than 20 (%)
Keyboard	28	51.67	10	6.33	4
Speech	13.33	11.67	39.67	18	17.33
Touch	12	19	24	29	16
Failure	15	31.67	32.33	8.33	12.67
Access	9.67	30.33	25.33	21.33	13.33
Stay	7.33	30.67	28	19.33	14.67

Table 4.34 shows the operating habits at work. Users are motivated to use computer shortcuts and voice operations and are more cautious in the use of touch-screen operations. The number of tasks in the user is relatively low, indicating that the system or application is more stable. The total number of visits and the length of the page indicates that the user has an average usage of frequency and depth of the system. Computer keyboard most users use computer shortcut key 6-10 times a month, indicating that the customer shortcut key is not high dependent. Speech commands use the most frequently in 11-15 categories of 39.67 percent, and the use of the distribution in other categories is relatively uniform. Indicates that the customer is improving the way the voice command interaction experience, because it is a popular interaction. A considerable number of users have a 16-20 use in the touchscreen operation, indicating that the user has an obvious preference on the touch screen. As for the average number of task failures per month, it is mainly concentrated in 6-15, and it is necessary to pay attention to prevention and investigation of failure causes to avoid affecting customer

satisfaction). Most users visit the platform 6-10 times a month, and it is recommended to maintain efforts to attract users, especially those who visit less, to increase overall user retention. The user's time on the page presents a variety of patterns, the most common range is 6-10 times accounting for 30.67 percent. Quite a few users spend a long time on the page (20 or more times), investigating content or features that attract users to stay for a long time, and considering promoting them.

4.6.3 Interface Preference

Table 4.35 : Theme Preference

Theme	Customer	
	frequency	%
Quiet mode	68	22.67
Large character mode	91	30.33
Leisure mode	59	19.67
Office mode	82	27.33

Table 4.36 : Colour Preference

Colour	Customer	
	frequency	%
Green	57	19
Red	38	12.67
Black and white	72	24
Blue	101	33.67
Gray	32	10.67

Table 4.37 : Layout Preference

Layout	Customer	
	frequency	%
Single column layout	49	16.33
F layout,	40	13.33
Z layout	55	18.33
Split screen layout	117	39
Lists	39	13

Table 4.38 : Rate Preference

Rate	Customer	
	frequency	%
1024*768	28	9.33
1280*720	31	10.33
1366*768	60	20
1920*1080	96	32
2560*1440	85	28.33

In Table 4.35 (Theme preference) shows, the popularity of large-print and office modes may mean that users have a higher demand for larger, clearer text and interfaces that focus on office tasks. In Table 4.36 (Theme preference) shows, users preferred blue coloured interfaces, which may be related to their perception or emotions. Also, black, and white colours are popular choices, which may indicate that users prefer

simple, clear designs. In Table 4.37 (Layout preference) shows, users preferred split screen layouts, possibly because they offer more information display and ease of multitasking. z-layouts were also relatively popular, possibly due to their smooth flow of information. In Table 4.38 shows, users preferred higher resolutions, such as 1920 * 1080 and 2560 * 1440, which may indicate that users place more importance on clarity and display effects.

4.6.4 Assist Service

Table 4.39 : Service Frequency Preference

Project	1-5 times (%)	6-10 times (%)	11-20 times (%)	21-30 times (%)	More than 30 (%)
Robot frequency	12	14.33	41.33	16.67	15.67
Field frequency	6.33	8	34	36.67	15
Remote frequency	7.33	22	33	14.67	23

Table 4.40 : Customer Service Response Time

Project	1-5s (%)	6-10s (%)	11-20s (%)	21-30s (%)	30s More than (%)
Robot Time	16	28.67	22.33	16.33	16.67
Field Time	7.33	22	39	15.33	16.33
Remote Time	17.67	22.33	21.67	27.67	10.67

Table 4.39 (Service Frequency Preferences) shows the distribution of different types of services (robotic services, on-site services, and remote services) in different frequency ranges. The use of robotic services is mainly concentrated between 11-20 times (41.33%), while the use of on-site services ranges between 11-20 times (41.0%) and 21-30 times (36.67%), and remote services are more dispersed, but are used more in the two intervals of 11-20 times (33.0%) and more than 30 times (23.0%). This

suggests that robo-services are suitable for medium-frequency users, while on-site services mainly support high-frequency users, and remote services are more favoured among high-frequency user groups.

Table 4.40 (Customer Service Response Time) reflects the distribution of response speed of different service modes. The main response time of intelligent customer service is concentrated in 6-10s (28.67%) and 11-20s (22.33%), but there are some cases of more than 30s (16.67%), which indicates that its response time is faster overall but occasionally delayed. On-site services have longer response times due to physical constraints, with 11-20s (39%) and 6-10s (22%) being the main distribution zones, while 1-5s (7.33%) accounts for a lower percentage. The response time of remote services is more balanced, with 1-5s (17.67%) and 6-10s (22.33%) reflecting a certain degree of rapid response capability, but 21-30s (27.67%) also accounts for a higher proportion, indicating that there are still delays in some cases. Overall, remote service is more balanced in terms of response speed and frequency applicability, intelligent customer service is suitable for short response time requirements, while on-site service is suitable for situations requiring more in-depth processing.

Summarising the analysis from 4.6.1 to 4.6.5, factors such as work habits, operating habits, interface preferences, ancillary services, and customer service response time play a key role in influencing satisfaction in the customer's purchase decision. Customers' work hours and workplace preferences, as well as teamwork needs, directly influence their expectations of product suitability and productivity, which in turn influence purchase decisions. Customers' preferences for operating styles reflect their need for ease of use and efficiency, and the extent to which this need is met

determines their satisfaction. Customers' preferences for product appearance, colour, and layout indicate the importance they place on visual appeal and operational comfort. Satisfying these preferences helps to increase the customer's attraction to the product, which in turn influences the purchasing decision. Customers' needs for frequency and type of service, as well as their requirements for customer service response time, reflect their expectations for after-sales support. The speed and quality of response to different services directly affects overall customer satisfaction.

4.6.5 Buying Participants and Customer Product Satisfaction

The overall satisfaction score reflects the results of a comprehensive evaluation of the product by purchasing participants and customers. This score reflects the overall impact of their preferences in the selection process, as well as the overall performance of the product in meeting the user's needs and expectations. Higher satisfaction scores usually indicate that the product is effective in meeting the user's needs in each of these areas, while the opposite may indicate that some aspects of the product fail to meet the user's expectations, affecting overall satisfaction. Thus, overall satisfaction scores are an important indicator of how well the various features of a product combine to influence the final purchase decision.

Table 4.41 : Satisfaction Scores of Customers on Purchased Products

Satisfaction (Score)	Buying participants		Customer	
	frequency	%	frequency	%
1	1	0.33%	2	0.67%
2	10	3.33%	2	0.67%
3	9	3.00%	6	2.00%
4	16	5.33%	11	3.67%
5	24	8.00%	33	11.00%
6	39	13.00%	48	16.00%
7	62	20.67%	57	19.00%
8	62	20.67%	65	21.67%
9	49	16.33%	45	15.00%
10	28	9.33%	31	10.33%
Average	7.06		7.62	

This study is based on Eubanks' (2022) 10-point scoring and evaluation method for satisfaction evaluation, in which more than 6 points is considered as passing grade, and more than 7 months represents satisfaction. Table 4.41 shows Because the data of the companies selected in this paper comes from the actual data of customers who have already purchased the products of HMC Enterprises, the satisfaction scoring represents the satisfaction situation of the customers' needs and preferences for the products. From the data in Table 4.5, Buying participants are more satisfied with the existing products, especially in the rating of 7 points and above the object accounted for 201 people accounted for 67.0 percent of the total number of researchers 300. Customers in the rating of 7 points and above the object of a total of 198 people accounted for 66.0 percent of the total number of researchers, and at the same time the performance of the score of 8 and above the user accounted for a large percentage of users, indicating that a significant portion of users are more satisfied with the product performance, which means that there is a significant portion of users are more satisfied with the product performance. This indicates that a significant portion of users are

more satisfied with the product performance. Despite the small percentage of low-scoring users, it is still necessary to pay attention to their feedback and needs to improve the shortcomings of the product and increase overall user satisfaction.

In order to understand the overall satisfaction of each group, we performed calculations using averages, which means that we calculated the average score based on the frequency of occurrence of each rating. First, we multiply each rating (e.g., rating 1, rating 2, etc.) by the frequency of that rating (i.e., the number of times that rating appears). This gives us a weighted value for each rating. Next, the values obtained by multiplying all ratings and frequencies are added together to get the weighted sum. Then, add up all the frequencies to get the sum of the frequencies. Here is the sum of the number of occurrences of all ratings. Finally, the weighted sum is divided by the total frequencies to get the weighted average score. This result then represents the weighted average of all ratings. The result is that Buying participants satisfaction mean is 7.06 and Customer satisfaction mean is 7.62. Overall, customers are likely to purchase a product only if the overall satisfaction scores of both the purchasing participant and the user's needs and preferences for the product are greater than 7.

4.7 Product Demand and Preference Importance Analyses

In order to study the satisfaction impact of product needs and preferences in the purchasing decision-making process, we view the satisfaction with existing products (satisfied, dissatisfied) by the characteristic elements of purchasing product needs and preferences as a dichotomous problem, and we learn from the existing data to create an ability to study the satisfaction impact on new data.

4.7.1 Random Forest Prediction Models

Random Forest algorithm is a generalised classification and regression method proposed by Breiman. It integrates multiple decision trees through the idea of integrated learning, integrates all the classification votes, designates the category that receives the highest number of votes as the final classification result, and it shows excellent performance in situations where the number of variables is much larger than the number of observations. The Random Forest algorithm has the following advantages.

- a) The model introduces randomness and is not prone to overfitting.
- b) It is fast to train and can parallelise the computation.
- c) It can handle discrete, Boolean, and continuous data without the need to do normalisation as well as feature selection.
- d) Applicable to the presence of many unknown features in the dataset.
- e) Can estimate which feature is more important in classification.
- f) When there is a lot of noise in the data set, it can also achieve good prediction performance.

Based on the above advantages, the random forest model can be easily adapted to a variety of special learning tasks and is suitable for the evaluation model in this paper.

The flow of the random forest algorithm is shown in Figure 4.1.

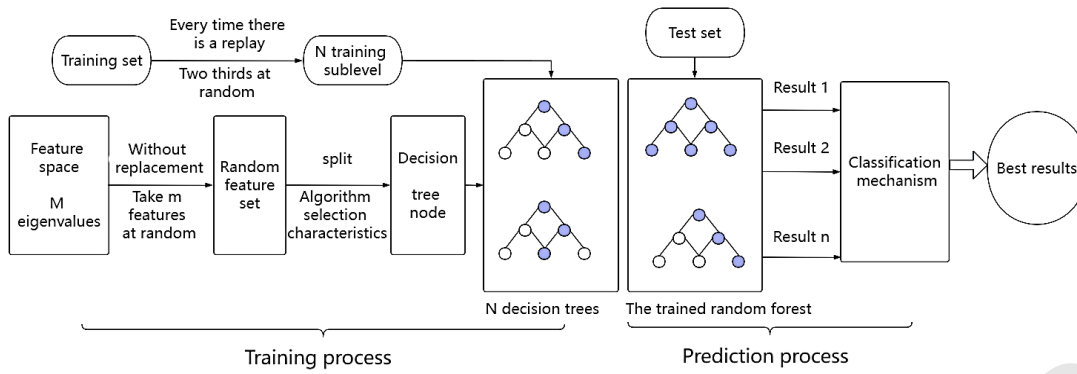


Figure 4.1 : The Flow of the Random Forest Algorithm
(Source by author)

In this thesis, Random Forest algorithm is applied to the product demand and preference during the purchase process as the basic data set of 300 items. Buying participants combine the demand and preference factors to score the satisfaction level of the existing products out of 10, and at the same time, the customer also scores the overall satisfaction of the use of the situation, which is divided into two categories: “satisfied” and “dissatisfied”, which will be used as a label for the data set. “Satisfaction” and “Dissatisfaction”, which will be used as the labels for the dataset. In this paper, the scores of the secondary indicators such as basic information and job information are also used as candidate features, thus the input feature dimensions of the model are buying participants $n = 148$ and Customer $n = 136$. The data in the experiment is divided into 80.0 percent of training data and the rest is used as test data. The model uses the training set to generate the corresponding random forest during the prediction process and the feature vectors are used to predict the satisfaction situation. The random forest is selected model as a weak classifier decision tree with a maximum number of decision trees ($n_estimators$) of 500, minimum number of samples required for leaf nodes ($min_samples_leaf$) of 1, and minimum number of samples required for nodes while splitting ($min_samples_split$) of 2.

Customer	Type			
Customer1	Type1			
Customer2	Type2			

→

Customer	Type1	Type2	Type3
Customer1	1	0	0
Customer2	0	1	0

Figure 4.2 : Numerical Normalisation
(Source by author)

For the Random Forest algorithm, if the gap between the values of several attributes is particularly large, it will affect the accuracy of the result, so the data is normalised. representation of categorical variables by One-hot Coding For any attribute in the data table, the maximum possible value of the attribute is selected; then for that attribute, the value of this attribute for all samples is divided by the maximum value after traversing the data table, so that the value of each attribute is in the range of $[0, 1]$, and such a representation helps to deal with the categorical features in a machine learning model, especially in algorithms that involve distance calculation algorithms (Figure 4.2).

4.7.2 Analysing Experimental Result

Data preparation: The proportion of the dataset in a random forest that is divided into a training set and a test set is determined by the specific problem and the amount of data. It is common practice to use most of the data 80 for training and leave 20 for testing. This ensures that the model learns the features of the data during training and at the same time has enough unseen data to evaluate the generalisation performance of the model. The following are the training set and test level sample distributions for this paper.

Table 4.42 : Sample Distribution of Buyer Training Set and Test Level

Data Set	Description	
Training Set	Number of samples with satisfied purchasers	112
	Number of samples with unsatisfied buyers	111
Test Set	Number of samples with satisfied purchasers	27
	Number of samples with unsatisfied buyers	50

(Source by author)

Table 4.43 : Customer Sample Distribution for Training Set and Test Level

Data Set	Description	
Training Set	Customer satisfactory sample size	111
	Customer unsatisfied sample size	87
Test Set	Customer satisfactory sample size	80
	Customer unsatisfied sample size	22

(Source by author)

Random Sampling: Random sampling with put back is performed for the training data set (Table 4.42 and 4.43).). This means that the training data for each decision tree is drawn from the original data and for each division of each decision tree, a certain number of features are randomly selected from all the features, which helps to increase the diversity of the model.

Decision Tree Construction: A decision tree is constructed using selected training data and features. The construction process usually uses a recursive approach, according to the different features of the data is divided until the stopping condition is reached. The tree generated by ranger is roughly 500 trees, buyer, customer product preference in satisfaction with the division logic, different colours correspond to different targets, and each fork is marked with the conditions of the split, so the division logic is clear immediately. The depth of the tree is also neatly reflected. The diameter of the branches is not a decoration, but represents the number of samples (proportion), the more samples under the division conditions, the thicker the trunk(Figure 4.3 and 4.4).



Figure 4.3 : Sample Cases of Satisfaction Classification
(Source by author)

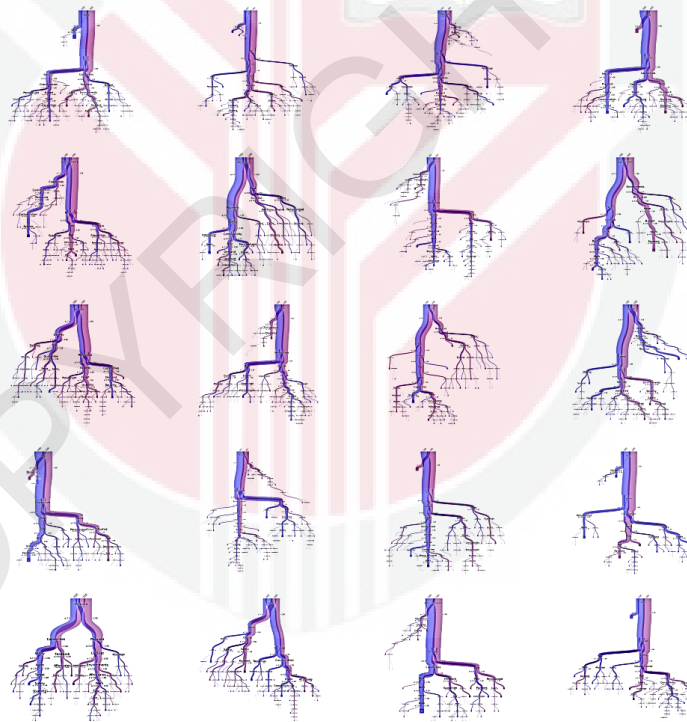


Figure 4.4 : Sample Cases Process Diagram of Satisfaction Classification
(Source by author)

Model evaluation: The constructed Random Forest model is evaluated using a test dataset. Accuracy, AUC, and other indicators are usually used to measure the performance of the model. Adjustment: According to the evaluation results, hyper-

parameter adjustment, such as the number of trees, tree depth, etc., is performed to optimise the model performance.

Table 4.44 : Table Trial Experimental Results

Item	ACC	AUC	Precision	Recall
Buying participants	0.83	0.95	0.87	0.93
Users	0.86	0.94	0.85	0.82

(Source by author)

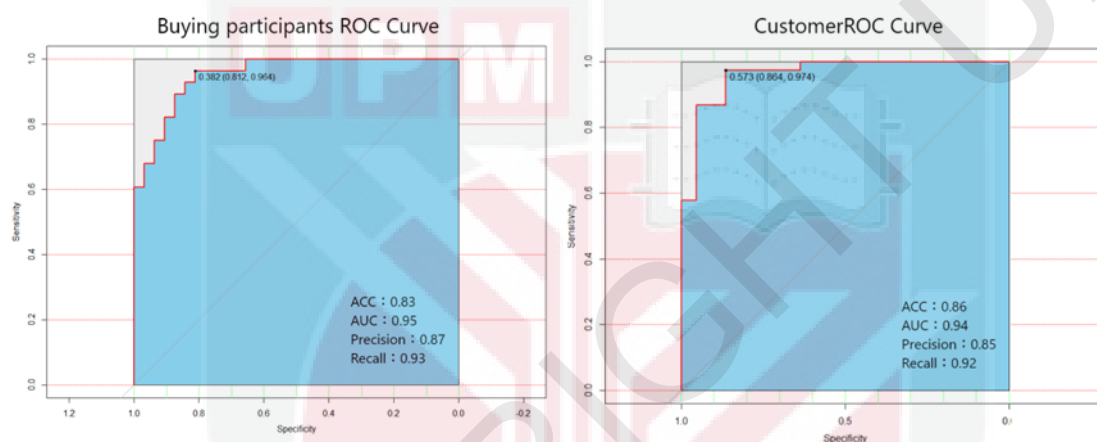


Figure 4.5 : Trial Experimental Results

(Source by author)

Table 4.4 and Figure 4.5 can be seen:

Accuracy (ACC): Indicates the proportion of samples correctly predicted by the model over the total samples. For the Buyer group, the ACC is 0.83, and for the Customer group, the ACC is 0.86. Higher ACCs indicate better overall model performance.

Area Under the Curve (AUC): The area under the ROC curve, which is a measure of the trade-off between the true and false positive rates of the model at different

thresholds. For the buyer group, the AUC is 0.95, and for the Customer group, the AUC is 0.94. The closer the AUC value is to 1, the better the performance of the model.

Precision: Indicates how many of the samples predicted by the model to be in the positive category are in the positive category. For the buyer group, the precision is 0.87 and for the Customer group, it is 0.85. Higher precision indicates a higher probability of a true category when the model predicts a positive category.

Recall: Indicates the proportion of samples in the positive category that the model correctly predicts out of all samples in the true positive category. For the Buyer group, the Recall is 0.93, and for the Customer group, the Recall is 0.92. A higher Recall indicates that the model correctly predicts a higher proportion of all true positive category samples. The Confusion Matrix is a table used to evaluate the performance of a classification model, where each row represents the actual categories, and each column represents the predicted categories.

4.7.3 Satisfaction Affects the Prediction Results

Buying participants 148 features and Customer 136 features in the dataset, how much each feature contributes to each tree in the random forest, and then take an average, and finally compare the size of the contribution between the features. The Gini index or Out of Bag (OOB) error rate is used as an evaluation metric to derive the importance score. High importance elements are the features that have the greatest impact on customer satisfaction. Organisations should ensure that they do a better job in these areas to improve customer satisfaction. Medium importance elements, these features have some impact on satisfaction but are not a major factor. Companies can consider

optimising these features to increase satisfaction. Low importance elements: These features have less impact on satisfaction. companies may choose to moderate or direct resources to more important areas.

According to the satisfaction scoring results and classification criteria in Section 4.6.5, a score of 7 or more is considered “satisfied” and a score of less than 7 is considered “dissatisfied”. Based on this, a random forest classification model was used to analyse customer satisfaction, identifying the influence and importance of the purchase participant element and the customer element on satisfaction. In the model setup, the random forest contains `n_estimators=500` (the number of decision trees), `max_depth=None` (the maximum depth of the tree), `min_samples_split=2` (the minimum number of samples for internal node repartitioning), and `min_samples_leaf=1` (the minimum number of samples for leaf nodes), `criterion=“gini”` (Gini coefficient is used to measure the impurity of nodes) and other parameters. The degree of contribution of each feature to customer satisfaction is evaluated through the feature importance score (Feature Importance), Information Gain and other metrics. The prediction results of this paper’s elements in satisfaction impact multiple stabilisations are as follows.

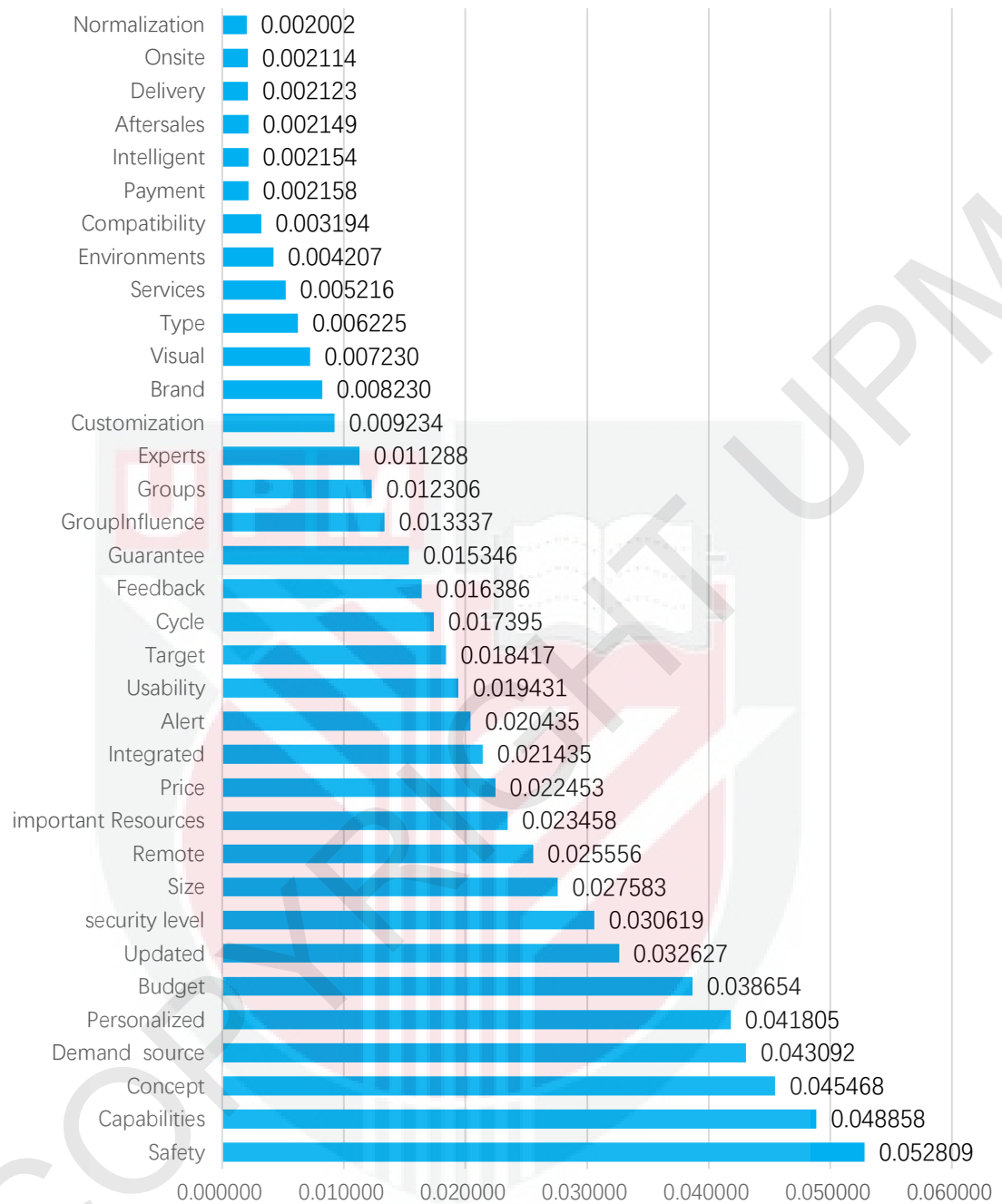


Figure 4.6 : Buying Participants Element Importance
(Source by author)

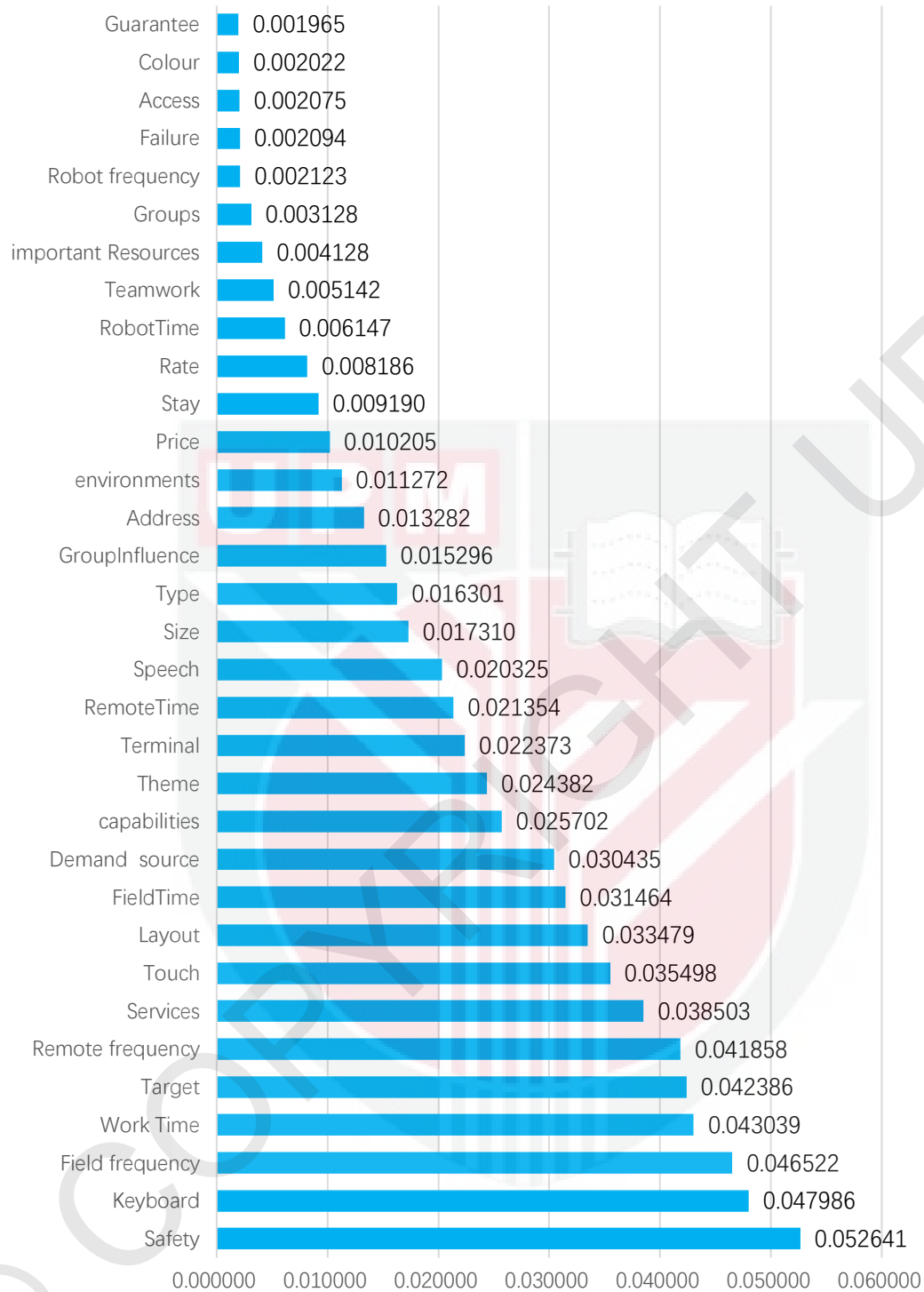


Figure 4.7 : User Element Importance
(Source by author)

In Figure 4.6, the results of the impact of elements on satisfaction for purchasing participants show that safety, capabilities, concept, and demand source are the most critical factors to consider, followed by personalised and budget. In addition, updated, security level, and size were also of some importance, while payment, intelligent, and aftersales were relatively less influential. Overall, buyers are more concerned with security, core competencies, and accessibility of resources. In Figure 4.7 for the user's elements on the satisfaction results, safety, keyboard, work time, target, remote frequency and services are the most important factors. demand source, layout, touch, and field time are also important, while teamwork, group influence, and environments have relatively low weight. Overall, users are more concerned about security, interaction, remote usage, and service experience.

Buying participants and customers have both commonalities and differences in decision-making factors. Both are highly focused on Safety, Demand source and Capabilities, reflecting a common need for product reliability and stability. However, buying participants focus more on budget, personalised, updated, and security level, emphasising long-term value and affordability, while users focus more on keyboard, touch, layout, work time, and remote usage. keyboard, touch, layout, work time and remote frequency, reflecting the need for ease of use and efficiency. Overall, buyers are concerned with macro-decisions and long-term benefits, while users are more focused on the actual operation and experience, both of which influence the final product value.

4.8 Conclusion

Combining the above statistical analysis of the data with the predictive analysis this study yields the following results:

- a) First empirical investigation of buying participants
 - i) Buying participants' basic information - Buying participants and customers are more balanced in terms of gender. Buying participants are mainly in the 36-45 age group, with a higher proportion of technical and operational positions, and most of them are senior practitioners with more than 5-10 years of experience, which indicates that there is a greater demand for specialised knowledge and execution ability in the purchasing stage.
 - ii) Buying participants' product demand - Buying participants believe that grassroots employees are the main users and are obviously concerned about the superior performance and industry competitiveness brought by the products. They have high demand for social and security products, and are most concerned about abnormal behaviour alerts, with obvious demand for localised adaptation and private network deployment. In terms of resources, they pay most attention to technical resources and are concerned about financial resources. When resources are limited, cost control becomes an additional concern. Most of them think that the demand mainly comes from user demand and market analysis. The decision-making process is most influenced by grassroots employees, and key considerations include product usability, performance, and added value. In addition, usability was also a concern in the purchase decision stage. The main accepted price range for buying participants was 11-30w, with a preference for companies with 201-300 employees. It found that grassroots employees are the most influential in the purchase decision process, and product availability is a core consideration in both groups. In addition, purchase participants are more concerned with cost control, while customers are more influenced by policy adjustments. There are subtle differences in resource requirements,

technology preferences, and price acceptance, but the overall trend shows that social and security products, technical resource support, and product usability are common key concerns.

- iii) Buying participants' preference - Buying participants prefer products that comply with national standards and have higher requirements for information security level, violation alerts, product scalability, brand influence, budget control and after-sales service. Among them, in terms of information security, more Buying Participants prefer products with a rating of 2 or 3; in terms of functionality, compatibility and customisation are more valued; in terms of branding, expert recognition and brand influence are important decision-making factors; in terms of economy, budgetary considerations are more stringent and payment by instalment is more popular; in terms of service, speed of feedback and on-site customer service are more preferred, while smart customer service receives less attention. It is noticeable that purchase participants are particularly concerned about national standards and higher-level information security requirements. Compatibility, brand influence and budget factors have a significant impact on purchase decisions. Purchasing participants prefer a long and stable product life cycle and have a demand for efficient after-sales service.
 - iv) Purchase participant satisfaction situation - Purchasing participants were mainly concentrated in the range of 6-9 points, with the highest percentage of 7 and 8 points, followed by 9 and 6 points. Relatively few participants gave ratings lower than 5, indicating that the majority of purchasing participants had a more positive opinion of the product or service. However, the percentage of 10 out of 10 (9.33%) is not considered the highest, indicating that there is still room for improvement.
- b) Second empirical investigation customer (user)
- i) Customer basic information - The customer base is mainly concentrated in the age group of 26-45, with a higher proportion of management and those with 3-5 years of experience being the most active, showing strong

loyalty and service demand. In terms of educational background, purchase participants are mostly high school and secondary school educated, while customers are mainly college and bachelor degree holders, with a lower percentage of higher educated people in both, probably due to more cautious decision making. Special findings are that the 56+ group is more willing to try new products but less loyal, and that the high school and post-secondary group is active in purchasing but less represented in the customer base. These characteristics provide important references for marketing, product design and customer management.

- ii) Customer product demand situation - Customers perceive product services as more inclined to serve managers. Customers pay more attention to daily work efficiency and industry competitiveness. The highest proportion of products in the social and security category and are very concerned about data security encryption. There is a higher demand for infrastructure stability and a focus on Internet deployment. In terms of resources, they pay the most attention to technical resources but have a higher demand for hardware resources. When resources are limited, they pay attention to business logic rationality, functional integrity, and on-time delivery, but do not place extra emphasis on cost control. Customers believe that the demand for products mainly comes from user needs, but policy adjustments have a greater impact. Perceived that grassroots employees have the greatest influence in the decision-making process, focusing on core factors like those of buying participants, but with higher acceptance of higher-priced products (31-50w) and a greater preference for companies with 101-200 employees.
- iii) Customer preference situation - Customers mainly focus on working early in the morning, office and public places are the main working scenarios, and desktop computers are the main end devices. Customers have a high demand for collaboration tools. In terms of operating habits, users are more inclined to use computer shortcuts and voice operation and are more cautious about touch screen operation. Users' task failure rate is concentrated at 6-15 times/month, and the page dwell time and

number of visits show diverse patterns, with some users staying longer on certain functions. In terms of interface, customers prefer large fonts and office mode, prefer blue in colour, prefer split-screen layout and Z-shaped layout in layout, and favour high resolution. In terms of customer service, the reliance on on-site service is relatively high. Overall, customers favour simple and clear interface, larger fonts, split-screen layout and high-resolution adaptation. There is a high demand for service response speed.

- iv) Customer satisfaction situation - The distribution of customer satisfaction is like that of purchase participants, with a concentration of scores of 6-9, with the highest percentage of scores being 8, followed by 7 and 6. Lower scores (1-4) accounted for a relatively small percentage, indicating a high level of overall satisfaction. However, there is a slightly smaller percentage of 10-point scores, indicating that there are still opportunities to improve the customer experience. Overall, customers recognised the product or service well, but there are still some customers who did not give the highest rating, which may be influenced by certain details or lack of experience.
- c) The third empirical investigation the extent of product demands and preferences during the buying process influence satisfaction.
 - i) Prediction results - The model's prediction performance on purchase participants and customer groups is good, with high overall accuracy (ACC of 0.83 and 0.86, respectively), AUC close to 1 (0.95 and 0.94, respectively), and high precision and recall, indicating that the model performs consistently in correctly categorising the positive category samples and in overall prediction performance.
 - ii) Identify the different importance of product satisfaction for buyers and customers - Purchasing participants are more concerned with overall decision-making factors, such as security, capacity, budget, source of demand, and long-term updating ability, while users are more concerned with the specific experience of the product, including security, interaction,

remote use, and work efficiency. Purchasers take a macro decision-making perspective, while users are more oriented to the actual operation and experience, and their concerns complement each other in determining the final value of the product.

In summary, in practice, the buyer is usually the procurement decision maker of the enterprise or organisation, who pays more attention to the security, compatibility, brand influence and long-term cost-effectiveness of the product to ensure that the purchased product meets the enterprise standards, reduces operational risks and optimises the long-term input-output ratio. Customers (end-users), on the other hand, are more concerned with usability, interactive experience and remote use of the product to improve work efficiency and ease of daily operations, while ensuring security. This difference in demand complements each other in the purchasing and usage segments, which together determine the market competitiveness of the product. In addition, the unexpected findings include that the senior age group is less loyal although more willing to try new products, indicating that companies need to optimize their strategies on long-term user retention. In addition, customers' acceptance of high-priced products exceeded expectations, suggesting that market demand for high-value products may be stronger than expected, providing a reference for companies to optimise product pricing and high-end market positioning.

The results of multiple predictions show that the model can identify the key factors affecting satisfaction more accurately (ACC of 0.83 and 0.86 respectively, AUC close to 1), which provides data support for enterprises to formulate precise marketing and product optimization strategies. The model can accurately identify the different key factors of buyers' and customers' satisfaction with products, providing data support

for enterprises to develop differentiated marketing strategies. However, there are still limitations in the prediction results. Limitations in data collection may affect the generalisation ability of the model, such as the representativeness of the sample size, the limitation of the data collection time, and the quantitative accuracy of individual key variables. Second, although the model can better identify the factors affecting satisfaction, the actual purchase decision is still subject to some human subjective judgments, such as corporate culture, personal preferences, and market dynamics, which are difficult to be fully captured by data. Therefore, in actual business, it is necessary to combine subjective and objective comprehensive analysis, such as industry experts' opinions and other subjective complementary to the results of data analysis to ensure the comprehensiveness and reasonableness of decision-making.

In the future, product developers should optimise data collection strategies, increase long-term tracking data, and combine quantitative and qualitative research with expert analysis to more accurately meet the needs of different groups and improve market competitiveness and user satisfaction. In addition, enterprises should balance security and user experience in product design to meet the compliance needs of purchasers and enhance the user experience. At the same time, they should optimise marketing strategies for different groups of people, such as providing flexible pricing models, strengthening after-sales services, and enhancing user stickiness through accurate user profiling, to improve the market competitiveness and user satisfaction of their products.

CHAPTER 5

DEVELOPMENT OF A NEW FRAMEWORK

5.1 Introduction

This chapter discusses the findings of RQ1 and RQ2 results and addresses further on the development accordingly to the RQ3. The main discussion on this chapter mainly on the research Objective 3 - To develop a new framework that integrates the elements of demand and preference of the product in the buying decision process toward customer satisfaction. In this chapter, the discussion is based on the development of a new framework of the customer buying decision process toward satisfaction and its process. The framework becomes attempts to facilitate the product developer to develop a new product based on demand and preference and help the customer to make the buying decision of a new product. The validation of the value framework was conducted in the end of the chapter to prove its significance.

5.2 Discussion of Finding

As stated in the early chapter of this thesis, the research fieldwork was addressed into two (2) research questions. The first research question is about the importance of product demand and preference in the buying decision process toward customer satisfaction, followed by identifying the elements of product demand and preference that was influenced in the buying decision process toward customer satisfaction.

5.2.1 The Importance Factors of Product Demand and Preference in Buying Decision Process toward Customer Satisfaction

According to results of Chapter 4, it finds that in software product development and marketing, enterprise customers are affected by national and local policy requirements and financial support, and must satisfy some objective mandatory requirements, and need to be customized according to different customer preferences to meet the purchase needs of customers in different regions. Only by integrating objective product requirements and subjective product preferences in the purchasing decision process can we enhance the purchasing power of products and improve customer satisfaction.

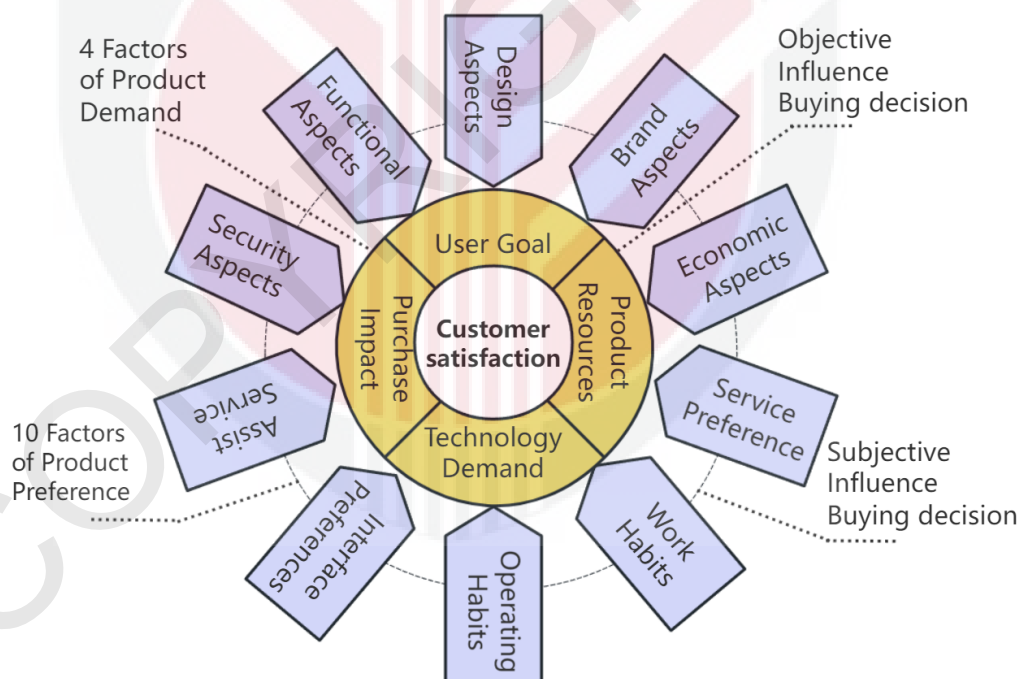


Figure 5.1 : The Importance factors of Product Demand and Preference in Buying Decision Process toward Customer Satisfaction
(Source by author)

a) Important product demand - Product requirements are the basic problems and needs that must be solved when customers use a product or service in an enterprise customer. These requirements are usually based on the user's basic needs and practical application scenarios derived, is clear and indispensable. The satisfaction of objective requirements is the key to ensure that the product can operate effectively, achieve the core functions, and solve the user's problems including user goals, product resources, technology demand, purchase impact.

i) User goal - User Goal is the core guiding principle of product design, which needs to be based on facts, data, and actual application scenarios to evaluate user goals, to design and develop products that meet actual needs. User goal can help the team to determine the priority of product development, the team can focus on the development of key features and ensure that the development work focuses on the most important tasks, to ensure that the core value of the product. User goals can be used as a benchmark to validate the direction of the product and help the team avoid the risk of deviating from user needs.

ii) Product resources - Product resources are one of the key success factors of a product, and these resources help users maximise the functionality of the software and ensure they have the best possible experience while using it. Clarifying the bottom line of the customer's product resources helps the team identify the minimum guaranteed service capabilities to meet the customer's minimum needs in a limited resource environment.

iii) Technology demand - Technology demand determines the adaptability of the product in the user's environment. Technology demand is the key factor to ensure the stability, security, and effectiveness of software products in the operating environment. In the software development and operation process, the satisfaction or non-satisfaction of technology demand has a direct impact on the success of the product and the user's purchase metrics.

- iv) Purchase impact - It refers to the objective factors of the customer or organisation's purchase decision. Due to the special characteristics of enterprise customers its purchase process and budget are influenced by the country and enterprise. Purchase Impact analysis is the core requirement that users consider when purchasing a product.
- b) Important product preference - Product preferences are users' preferences and inclinations towards products, which are often based on subjective feelings, emotional connections, and personalized experiences. Product preference is often an important driver of customer satisfaction and loyalty. The impact of product preferences on customer satisfaction can be seen in the following areas:
 - i) Security aspects - The consideration of Security Aspects is crucial to the preference of purchasing participants. Purchasers are concerned about the local government's security level services and early warning plan services for products or services. If the product or service can meet the national security needs, the purchasers will be more confident to purchase it, especially for products involving personal privacy or sensitive data, security is one of their primary considerations.
 - ii) Functional aspects - Purchasing participants tend to choose products or services with strong functional integration capabilities, comfortable applications, and the ability to expand and delete on-demand and expect the products to provide regular fixes to ensure the stability and reliability of the products. Products or services that satisfy these characteristics can better meet users' needs and enhance their satisfaction and loyalty.
 - iii) Design aspects - The design of a product or service affects the aesthetics and experience of buyers, thus influencing their purchase preference. Attractive interface design, user-friendly operation process and good user experience can increase buyers' satisfaction and loyalty. Well-designed products are usually favoured more by buyers.
 - iv) Brand aspects - The influence of Brand Aspects on buyer preference is obvious. Purchasers tend to prefer branded products that are well known,

reputable and recognised by experts because they have some trust and recognition of these brands. Brand image represents the quality, reliability and service level of the product and is one of the important factors for buyers to make purchase decisions.

- v) Economic aspects - Economic Aspects is the most sensitive aspect of influence, buyers are concerned about the price of the product or service, its value for money and how well it matches their budget. Economic factors directly affect the purchasing decision of buyers, so providing reasonable prices and preferential policies can attract more buyers.
- vi) Service preference - Service Preference Customers also have certain preference for after-sales service of products or services. Good after-sales service can enhance buyers' satisfaction and loyalty, and buyers are more willing to choose brands or products that provide good after-sales service.
- vii) Work habits - Products or services that conform to the user's work time and work style habits can enhance the user's sense of comfort and convenience, thereby enhancing the user's purchase trust.
- viii) Operating habits - Understand and meet the user's preferences for operating buttons, voice, touch screen and other operating modes, reduce the number of operation failures, improve the fault tolerance of the product, can significantly enhance user satisfaction.
- ix) Interface preferences - The interface designed according to user preferences can enhance the user's pleasure and sense of identity and improve the competitiveness of the product.
- x) Assist service - When users encounter problems when using the software, can get fast and accurate answers and help, can reduce the user's waiting time, they will be more satisfied, and willing to continue to use and recommend the product or service.

5.2.2 The Elements of Product Demand and Preference that Influenced in Buying Decision Process toward Customer Satisfaction

According to results of Chapter 4, a total of 55 elements were obtained for product buying decision are 13 elements for the product demand and 42 elements for the product preferences. The list of elements and description as showed in Table 5.0 below. These key elements are essential to understanding the product demands and preferences of buying participants and customers. These 55 key elements include key items that cover the impact of product satisfaction from functionality to aesthetics, and from price to service. These elements are not only the foundation of product design and marketing, but also the key to meeting customer needs and increasing customer satisfaction. The 13 elements on product needs of purchasing participants and customers can help us better understand our customers' basic needs, customer demands and expectations, thus enabling us to design products that fulfil these needs. On the other hand, the 42 elements for customers' product preferences can gain access to customers' individual demands and preferences, which can help us to target our products and provide customised products and services to meet their needs, thus further increasing customer satisfaction and loyalty more accurately.

Table 5.1 : The Elements of Product Demand

a) User group

Elements	Description
User Group	According to the characteristics of the application group, more targeted services, and support, optimize the allocation of resources. To better meet the demands and expectations of important customer groups is the purchase decision conditions affecting the key elements.
Target	Customers' purchasing decisions are often influenced by the goals and intentions of their country or organization; therefore, meeting the requirements of customers' objective goals is the key to improving customer satisfaction in the purchasing decision process.
Type	According to the type of products expected by customers, according to the market demand out with differentiated competitive products, can be

Table 5.1 : Continued

	more attractive to customers to buy. Enterprises need to carefully consider the match between product types and customer needs to enhance customer satisfaction and brand value.
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b) Technology demand

Elements	Description
Safety	Data security is an important indicator to improve customer satisfaction in the process of purchasing decisions. It is directly related to the protection of customer privacy and business rights and interests. Effective data security strategy, enterprises can improve customers' trust in themselves.
Capabilities	Product guarantee power can help enterprises or customers to solve problems better, coordinate resources under the condition of balanced working environment, improve work efficiency, enhance product quality, meet customer needs, to gain competitive advantage and enhance customer recognition of the product.
Environments	Different deployment environments will affect the performance and stability of the product. Providing diversified deployment options can meet the needs of different customer groups, enhance the adaptability and flexibility of the product, enable customers to choose the deployment environment that best suits their business needs, and increase satisfaction.

c) Product resources

Elements	Description
Important Resources	Resources are one of the key factors in the purchase decision process to improve customer satisfaction. Important resources include those of hardware, manpower, technology, finance, and marketing. The adequacy or inadequacy of these resources directly affects the quality of the product, the level of service and market competitiveness, thus affecting customer satisfaction.
Resources Guarantee	As an important indicator to improve customer satisfaction in the process of purchase decision-making, the minimum guarantee is not only reflected in the safety characteristics and measures of products or services, but also includes the integrity of product functions, cost control and timely delivery of tasks, which are designed to meet customers' needs for safety.
Demand Source	Important customer demand source pathway, they provide different perspectives and levels of information to help companies more comprehensive understanding of customer needs, to make more effective decisions to improve the quality of products or services and customer satisfaction.

d) Purchase impact

Elements	Description
Group Influence	Because customers' purchase decisions are often affected by various group factors, group influence can come from the user groups and management groups, etc. Group influence analysis can help enterprises

Table 5.1 : Continued

	better understand customers, develop marketing strategies and service plans more in line with customer needs, and improve satisfaction.
Services	The characteristics, availability, reliability, performance and added value of the product directly affect the customer's feeling and satisfaction with the product and are an important indicator to improve customer satisfaction in the process of purchasing decision.
Price	Reasonable pricing strategies can help enterprises to maximise the value of their products and improve customer satisfaction. By combining the analysis of sales price range, enterprises can determine appropriate pricing strategies, including differentiated pricing, promotion strategies, etc., to meet the needs of different customer groups and improve customer purchase experience and satisfaction.
Size	The scale of suppliers directly affects the quality, reliability, delivery ability and after-sales service level of products or services, and then affects the purchase decision and satisfaction of customers. Therefore, the scale is one of the key factors to improve customer satisfaction.

(Source by author)

Table 5.2 : The Elements of Product Preference

a) Security aspects

Elements	Description
Normalization	Standardization refers to ensuring that systems, software, or services comply with certain security standards and specifications to prevent potential security vulnerabilities or risks. Products or services purchased by customers are in line with industry standards and norms, and can reduce potential security risks, thus enhancing customer trust and satisfaction.
Security level	In their purchasing decision, customers will consider whether the security level provided by the product or service can meet their security needs, especially for the product or service involving sensitive information. Products or services with security level protection can effectively protect customers' data security and privacy and enhance customer satisfaction and trust.
Alert	The system or service can detect potential security threats or anomalies in time and issue an alert to notify relevant personnel or administrators to process and reduce the impact of security events on the business, which is one of the most important considerations for customers when purchasing products or services.

b) Functional aspects

Elements	Description
Integrated	Customers tend to purchase a product or service that can be seamlessly integrated with an existing system or service. Integrating strong performance products can reduce unnecessary interruptions and trouble in the workflow, improve work efficiency, and thus enhance customer satisfaction.
Customisation	Customisation can meet the personalised needs of customers, enhance

Table 5.2 : Continued

	the fit between products and customers, thus affecting customers' purchase experience and satisfaction.
Compatibility	The compatibility of a product or service determines its interoperability with other systems, software, or hardware. Good compatibility can ensure that the product or service cooperates with the customer's existing environment, reduce potential technical problems and incompatibilities, and improve customer satisfaction.
Updated	The products or services that customers want to purchase can be continuously updated and upgraded to keep their performance, functionality, and security up to date and provide a better service experience for customers.

c) Design aspects

Elements	Description
Visual	Visual Including colour, icon, typesetting and so on. Good visual design can attract users' attention, improve the beauty and professionalism of the product, enhance users' goodwill towards the product, to improve the purchase satisfaction.
Usability	A product or service that is easy to understand and operate can reduce users' learning costs and operation difficulty, improve users' work efficiency and satisfaction, and enhance users' recognition and loyalty to the product.
Personalised	Personalization is to provide customised services or experiences to users according to their preferences and behaviour habits. Personalised products or services that can enhance users' emotional connection and identity,

d) Brand aspects

Elements	Description
Brand	Brand is the symbol and representative of the product or service, including the awareness, reputation, and image of the brand. A good brand can improve the recognition and trust of products or services and reduce the risk of purchase.
Concept	Concept refers to the concept, core values and uniqueness represented by a product or service. A clear product concept enables customers to better understand the value and significance of the product, enhance their emotional connection with the product, and improve purchase satisfaction.
Experts	Expert support includes the recognition and support of a product or service by professionals, industry leaders, or authorities. The endorsement of experts can enhance customers' trust and recognition of products or services and improve purchase satisfaction.

e) Economic aspects

Elements	Description
Budget	The budget is the range of expenses that a customer can afford when purchasing a product or service. Understanding the customer's budget range can help enterprises to provide appropriate product or service options to meet customers' affordability, and thus improve purchase

Table 5.2 : Continued

	satisfaction.
Payment	Diversified payment methods can improve the flexibility and convenience of purchase, meet customers' different payment habits, and enhance purchase satisfaction.
Cycle	Purchase cycle refers to the time interval during which a customer purchases a product or service, and different products or services may have different purchase cycles. Understanding the purchase cycle of customers can help enterprises to better develop sales strategies, timely provide related products or services, and increase the purchase frequency of customers.

f) Service preference

Elements	Description
Feedback	Providing an effective feedback mechanism can enable customers to express their opinions and suggestions, help enterprises understand customer needs and problems, and timely improvement and optimisation. A good feedback mechanism can enhance customer participation and satisfaction and improve the quality and competitiveness of products or services.
Delivery	Delivery speed refers to the length of time for a product or service. Delivery speed is an important indicator in the purchase decision process because it directly affects the customer purchase experience and satisfaction.
Intelligent	Intelligent service through advanced technical means to provide personalized, rapid response to customer needs, improve service efficiency, enhance customer trust.
Remote	Remote support refers to providing services and support to the customer through remote technology without reaching the customer's location. This mode of service can quickly diagnose and solve the problems encountered by the customers, reduce the delays caused by the reasons such as waiting or transportation, and improve the quality and efficiency of the service.
Onsite	Providing timely and effective on-site services can solve customer problems and enhance customer trust and satisfaction with products or services.
After sales	After-sales service includes product warranty, maintenance, upgrade, etc., which can ensure customer satisfaction and loyalty after trial or purchase.

g) Work habits

Elements	Description
Work Time	Provide flexible working schedule according to customer needs and time zone differences and ensure that customers can get timely response and support when needed. This is one of the most important considerations for customer satisfaction.
Address	By obtaining the user's working address, enterprises can better understand the user's living and working environment and provide them with more personalised and intimate services.
Terminal	Understand the common terminal preferences of users, optimise the screen size and operation habits of different terminal devices, so that users can complete work tasks more easily. Therefore, terminal equipment is one of the important indicators in the purchase decision process.

Table 5.2 : Continued

Teamwork	Confirm the working mode of users, improve the independent working efficiency by optimising the team cooperation mode, and provide customers with better purchasing experience and service.
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k) Operating habits

Elements	Description
Keyboard	The keyboard is one of the main ways for users to input information and perform operations. An easy-to-use operation process can improve user operation efficiency and comfort, thus enhancing user satisfaction.
Speech	With the development of speech recognition technology, speech has become a convenient and fast way to interact. Providing a good voice recognition function can help users interact with products or services more easily and improve user experience and satisfaction.
Touch	Touch has become the primary way of interaction for many devices. A sensitive, smooth touch interface can improve the user's operation experience, make users more willing to use the product or service, and enhance their satisfaction.
Failure	When users encounter a product or service failure, it will have a negative impact on the purchase experience. Timely understanding of the failed operation situation to take the initiative to solve. Providing effective customer support and after-sales service can reduce users' dissatisfaction and enhance their trust and satisfaction with products or services.
Access	A stable and efficient access platform can ensure that users can easily access the information and functions they need anytime and anywhere and improve users' purchase experience and satisfaction.

i) Interface preferences

Elements	Description
Theme	The theme is a symbol of the overall style and positioning, including the brand image, design style and emotional expression. A unique, engaging theme can help a product or service stand out in a competitive market, capture users' attention, and increase their buying desire and satisfaction.
Colour	Colour has an important impact on the visual effect and emotional communication of a product or service. Suitable colour matching can create a comfortable and pleasant user experience, enhance the user's goodwill and identity of products or services, to improve the purchase satisfaction.
Layout	Layout refers to the structure and layout of a product or service page. A clear, concise, easy to understand layout can improve user convenience and operation efficiency, reduce user sense of disorientation and confusion, thus enhancing user satisfaction.
Rate	Considering the resolution of a user's electronic device is one of the factors that must be considered when designing a product or service. By understanding the resolution range of the user's device and adopting the corresponding design strategies, we can ensure that the product or service can provide a good user experience on different devices, to improve the user satisfaction and the competitiveness of the product.
Robot frequency	The robot quiz can provide online help services and support, and the frequency of its applications reflects users' application preferences.

Table 5.2 : Continued

j) Assist service

Elements	Description
Robot Time	The time required by the robot to perform tasks or operate represents work efficiency and productivity. completing tasks in a short time can reduce the waiting and delay in the production process and help improve user experience and satisfaction.
Field frequency	The degree of on-site operation frequency means that products or services can respond to the needs of users on site in a timelier manner. Frequency means providing faster on-site support and services, which helps to enhance the trust of users and indirectly reflects the room for improvement.
Field Time	Shorter on-site service time means that users can solve problems or complete customer tasks faster, which can reduce customer waiting time and production stagnation time and is the main reference index of customer satisfaction.
Remote frequency	The shorter the completion time of the remote task, indicates the efficiency of the user to solve the problem through the remote operation, which represents the user's preference for the remote service, and indirectly reflects the product improvement space. Providing appropriate preference services helps to improve user satisfaction.

(Source by author)

Based on these key elements, salespeople, product people develop appropriate product development, marketing strategies, and customer service strategies to ensure that they meet the customer's needs and stimulate their interest. Develop a more targeted and effective strategy for your organisation to improve product sales, customer satisfaction, and market competitiveness.

5.2.3 The Product Satisfaction

Customer satisfaction of purchase decision is the overall satisfaction of the customer with the purchased product or service after completing the purchase decision. This concept covers the customer's feelings, experiences, and evaluations during the purchase process, from the beginning of the purchase decision to the completion of the purchase. This satisfaction not only reflects the quality of the product or service itself, but is also influenced by the customer's expectations, needs, preferences, and

the experience and services received during the purchase process. Customer satisfaction in the process of purchasing a product is mainly reflected in the following 3 points:

- a) Information acquisition stage: When acquiring product or service information, customers can obtain true and accurate product or service information and experience the consistency between the information and the target demand, to improve the satisfaction and success rate of the purchase decision.
- b) Comparison and choice stage: Customers are comparing the advantages and disadvantages of different products or services such as functionality, performance, personality, after-sales and so on. This stage is usually a challenge for customers because they need to consider and weigh multiple factors, and there may be some difficulty in choosing. Enterprises through the professional attitude and level of service personnel, the timeliness and effectiveness of the customer to solve problems, provide clear information on the value of the customer to provide customers with a better shopping comparison and selection experience, the customer to experience the confidence and satisfaction of the purchase, to confirm that their choice is correct.
- c) Purchase decision stage: Customers in making the final purchase decision, will assess its price and the value provided by the degree of match between the enterprise through the product or service preference analysis of the formation of excellent cost-effective strategy to meet customer needs and expectations, so that customers feel great satisfaction.

5.3 The Development of New Framework

The development of a new framework namely Customer Buying Decision Framework (CBDF) is integrated the Demand and Preferences: [Demand Elements (DEs) +

Preference Elements (PEs)] = Customer Satisfaction (CS). The detailed integration of factors and elements as follow:

[Product Demand = PD-UG₁ (User Group + Target + Type) + PD-TD₂ (Safety + Capabilities + Environments) + PD-PR₃ (Important Resources + Resources Guarantee + Demand Source) + PD-PI₄ (Group Influence + Services + Price + Size)] + **[Product Preference** = PP-SA₁ (Normalization + Security level + Alert) + PP-FA₂ (Integrated + Customisation + Compatibility + Updated) + PP-DA₃ (Visual + Usability + Personalised) + PP-BA₄ (Brand + Concept + Experts) + PP-EA₅ (Budget + Payment + Cycle) + PP-SP₆ (Feedback + Delivery + Intelligent + Remote + Onsite + After sales) + PP-WH₇ (Work Time + Address + Terminal + Teamwork) + PP-OH₈ (Keyboard + Speech + Touch + Failure + Access + Stay) + PP-IP₉ (Theme+ Colour+ Layout +Rate) + PP-AS₁₀ (Robot Frequency + Robot Time + Field Frequency + Field Time + Remote Frequency + Remote Time)]

Table 5.3 : Element Coding

Product Demand (PD)	Code	Product Preference (PP)	Code
Groups	DE1	Normalisation	PEa1
Target	DE2	Security level	PEa2
Type	DE3	Alert	PEa3
Safety	DE4	Integrated	PEa4
Capabilities	DE5	Customisation	PEa5
Environments	DE6	Compatibility	PEa6
Important Resources	DE7	Updated	PEa7
Guarantee	DE8	Visual	PEa8
Demand source	DE9	Usability	PEa9
Group Influence	DE10	Personalised	PEa10
Services	DE11	Brand	PEa11
Price	DE12	Concept	PEa12
Size	DE13	Experts	PEa13
		Budget	PEa14
		Payment	PEa15
		Cycle	PEa16
		Feedback	PEa17
		Delivery	PEa18
		Intelligent	PEa19

Table 5.3 : Continued

	Remote	PEa20
	Onsite	PEa21
	Aftersales	PEa22
	Work Time	PEb1
	Address	PEb2
	Terminal	PEb3
	Teamwork	PEb4
	Keyboard	PEb5
	Speech	PEb6
	Touch	PEb7
	Failure	PEb8
	Access	PEb9
	Stay	PEb10
	Theme	PEb11
	Colour	PEb12
	Layout	PEb13
	Rate	PEb14
	Robot Frequency	PEb15
	Robot Time	PEb16
	Field Frequency	PEb17
	Field Time	PEb18
	Remote Frequency	PEb19
	Remote Time	PEb20

(Source by author)

Table 5.3 show the systematically categorises and identifies elements, with each “Code” corresponding to a specific need or preference dimension. The codes use abbreviations (e.g., DE for product requirements, PEa for product preferences, etc.) combined with numerical combinations to assign a unique identifier to each requirement and preference, with the DE category representing product requirements (e.g., DE1, DE2, etc.) and the PEa category representing product preferences (e.g., PEa1, PEa2, etc.). This structure allows different requirements and preferences to be clearly distinguished, simplifying the data management and analysis process.

5.3.1 Mapping the Elements of Product Demand and Preference

Through questionnaire analysis and satisfaction prediction, we understand and realise that satisfied product demands (DEs) and product preferences (DPs) are important for customers in purchase decisions. Sales or product personnel use DEs as a necessary condition for product purchase, while DPs become the main reference condition for product purchase. By mapping the elements of product needs and preferences, suppliers can understand exactly what the specific needs and preferences of their business customers are. This enables suppliers to offer products that better meet customer expectations, thereby increasing the likelihood of purchase.

Elements of product Demand (13-DEs)		+	Elements of Product preference (42-PEs)		=	Elements of Customer satisfaction (55-CS)	
product demand (13) (Buying participant and Customer)			Product preference (42) (Buying participant) (Customer)				
User Goals	User Group	Security Aspects	Normalization	Work Habits		Work Time	
	Target						
	Type						
Technology Demand	Safety	Functional Aspects	security level	Alert		Address	
	Capabilities						
	Environments						
Product Resources	important Resources	Design Aspects	Integrated	Customization		Teamwork	
	Resources Guarantee						
	Demand Source						
Purchase Impact	Group Influence	Brand Aspects	Updated	Visual		Keyboard	
	Services						
	Price						
	Size						
		Economic Aspects	Usability	Personalized		Speech	
		Service Preference	Brand	Concept		Touch	
			Budget	Concept		Failure	
			Experts	Feedback		Access	
			Delivery	Intelligent		Stay	
			Remote	Onsite		Theme	
			Aftersales			Colour	
						Layout	
						Rate	
						Robot Frequency	
						Robot Time	
						Field Frequency	
						Field Time	
						Remote Frequency	
						RemoteTime	

Figure 5.2 : The Elements of Product Demand and Preference
(Source by author)

Figure 5.2 show an establishment of Customer Satisfaction (CS) Decision-Making Framework, where Product Demand (PD) and Product Preference (PP) collectively determine Customer Satisfaction (CS). PD represents fundamental requirements such as user goals, technology demand, product resources, and purchase impact, covering elements like Price, Services, and Group Influence. PP reflects customer expectations across security, functional, design, brand, economic, and service aspects, incorporating factors such as customisation, usability, budget, experts, and delivery. The integration of PD and PP shapes CS, which is assessed through work habits, operating habits, interface preferences, and assist services (e.g., teamwork, speech, touch, layout, and remote frequency). This structured approach provides a clear analytical framework, offering a systematic foundation for understanding customer needs, optimising product strategies, and enhancing market competitiveness. By mapping the elements of Product Demand (PD) and Product Preference (PP), suppliers can gain a comprehensive and systematic understanding of the key factors that enterprise customers are concerned about in the procurement process. This not only helps the suppliers to accurately grasp the specific needs of their customers, but also enables them to adjust in product design, resource allocation and marketing strategies that are more in line with their customers' expectations, thus enhancing product matching and increasing the likelihood of closing a deal.

Proper demand and preference analysis is the only way to optimise the purchasing process for enterprise customers, making it more efficient and transparent. By clarifying customers' core needs and preferences, suppliers can quickly screen and recommend eligible products, reducing repeated communication and adjustments due to information asymmetry in the procurement process of enterprise customers, thus

shortening decision-making time and lowering transaction costs. In addition, data-driven analysis can also help suppliers continuously optimize their products and services to improve market competitiveness, while enhancing customer stickiness and promoting the establishment of long-term cooperative relationships. Ultimately, this procurement model based on precise matching of needs not only improves procurement efficiency, but also significantly increases overall customer satisfaction.

5.3.2 Construct the Framework

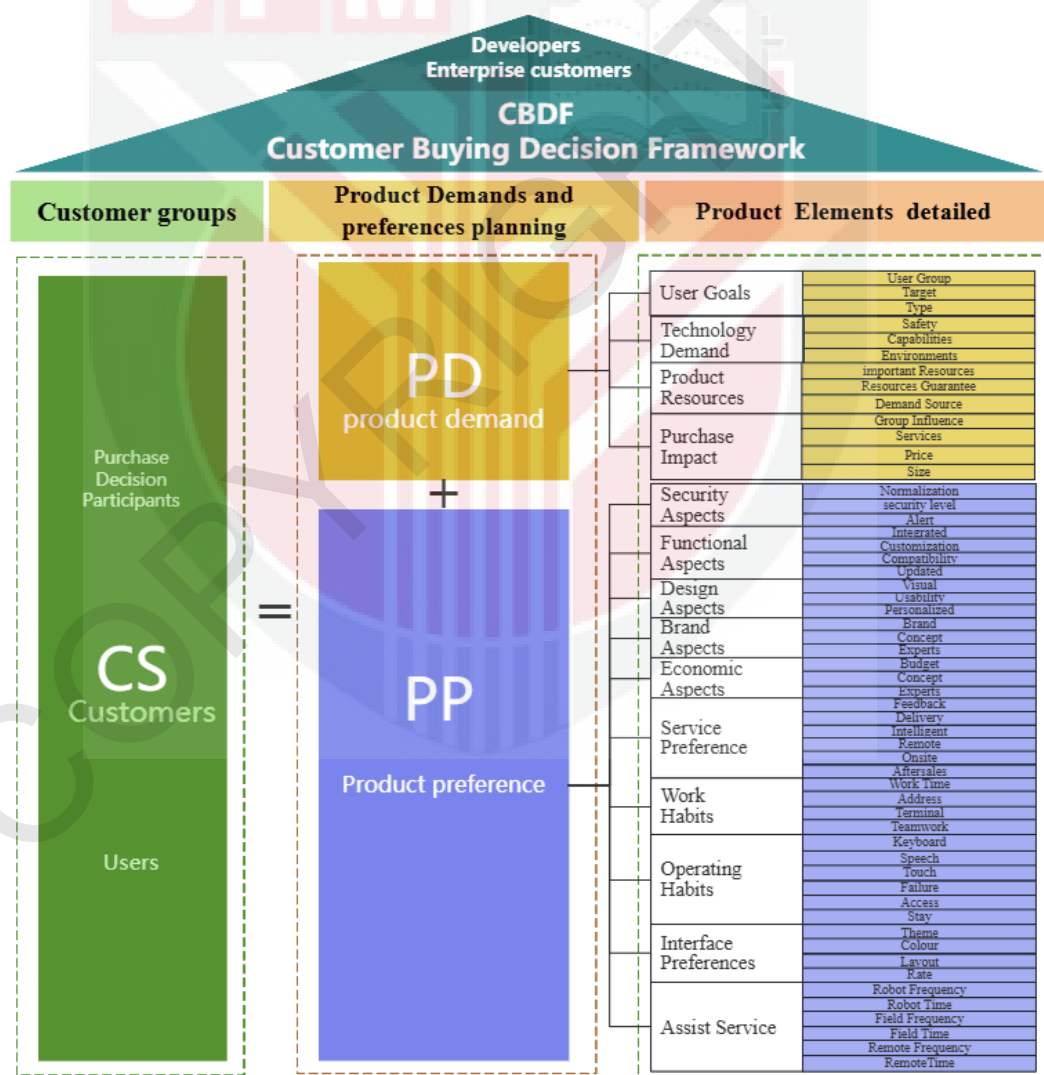


Figure 5.3 : Customer Buying Decision Framework
(Source by author)

Figure 5.3 Framework diagram shows the Buying Decision Framework (CBDF) house architecture with a clear and hierarchical core structure. The foundation (CS: Customer Group) shows that the customer is the root of the decision, and all analysis is carried out in a customer-oriented manner. The main framework (PD: Product Demand + PP: Product Preference), Demand (PD) determines the basic functions, such as the wall structure of the house, to ensure stability and practicality; Preference (PP) is like the decoration and layout, so that it is more in line with the personal or preferences. The roof (CBDF overall framework), the unified coordination of customer groups, needs and preferences, the formation of a complete purchase decision system to feedback customer satisfaction. Ultimately the framework serves developers and corporate clients, as well as related stakeholders. In addition, the framework effectively depicts the relationship between needs and preferences (factors, elements), and the structure helps to fully understand and discover more details about the satisfaction of customer segments in the purchasing decision process. This framework is like a strong and flexible house, with the core objective of systematically analysing the customer's buying decision process, providing companies with a clear idea of decision-making through the combination of product needs and product preferences, while being able to adapt to market changes and continuously optimise the customer experience.

5.3.3 Framework Process for Customer Purchase Decision

The customer purchase decision process is a complex process involving multiple stages such as customer perception of needs, solution evaluation, decision making, purchase evaluation and purchase implementation. Enterprises need to understand the various aspects of the customer purchase decision process, and through effective

marketing strategies and service support, to guide the customer to complete the purchase behaviour, and establish a long-term cooperative relationship. As shown in the Figure 5.4, Purchase decision process:

- a) Identify the problem - Identifying the problem is the starting point of the decision-making process, and at this stage, clarifying product needs is key. For example, technology needs, resource needs, etc., help decision makers determine the type and range of products that need to be purchased.
- b) Organise buying participants - When organising a buying team, product preferences may influence the composition of participants. Certain individual characteristics (e.g., professional background, experience, preferences, etc.) may influence the composition of the team and their perceptions of the product.

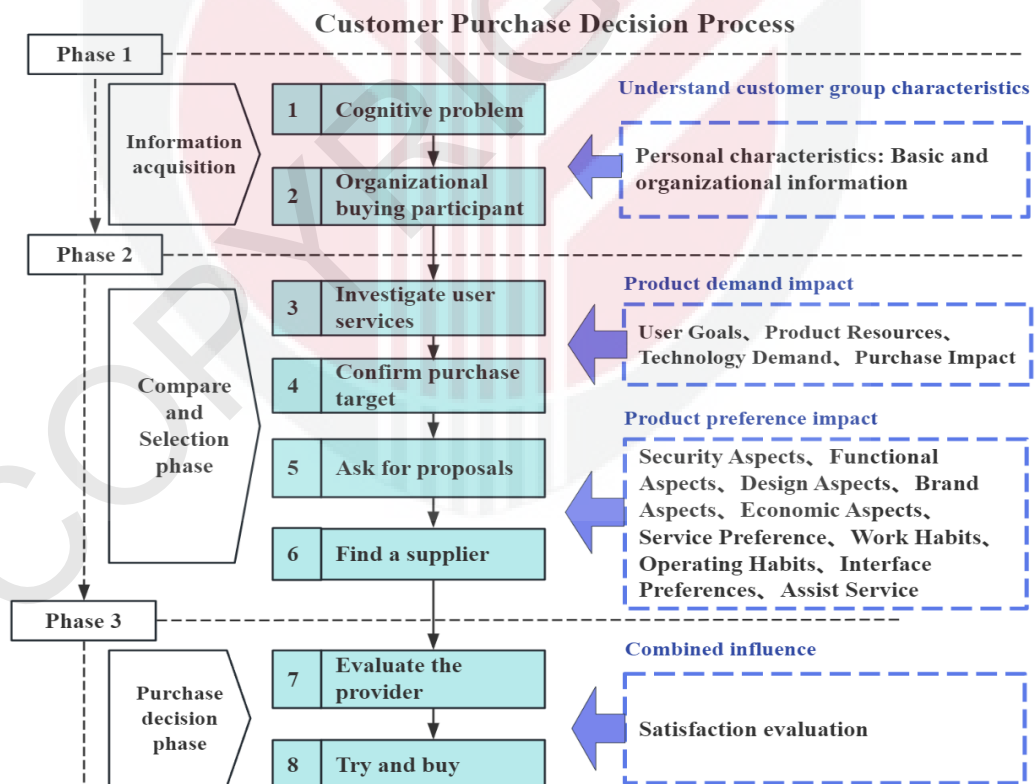


Figure 5.4 : Customer Purchase Decision Process
(Source by author)

- c) Investigating user business situations - For investigating the user business situation, product requirements help define the expectations and needs of the business. For example, determining what kind of functionality, performance, etc. the user needs will guide the subsequent steps of the decision process.
- d) Confirmation of purchase objectives - Confirming the purchase objective is a key step in the decision process. This objective is directly driven by product requirements. Clarifying the objective helps to prioritise purchases and the direction of future product design and development.
- e) Sourcing suppliers - Product preferences play a key role in this stage. The customer's brand preferences, design preferences, safety awareness, etc., will influence the type of supplier they choose. Whether the supplier matches the customer's brand image and design philosophy will determine whether they are shortlisted or not.
- f) Elicitation of programs - When soliciting solutions, the customer's product needs and preferences will directly influence the evaluation criteria. For example, the user's technical and resource requirements for the product, as well as branding and design preferences, will determine the evaluation and selection of providers.
- g) Provider or competitor evaluation - In this phase, the decision team will evaluate providers based on product needs and preferences. Factors such as technology, resources, and price will determine the viability of the provider, while factors such as branding, safety, and service will influence the customer's final choice.

Taken as a whole, product requirements define the functionality and performance that customers expect from a product, while product preferences determine the branding and design preferences of customers. Together, these two (2) influence the buying decision process, ensuring that customers get the products they need and love. They are both the foundation and driver of the decision process. Ensuring that product needs

are clear, and preferences are clear helps to make better buying decisions. Customer satisfaction and loyalty are directly dependent on these factors, so their importance throughout the decision-making process cannot be overlooked.

5.4 The Validation of a New Framework by AHP Method

Fuzzy comprehensive evaluation method of customer satisfaction, establishment of AHP hierarchy building and fuzzy comprehensive evaluation flow, determination of subjective and objective weights through AHP expert scoring and random forest importance prediction, calculation, and processing of fuzzy comprehensive evaluation results at customer level after synthesising the final weights (Li et al., 2021; Wang et al., 2024). The flow includes the synthesis of subjective and objective factors to make the weight allocation more scientific and reasonable, combines expert knowledge and data-driven prediction models, and improves the accuracy and reliability of the evaluation results.

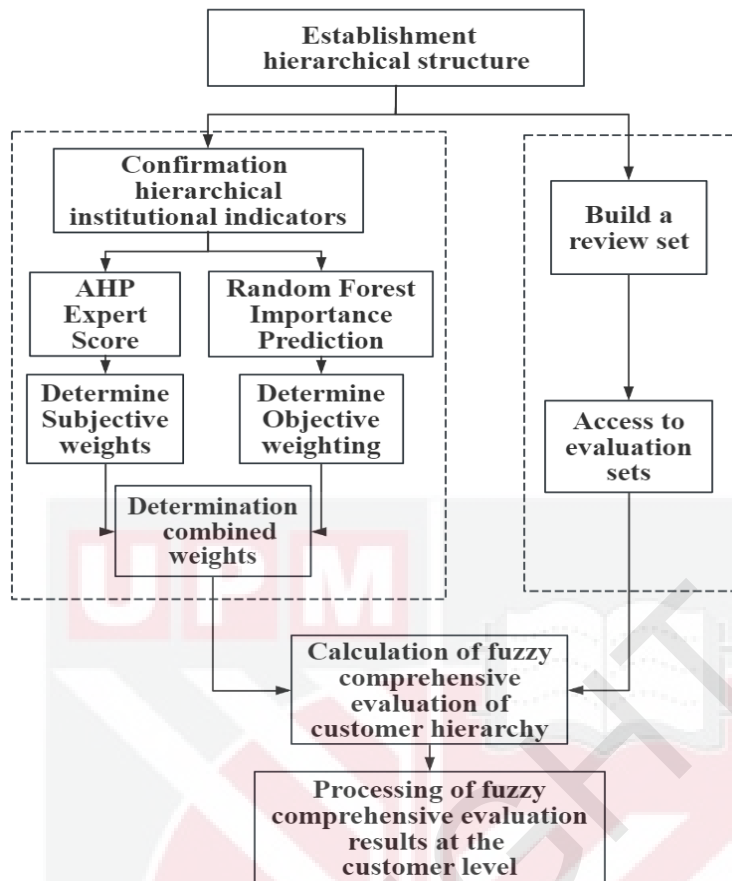


Figure 5.5 : Fuzzy Comprehensive Evaluation Method for Customer Satisfaction
(Source by author)

5.4.1 Analytic Hierarchy Process

Hierarchical analysis is a multi-objective decision analysis method (Xu et al., 2022) proposed by Professor T.L Saaty of the University of Pittsburgh in the early seventies, it is a simple method of quantitative analysis of non-quantitative events in systems engineering, and it is also an effective method of objective description of people's subjective judgement, the hierarchical analysis method (AHP) firstly breaks down the complex problem into various constituent factors, and groups these factors into an orderly hierarchical structure according to the dominant relationship. Hierarchical analysis (AHP) first breaks down a complex problem into its constituent factors, groups these factors according to their dominance to form an orderly hierarchical

structure, determines the relative importance of the factors in the hierarchy by comparing two by two, and decides the order of relative importance of the factors in decision-making by combining the judgement of many people. Hierarchical analysis can closely link the subjective judgement and reasoning of the decision maker, and quantitatively describe the reasoning process of the decision maker (Li et al., 2024). The AHP method embodies the basic features of decomposition, judgement, and synthesis in the decision-making thinking process, and it is a kind of multi-criteria decision-making method with many characteristics and advantages, and therefore it has been widely used in recent years (Schurz et al., 2021).

The basic idea of hierarchical analysis is that, according to the nature of the analysed object and the overall goal of decision-making or evaluation, the various influencing factors in the overall phenomenon are structured by dividing them into interrelated and orderly levels. Firstly, according to the interconnectedness and affiliation of the factors, the factors are assembled and combined at different levels to form a multi-level analytical structure model. Secondly, based on the subjective judgement of the objective phenomenon, the relative importance of the factors at each level is quantified. Finally, mathematical methods are used to determine the value of the order of relative importance of all factors at each level. In other words, the hierarchical analysis method is a multilevel analysis structure, which is ultimately reduced by the systematic analysis to the problem of determining the value of the relative importance of the lowest level in relation to the highest level, or the ranking of the relative advantages and disadvantages.

- a) Basic process of AHP Hierarchical Analysis Method:
- i) Establishing a Hierarchical Model - This is the first step of hierarchical analysis. After in-depth analysis of the problem to be studied, the factors included in the problem are divided into different levels, including the highest level, the middle level, and the lowest level (Xu et al., 2022). The top level is the goal level, which represents the goal that the decision maker wants to achieve; the middle level is the criterion level, which represents the discriminatory criteria for measuring whether the goal has been achieved or not; and the bottom level is the scenario level, which represents the alternatives available. The lines between the layers indicate the correlation of the elements between the upper and lower layers. Factors at the same level are used as criteria for comparison and evaluation, and some factors at the next level are dominant and subordinate to those at the previous level. For complex decision-making problems, the goal may be more than one, then the goal layer can be expanded into two layers, the first layer for the overall goal, the second layer for the sub-goals side by side; the criteria may also be more than one layer, can also be divided into guidelines and sub-criteria layer, and so on.
 - ii) Constructing judgement matrix - After establishing the hierarchical model, the affiliation of factors between the upper and lower levels is determined (Chen, et al., 2023). On this basis, it is necessary to judge the relative importance of each factor in each level. In the hierarchical analysis method, to make the judgement quantitative, these judgements by introducing the appropriate scale with a numerical value, written as a judgement matrix A. Judgement matrix A indicates that for the previous level of a factor, the level and the relative importance of the factors related to the two-two comparisons between the factors, the judgement matrix is usually used in the 1-9 scale method.
 - iii) Consistency test of judgement matrix - Due to the differences and subjectivity of experts in making judgements (Sato & Tan, 2023), some values in the judgement matrix may be inconsistent, i.e., when $A > B$,

$B > C$, $A < C$ may occur. When $A > B$ and $B > C$, there may be a situation that $A < C$. If the judgement matrix is not consistent, it may lead to invalid judgement matrix. If the judgement matrix is not consistent, the judgement matrix may be invalid, and the correct conclusion cannot be reached. Therefore, we need to check the consistency of the judgement matrix. In hierarchical analysis, C is used as the consistency index of judgement matrix:

b) AHP hierarchical analysis related methods

- i) Weight vector calculation method - The algorithm of weight vector under single person and single criterion is the basic link to synthesise the weight vector. Some common algorithms for weight vector under single person and single criterion are eigenvector method, which determines the weight vector by constructing the judgement matrix and calculating the eigenvector corresponding to its largest eigenvalue, which can better reflect the subjective judgement of the decision maker and has mathematical rigour. When there are large inconsistencies in the judgement matrix in AHP, the logarithmic least squares method can improve the stability and accuracy of the weight calculation. Algorithms for weight vectors under multiple people and single criterion are mostly a topology of weight vector algorithms under single people and single criterion, which can be broadly divided into three categories: topology optimisation algorithms, judgement matrix synthesis methods, and weight vector synthesis methods.

Topological optimisation algorithms, which are suitable for a variety of multi-objective optimisation problems and decision analysis, are used for a variety of multi-objective optimisation problems and decision analysis and are more computationally intensive when dealing with complex multi-objective problems, which may require more computational resources and time. Judgement matrix synthesis method based on pairwise comparison, constructing judgement matrix, can deal with a variety of

complex decision-making problems, suitable for multi-criteria analysis, higher requirements for one consistency, dependent on subjectivity. Weight vector synthesis method, suitable for multi-source data synthesis, multi-criteria decision-making for the synthesis of multiple weight vectors, through the weighted average of multiple weight vectors or other synthesis methods, to get a comprehensive weight vector. Common methods include weighted average method, geometric average method, etc., which can handle weight vectors from multiple sources and are suitable for multi-criteria analysis.

- ii) Combination of subjective and objective - In the actual statistical analysis work, often encountered in the comprehensive evaluation of multiple indicators and multi-objective decision-making problems, and at this time, to determine the weights of the indicators is a very important and very tricky problem. Usually when determining the weights, the method of empirical judgement is more often used, and the reasonableness of the weights will directly affect the final evaluation and analysis results. Because the method of empirical judgement is greatly influenced by subjective factors, sometimes it is difficult to grasp its objective rationality, and thus an objective quantitative analysis is needed.

In the fuzzy comprehensive evaluation, the weight will have a great influence on the final evaluation results, and different weights will sometimes lead to completely different conclusions. different weights will get completely different conclusions. The method of determining weights mainly includes two (2) categories: subjective weight assignment method and objective weight assignment. Subjective weighting methods mainly include the hierarchical analysis (AHP) method, expert scoring method, and so on. Commonly used objective assignment methods include principal component

analysis, entropy value method, deviation and mean square deviation method, multi-objective planning, and weighting method proposed by Professor Jin Ju Liang.

5.4.2 Fuzzy Integrated Assessment Algorithm

The concept of fuzzy sets was proposed in 1965 by Professor L.A. Zadeh, an American expert in automatic control, to express the uncertainty of things (Cao et al., 2022). The development of fuzzy mathematics has not only accumulated a wealth of theoretical results, but also its application involves almost every field of natural and social sciences. Especially in recent years, fuzzy theory and neural networks, knowledge engineering, genetic algorithms and reliability theory and other disciplines of the mutual combination of the formation of several types of broad prospects for the new field of research; in the application of a variety of fuzzy chips, fuzzy technology development tools and other fuzzy hardware and fuzzy software products appeared one after another, foreshadowing a new fuzzy technology industry's rise. Fuzzy technology will become the core technology of the new century, this technology is also more and more scientific and technological workers and entrepreneurs pay attention to, so a lot of institutions of higher learning in the postgraduate students and senior undergraduates in the opening of the fuzzy maths course, which undoubtedly has a very positive significance for the accelerated development of fuzzy theory.

a) Fuzzy comprehensive evaluation method

- i) Establish element set E - Evaluation objectives are determined in accordance with the characteristics of the evaluation object and the purpose of the evaluation. The assessment objective is the top-level structure of the set of evaluation elements, and the top-level assessment objective is decomposed into several specific evaluation indicators to form the structural hierarchy of the set of evaluation elements, which is

constructed based on the decomposed evaluation indicators. The set of evaluation elements can be expressed as a hierarchical structure, with the evaluation objective at the top, several subobjectives at the middle and specific evaluation indicators at the bottom. Establish $E = e_1, e_2, e_3, \dots, e_m$ is the element in the evaluated object, i.e., the evaluation indicator, and m is the number of evaluation elements, each group of research objects consists of m elements and is influenced by these elements.

- ii) Establish evaluation sets U - Evaluation sets are used to define the evaluation level of an evaluation indicator, also known as a judging grade or evaluation criteria. The evaluation results of each indicator will fall on a certain level of this evaluation set. Set $U = u_1, u_2, u_3, \dots, u_n$ for each element in the state of satisfaction N grades. There are many ways to establish evaluation grades, such as expert evaluation, frequency judgment, binary judgment, and other methods. Common evaluation grades can be 5 or 3 grades, such as “excellent”, “good”, “moderate”, “pass”, “fail”.
- iii) Constructing the Fuzzy Set of element weights W - Weights, also known as weights, are estimates that characterize the relative importance of each element of evaluation, The weight allocation set is represented as $W = [w_1, w_2, \dots, w_n]$, w_i is the importance data value for the i th element in the element set. There are many commonly used weight confirmation methods, and expert estimation methods can be used. This method depends on the knowledge and experience of experts in the field, and the weight of each evaluation index can be judged by the expert group. It can be obtained through customer research data performance combined with expert opinions.
- iii) Calculate element weight importance C_m - After the establishment of E and W , the element can be calculated according to the principle of fuzzy transformation C_m .

$$C_m = W \otimes E \quad (5.1)$$

W is a weight matrix that represents the weights of individual elements. E is an evaluation matrix that represents the evaluation value of each element.

- iv) Calculating the comprehensive fuzzy evaluation matrix C - Therefore $C = [c_{01}, c_{02} \dots c_m]$ is the result of a comprehensive evaluation, c_m is a fuzzy evaluation of the m th element in the test data, The results of the satisfaction evaluation at multiple levels are as follows:

$$C = \begin{bmatrix} C_1 \\ C_2 \\ \dots \\ C_m \end{bmatrix} = \begin{bmatrix} c_{11} & c_{12} & \dots & c_{1m} \\ c_{21} & c_{22} & \dots & c_{2m} \\ & & \dots & \\ c_{m1} & c_{m2} & \dots & c_{mm} \end{bmatrix} \quad (5.2)$$

- v) Confirmation of fuzzy decision results - Acknowledging the affiliation, in R $0 < r_{ij} < 1$, $[r_{ij}]$ represents affiliation to S_j
- c) Calculation of the assessment level
- i) Establishing the evaluation level S - Evaluate the comprehensive elements of satisfaction in the institution, Generally, they can be evaluated on four scales: “very satisfied”, “satisfied”, “dissatisfied”, and “very dissatisfied”. Therefore, N experts are invited to establish an evaluation grade matrix for the comprehensive evaluation $S = [S_1 \ S_2 \ S_3 \ S_4]$.
- ii) Establishment of Fuzzy relationship proof R - The calculation is performed by means of the affiliation function (Laursen et al., 2021), if for any element x in the domain (range of the study) U, there is a number $A(x) \in [0, 1]$ corresponding to it, then A is said to be a fuzzy set on U, and $A(x)$ is called the degree of affiliation of x to A. When x varies in U, $A(x)$ is a function, called the affiliation function of A. Affiliation degree $A(x)$ is closer to 1, that x belongs to the higher degree of A, $A(x)$ is closer to 0 that x belongs to the lower degree of A. Commonly used assignment type affiliation function calculation can be used “trigonometric function” “trapezoidal function” to calculate the degree

of affiliation. Degree of affiliation function, it applies to asymmetric distribution, applicable to a clear upper and lower boundaries, and there is a section of the interval in the middle of the data is completely credible, because the data in this paper belongs to the asymmetric, and most of them are from dissatisfaction to the process of satisfaction before purchase, suitable for the trapezoidal fuzzy function, the function of the $0 < R_A < 1$, the analytical formula for:

$$R_A = \begin{cases} 1 & (x < a) \\ \frac{b-x}{b-a}, & (a \leq x \leq b) \\ 0 & (x > b) \end{cases} \quad (5.3)$$

$$R_A = \begin{cases} 1, & (b < x \leq c) \\ \frac{x-a}{b-a}, & (a \leq x \leq b) \\ \frac{d-x}{d-c}, & (c < x \leq d) \\ 0, & (x < a, x \geq d) \end{cases} \quad (5.4)$$

$$R_A = \begin{cases} 0 & (x < a) \\ \frac{x-a}{b-a}, & (a \leq x \leq b) \\ 1 & (x > b) \end{cases} \quad (5.5)$$

Calculate sequentially to obtain a fuzzy relationship matrix R , $R = [r_{mn}]$ Fuzzy

Relationship Matrix In the evaluation, the response factor is a transformation

relationship of the membership degree at all levels, The analytic formula is:

$$R = \begin{bmatrix} r_{11} & r_{12} & r_{13} & r_{14} & \dots & r_{1j} \\ r_{21} & r_{22} & r_{23} & r_{24} & \dots & r_{2j} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ r_{m1} & r_{m2} & r_{m3} & r_{m4} & \dots & r_{ij} \end{bmatrix} \quad (5.6)$$

5.4.3 Fuzzy Comprehensive Evaluation of Customer Satisfaction

Customer satisfaction assessment and customer needs have significant fuzzy characteristics, and these ambiguities can be effectively dealt with through the fuzzy comprehensive evaluation method, so that enterprises can be more scientific and accurate in assessing and satisfying customer needs, thus enhancing customer satisfaction and enterprise competitiveness.

- a) Ambiguous features in satisfaction assessment
 - i) Uncertainty and subjectivity - Customer satisfaction is usually influenced by personal emotions and subjective judgements. Each customer's feelings and evaluation of the same product or service may differ significantly, so there is a high degree of uncertainty and subjectivity in satisfaction assessment. The fuzzy comprehensive evaluation method can deal with this uncertainty by expressing customers' fuzzy perceptions of different satisfaction levels through fuzzy sets and affiliation functions.
 - ii) Fuzzy affiliation - In traditional satisfaction assessment, customer satisfaction is usually categorised into definite levels (e.g., "very satisfied", "satisfied", "average", "unsatisfied", "very unsatisfied"). However, customer satisfaction is often vague. For example, a customer may consider a product to be somewhere between "satisfied" and "very satisfied". A fuzzy affiliation function can accurately describe this ambiguity and bring the evaluation results closer to the customer's true feelings.
 - iii) Complexity and multidimensionality - Customer satisfaction involves multiple dimensions, such as product quality, service attitude, price, delivery time and so on. There are interrelatedness and complexity in the satisfaction evaluation of each dimension. The fuzzy comprehensive evaluation method can consider the fuzzy evaluation of multiple dimensions and provide comprehensive satisfaction assessment results.

b) Fuzzy characteristics of customer needs

- i) Diversity and dynamics - Customer needs are diversified and dynamically changing, and the needs of different customers may be different at different times and in different situations. The fuzzy comprehensive evaluation method can flexibly adapt to the changes in customer needs and reflect the current customer needs by constantly adjusting and updating the fuzzy rules.
- ii) Ambiguity and vagueness - Customers often express their needs with ambiguity and vagueness. For example, customers may say “I want the product to be cheaper” or “I want the service to be better”, which are fuzzy and difficult to be quantified by precise figures. The fuzzy comprehensive evaluation method transforms these fuzzy demands into operational evaluation indexes through the fuzzy set theory.
- iii) Individuality and complexity - The needs of different customers are individualised and sometimes there may be contradictions between the needs. For example, some customers want high-quality products at low prices, while others attach more importance to brands and services. The fuzzy integrated evaluation method can provide a reasonable integrated evaluation result when dealing with these complex and contradictory needs.

The traditional method of enterprise satisfaction assessment is to obtain the assessment information by distributing questionnaires or interviews, and to statistically analyse the assessment information manually or by computer, which consumes a lot of time and energy, and the accuracy of the assessment cannot be guaranteed. Fuzzy comprehensive assessment is a quantitative assessment method, in which the assessor starts from the main factors affecting the problem, refers to the relevant data and situations, makes different degrees of fuzzy assessment of the complex problem according to the judgement, and then performs calculations by means of the methods

provided by fuzzy mathematics to arrive at the quantitative comprehensive assessment results. The fuzzy comprehensive assessment method is a method of using fuzzy mathematical methods to deal with complex phenomena with multiple factors, indicators, and variables. It is difficult to solve the comprehensive assessment problem of multi-factors, different weights, and rating scales with classical mathematical methods, but fuzzy mathematics provides a theoretical basis for solving the fuzzy comprehensive assessment problem, to find an effective and simple assessment method: when the assessment indexes are increased, the complexity of the problem does not increase, and the increase is only in the amount of computation. The designed fuzzy comprehensive evaluation algorithm is based on the use of computers to obtain information, sales, and product personnel to view and analyse the evaluation results at any time, and to support the processing of a large amount of data for rapid processing. Therefore, it is more effective to choose the fuzzy comprehensive assessment method.

5.5 Customer Satisfaction Hierarchy Indicator System Construction

The process of purchasing decision is a complex systematic project, in addition to involving more influencing factors, more indicators and more objective conditions, the continuous optimisation of the target is also a difficult point, in order to achieve the optimisation of the satisfaction target of different groups of customers, it is necessary to carry out an in-depth analysis of a lot of indicators, and to give different weights to each indicator, so as to reflect the degree of importance of the different indicators. The construction of the evaluation index system needs to follow the principles of completeness, independence, representativeness, comparability, operability, and conciseness. According to the overall goal of the project, it is divided into several criteria layers, and then decomposed layer by layer to determine the

indicator system Finally, a six-layer architecture system and a four-layer indicator system are determined.

5.5.1 Customer Satisfaction Hierarchy

In this paper, customers in the purchase decision-making process of the construction of the evaluation index system is not subjective, but through the enterprise customer project practice process is fully analysed, and through the data research and verification, satisfaction model predicts the degree of contribution, based on the expert supervisors to analyse, and verify the objective data, and ultimately build the hierarchical structure.

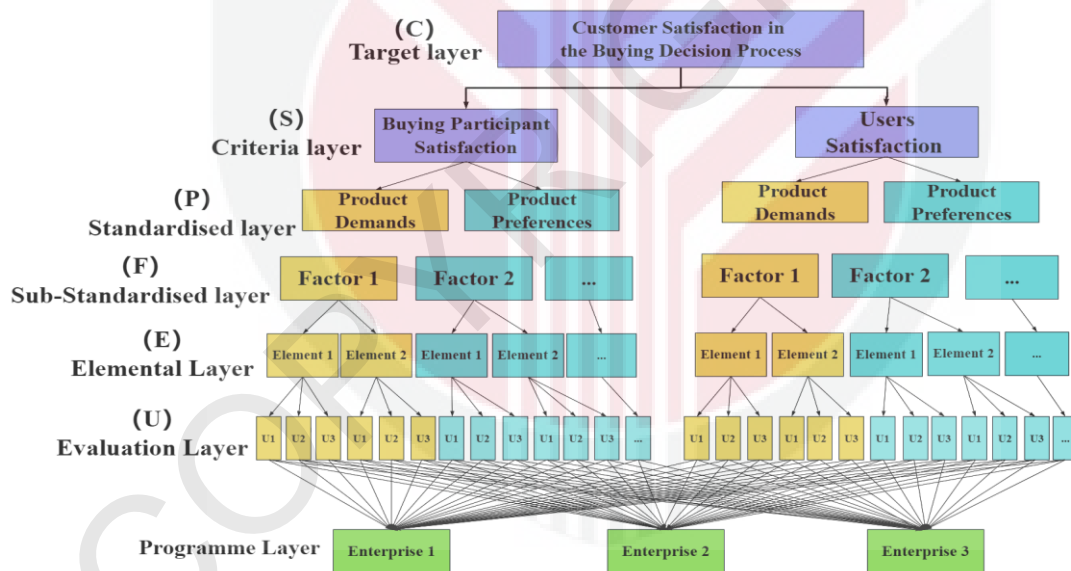
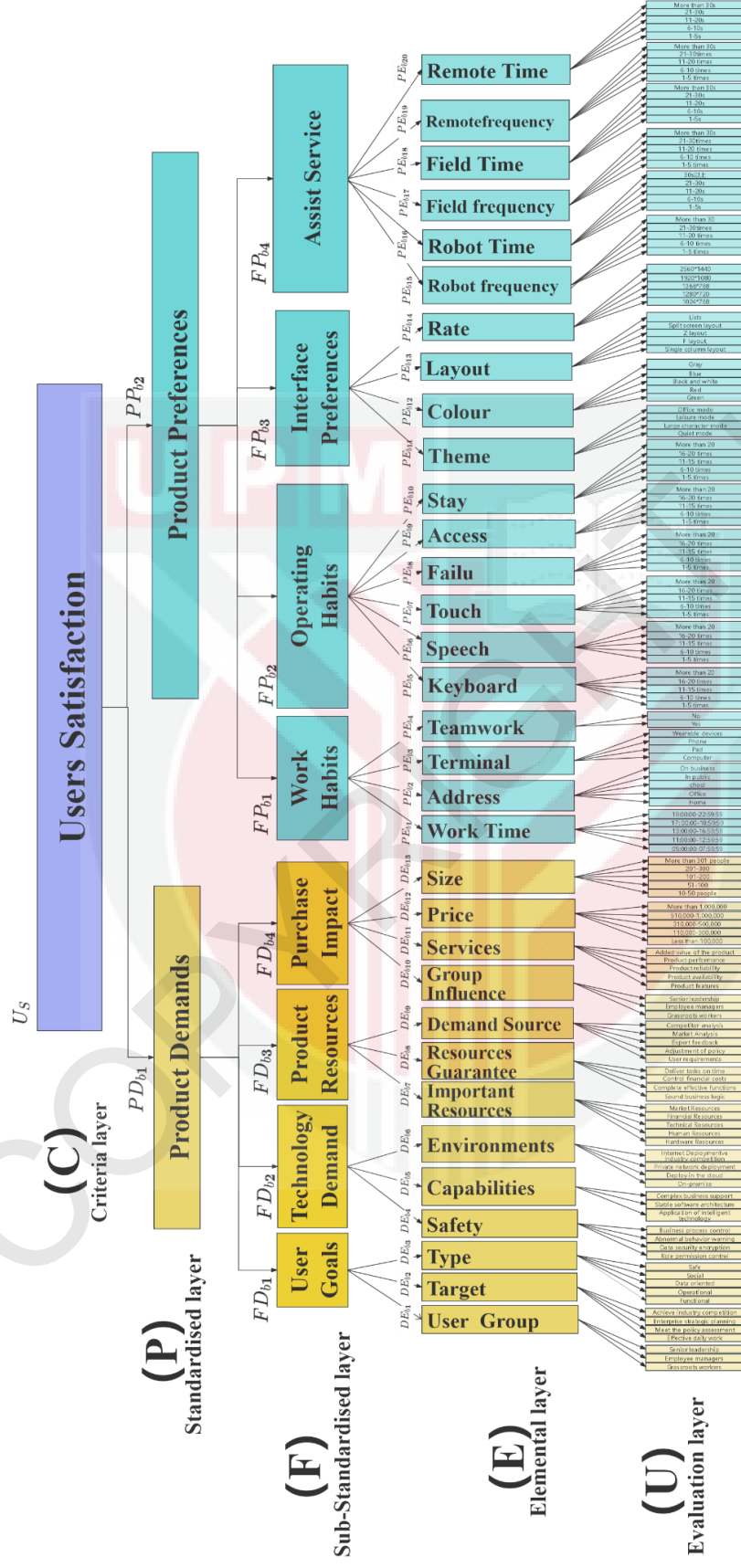


Figure 5.6 : Customer Satisfaction Hierarchy
(Source by author)

- a) The final confirmation is a 6-Layer System - Target level, Customer Satisfaction in the Buying Decision Process; Criteria layer including Buying Participant Satisfaction, Users Satisfaction; Standardised layer is the main standard classification for customer satisfaction, including product demand

and product preference; Sub-Standardised layer is mainly the key factors affecting customer groups; Elemental level is based on the dismantling of the factors around the key influencing elements; Evaluation level is based on the key evaluation items established by the elements, which are directly related to the actual scope of customer work. Evaluation level is the key evaluation items established around the factors, which are directly related to the actual scope of work of the customers. The last layer is the Programme level, which indicates that the product can be used by different enterprises to obtain different data.





- b) Multilevel detail - With the above figure, in this multi-level structural model, our complex problem is decomposed into multi-level components. These elements in turn form several levels according to their attributes and relationships. The content of the next level governs the relevant content of the previous level. For example, the overall goal level is the satisfaction of the purchasing participant or user, which is subdivided into two main sub-goals: product demand and product preference. Each sub-goal is further divided into multiple standardised indicators (e.g., user goals, technical requirements, safety aspects, functional aspects, etc.), and each standardised indicator is further subdivided into specific sub-standardised indicators, which are eventually refined into specific elements. At the bottom is the evaluation layer, which is used to collect and calculate evaluation data for each specific element. This multi-layered structure helps to systematically analyse and assess customer needs and preferences, thus providing companies with suggestions for improvement.

5.5.2 Customer Satisfaction Indicator System

Indicator construction is a systematic analysis of the purchase process, according to the AHP analysis of the decision-making rules to structure the problem, hierarchical, construct a hierarchical indicator model. By relying on the confirmation of the final experts to ensure that the evaluation index system is effective and feasible, only in this way can the customer satisfaction evaluation index system as a purchase decision-making process to evaluate the most powerful evaluation factors indicators.

Table 5.4 : Customer Satisfaction Indicator System

		Level 1 Indicator	Level 2 Indicator		Level 3 Indicator	
Target Layer (C)	Criteria Layer (S)	Standardise d Layer (P)	Sub-Standardised Layer (F)		Elemental Layer (E)	
Customer Satisfaction in the Buying Decision Process (Cs)	Buying Participants Satisfaction (Bs)	Product Demand (PD _{a1})	FD _{a1}	User Goals	DE _{a1}	User Group
					DE _{a2}	Target
					DE _{a3}	Type
			FD _{a2}	Technology Demand	DE _{a4}	Safety
					DE _{a5}	Capabilities
					DE _{a6}	Environments
			FD _{a3}	Product Resources	DE _{a7}	Important Resources
					DE _{a8}	Guarantee
					DE _{a9}	Demand Source
			FD _{a4}	Purchase Impact	DE _{a10}	Group Influence
					DE _{a11}	Services
					DE _{a12}	Price
					DE _{a13}	Size
		Product Preferences (PP _{a2})	FP _{a1}	Security aspects	PE _{a1}	Normalisation
					PE _{a2}	Security Level
					PE _{a3}	Alert
			FP _{a2}	Functional Aspects	PE _{a4}	Integrated
					PE _{a5}	Customisation
					PE _{a6}	Compatibility
					PE _{a7}	Updated
			FP _{a3}	Design Aspects	PE _{a8}	Visual
					PE _{a9}	Usability
					PE _{a10}	Personalised
			FP _{a4}	Brand Aspects	PE _{a11}	Brand
					PE _{a12}	Concept
					PE _{a13}	Experts
	FP _{a5}	Economic Aspects	PE _{a14}	Budget		
			PE _{a15}	Payment		
			PE _{a16}	Cycle		
	FP _{a6}	Service Preference	PE _{a17}	Feedback		
			PE _{a18}	Delivery		
			PE _{a19}	Intelligent		
PE _{a20}			Remote			
PE _{a21}			Onsite			
PE _{a22}			Aftersales			
Users Satisfaction (Us)	Product Demand (PD _{b1})	FD _{b1}	User Goals	DE _{b1}	Groups	
				DE _{b2}	Target	
				DE _{b3}	Type	
		FD _{b2}	Technology Demand	DE _{b4}	Safety	
				DE _{b5}	Capabilities	
				DE _{b6}	Environments	
		FD _{b3}	Product Resources	DE _{b7}	Important Resources	

Table 5.4 : Continued

					DE _{b8}	Guarantee
					DE _{b9}	Demand Source
					DE _{b10}	Group Influence
					DE _{b11}	Services
					DE _{b12}	Price
					DE _{b13}	Size
		Product Preferences (PP _{b2})	FP _{b1}	Work Habits	PE _{b1}	Work Time
					PE _{b2}	Address
					PE _{b3}	Terminal
					PE _{b4}	Teamwork
			FP _{b2}	Operating Habits	PE _{b5}	Keyboard
					PE _{b6}	Speech
					PE _{b7}	Touch
					PE _{b8}	Failure
					PE _{b9}	Access
					PE _{b10}	Stay
			FP _{b3}	Interface Preferences	PE _{b11}	Theme
					PE _{b12}	Colour
					PE _{b13}	Layout
					PE _{b14}	Rate
			FP _{b4}	Assist Service	PE _{b15}	Robot Frequency
					PE _{b16}	Robot Time
					PE _{b17}	Field Frequency
					PE _{b18}	Field Time
					PE _{b19}	Remote Frequency
					PE _{b20}	Remote Time

(Source by author)

5.5.3 Matrix of Customer Satisfaction Indicator System

A multi-level evaluation system for assessing customer satisfaction. The following is an explanation of the indicator set for each level (The following is an example of a purchasing participant):

Level 5: Elemental Level

$$DE_{01} = [DE_{011} \ DE_{012} \ DE_{013}]$$

$$\vdots$$

$$DE_n = [DE_{n1} DE_{n2} \cdots DE_{nm}] \quad (5.7)$$

$$PE_{01} = [PE_{011} PE_{012} PE_{013}]$$

⋮

$$PE_n = [PE_{n1} PE_{n2} \cdots PE_{nm}]$$

DE_n represents the product demand element, PE_n Product Preference Elements.

DE_{nm} PE_{nm} Respectively represented target layer components. Each element is made up of evaluation layer factors.

Level 4: Sub-Standardised Layer

$$FD_n = \begin{bmatrix} DE_{01} \\ DE_{02} \\ DE_{03} \\ \cdots \\ DE_n \end{bmatrix} \quad (5.8)$$

$$FP_n = \begin{bmatrix} PE_{01} \\ PE_{02} \\ PE_{03} \\ \cdots \\ PE_n \end{bmatrix} \quad (5.9)$$

F_n representative factors, Sub-Standardised layer is composed of a product demand factor set, a product preference factor set, and a product element.

Level 3: Standardised Layer

$$P_D = [FD_1 FD_2 FD_3 \dots FD_n] \quad (5.10)$$

$$P_P = [FP_1 FP_2 FP_3 \dots FP_n] \quad (5.11)$$

P_D represents the set of product requirements, P_P represents a set of product preferences. Each consists of a set of factors against the target.

Level 2: Sub-Target Level

$$B_S = \begin{bmatrix} P_{D1} \\ P_{P1} \end{bmatrix} \quad (5.12)$$

$$U_S = \begin{bmatrix} P_{D2} \\ P_{P2} \end{bmatrix} \quad (5.13)$$

U_S represents the set of user satisfaction, B_S represents the set of purchase participant satisfaction.

Level 1: Target Level

$$C_S = [B_S \ U_S] \quad (5.14)$$

C_S represents the set of customer satisfaction, C_S include U_S B_S two sets of sets.

5.6 AHP Validation Results

5.6.1 AHP Hierarchy Indicator Weights

In the fuzzy comprehensive evaluation, the weights will have a great influence on the final evaluation results, and different weights will sometimes get completely different conclusions. different weights will get completely different conclusions. In the traditional evaluation system, more methods are developed to determine the weights of the indicators. The subjective factor assignment method refers to the subjective judgement of the weights of the factors in the object of analysis according to the degree

of their importance and according to the personal experience, which is more perfect and most widely used, but the objectivity is also poorer, such as the AHP, the ANP, and the expert marking method, etc. The objective factor assignment method refers to the method of arranging, counting, and classifying the objectively obtained information to obtain the weights of the information, and this method is more objective than the subjective assignment method. In order to obtain the data weighting method, this method is formed later and incomplete than the subjective empowerment method, which includes entropy weighting method, standard deviation method, grey clustering method, etc. In recent years, many scholars have studied the combination empowerment method. In recent years, many scholars have studied the combination of assignment and reached a consensus that the combination of objective weight assignment method and subjective weight assignment method can complement each other. Due to the unavoidable subjectivity of customer satisfaction evaluation, at the same time, to reduce the impact of subjective factors on the evaluation to be able to determine the weight of the customer evaluation system, this study adopts the fuzzy comprehensive evaluation method to quantify the factors of empowerment, and the use of objective and subjective combination of methods to determine the indicator weights objectively and accurately. Therefore, this paper chooses to adopt the widely used AHP method for subjective assignment, the entropy value method for objective, and the combination of assignment methods for the assignment of quantitative index weights.

5.6.2 AHP Weighting Process

AHP is a method that focuses on complex problems that are difficult to quantify. It can introduce quantitative analysis into the complex decision-making process and make full use of the preference information given by the decision maker in the two-by-two comparison for analysis and decision support, which effectively absorbs the results of qualitative analysis and gives full play to the advantages of quantitative analysis, thus making the decision-making process highly organised and scientific.

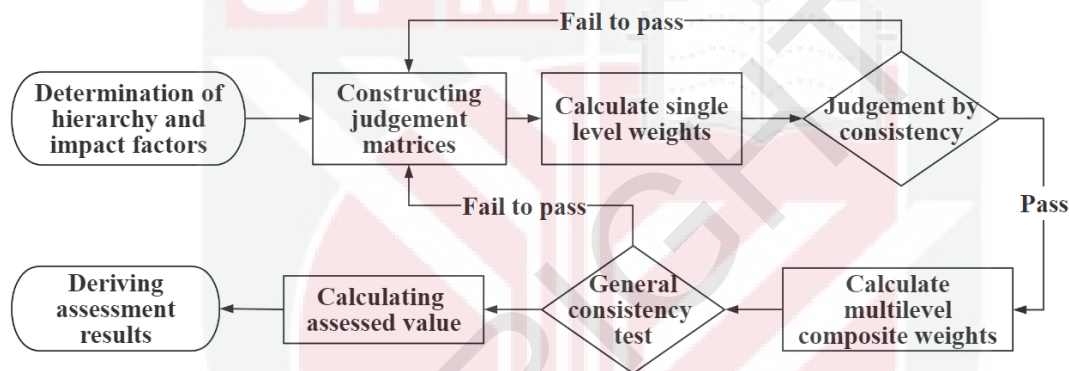


Figure 5.9 : AHP Weighting Process
(Source by author)

- a) Determination of the expert group - Because of HMC's nationwide service background, this is mainly for the medical product line business in North China covering more than 100 enterprises, considering that product development is a complex process of factors. Therefore, the invited experts are 15 experts from small and medium-sized enterprises to evaluate the indicators (see Table 5.5), which cover corporate executives, purchasing participants, business experts, experienced users, product managers, and sales staff. Ensuring that there are at least 2-3 experts in each key area, a moderate number of experts can provide diverse perspectives, reduce the bias of a single point of view, and improve the reliability of the evaluation results.

Table 5.5 : List of Experts

Expert Sources:	Expert	Quantity	Seniority	Age	Degree of Professionalism
Customer	Business executives	2	15-22	35-45	Very familiar
	Business Specialists	3	18-26	35-60	Very familiar
	Buying Participants	3	12-16	32-45	Very familiar
	User	3	8-12	32-45	Very familiar
Service	Product Manager	2	9-12	35-42	Very familiar
	Salespeople	2	7-12	35-42	Very familiar

(Source by author)

- b) Establishment of Judgement Comparison Matrix - Judgement matrix is the basic component of hierarchical analysis, the evaluation of indicators to build a judgement matrix, the fundamental role of the judgement matrix is to compare the indicators, so as to determine the size of its impact on the satisfaction, the use of Saadi scale to determine the value of the size of this impact, Saadi scale using the 9 scales 1-9 as the judgement of the elements of the judgement matrix scale, and with the help of the coefficient of trust, the final value of the impact is calculated. The final impact value is calculated by using the trust coefficient, and the Saadi scale is shown in Table 5.6 below.

Table 5.6 : Judgment Matrix Element Comparison Scale Table

No.	Scale meaning	Ratio
1	Former elements i and the latter elements j comparatively, i and j equally important	$a_{ij}=1$
2	Former elements i and the latter elements j comparatively, i and j slightly important	$a_{ij}=3$
3	Former elements i and the latter elements j comparatively, i and j obviously important	$a_{ij}=5$
4	Former elements i and the latter elements j comparatively, i and j strongly important	$a_{ij}=7$
5	Former elements i and the latter elements j comparatively, i and j absolutely important	$a_{ij}=9$
6	Represents the element I and j the importance lies somewhere in between	$a_{ij}=2,4,6,8$
7	If element i and j the relative importance scale is a_{ij} , then element j and I the relative importance scale is: $a_{ji}=1/a_{ij}$	Number of Collapses

(Source by author)

Each two elements in the matrix are judged according to the scale of the * in the above table, comparative judgment matrix A of order n can be obtained.

N judgment matrix

$$A_{n \times n} = \begin{bmatrix} a_{11} & a_{12} & a_{1..} & a_{1n} \\ a_{21} & a_{22} & a_{2..} & a_{2n} \\ a_{..} & a_{..} & a_{..} & a_{..} \\ a_{n1} & a_{n2} & a_{n..} & a_{nn} \end{bmatrix} \quad (5.15)$$

- c) Merge Expert Matrices - Merge expert matrices using geometric averaging, Will m specialists (m=1,2, k) The formed scoring matrix is multiplied bitwise, and then turned on the m power, get a unique integration matrix $\bar{A}$, The formula is as follows:

$$\bar{A} = (\prod_{k=1}^m a_{ij}^k)^{\frac{1}{m}} \quad (5.16)$$

- d) Calculate the relative weights of the judgment matrix - The weights of the ensemble unique matrix are calculated using the geometric mean method (square root method) as follows:

$$W_i = \frac{(\prod_{j=1}^n a_{ij})^{\frac{1}{n}}}{\sum_{i=1}^n (\prod_{j=1}^n a_{ij})^{\frac{1}{n}}}, \quad i = 1, 2, 3, \dots, n \quad (5.17)$$

Calculation steps:

$\bar{A}$ multiply the elements in rows to get a new vector.

Turn each component of the new vector to the nth power.

The resulting vector is normalized to a weight vector.

- e) Judge the Consistency of the Matrix - Practical experts may have inconsistent conclusions when comparing the indicators in pairs, so it is necessary to test the consistency of the existing judgment matrix to ensure the rationality of the index weights. At the same time, the academic community generally takes CR as the standard for judging the consistency of the matrix. CR is the ratio of the CI of the consensus index and the RI of the mean random consensus

index. If $CR < 0.1$, it indicates that the matrix meets the requirements and does not need to be modified; otherwise, experts should be asked to revise the judgment matrix again to make the final calculation $CR < 0.1$.

CR formula is as follows (4) show.

$$CR = \frac{CI}{RI} = \frac{\lambda_{max} - n}{(n-1)RI} < 0 \quad (5.18)$$

CI calculation formula is shown in Eq. (5).

$$CI = \frac{\lambda_{max} - n}{(n-1)} \quad (5.19)$$

λ_{max} is the maximum eigenvalue of the matrix, the calculation formula is as follows (6),

λ_{max} is the maximum eigenvalue of the matrix, thereinto $\bar{A}$ to judge the integration matrix, W is a weight vector, $[\bar{A}W]_i$ for the matrix $[\bar{A}W]$ I th component.

$$\lambda_{max} = \sum_{i=1}^n \frac{[\bar{A}W]_i}{nW_i} \quad (5.20)$$

RI is related to the matrix order, and the specific values are shown in the following Table 5.7.

Table 5.7 : Judgment Matrix Average Stochastic Consistency Index RI Value

N	1	2	3	4	5	6	7	8	9	10	11	12
RI	0	0	0.52	0.89	1.12	1.26	1.36	1.41	1.46	1.49	1.52	1.54

5.6.3 Weight Calculation of Level 1 Indicators

According to the formula 3, 4, 5, 6 pairs (PDa₁) – (PPa₂). The integrated matrix is used for weight and consistency calculations, and the calculation steps are as follows:

i) According to the above table, the judgment integration matrix is obtained $\bar{A}$

$$\bar{A} = \begin{bmatrix} 1 & 1.4411 \\ 0.6939 & 1 \end{bmatrix}$$

ii) $\bar{A}$ The elements are multiplied by rows to get a new vector B

$$B = \begin{bmatrix} 1.4411 \\ 0.6939 \end{bmatrix}$$

iii) Open each vector of the new vector B to the power of 2, Geometric mean, eigenvector is obtained M

$$M = \begin{bmatrix} 1.2005 \\ 0.8330 \end{bmatrix}$$

iv) The resulting vector M is normalised to the weight vector W

$$W = \begin{bmatrix} 0.5903 \\ 0.4097 \end{bmatrix}$$

v) Calculates the maximum eigenvalue $\lambda_{\max}$

The calculation principle is to multiply the row elements of the matrix by the corresponding weights, for example:

$$1 \times 0.5903 + 1.4411 \times 0.4097 = 1.1806$$

$$0.6939 \times 0.5903 + 1 \times 0.4097 = 0.8195$$

$$\bar{A}W = \begin{bmatrix} 1 & 1.4411 \\ 0.6939 & 1 \end{bmatrix} \times \begin{bmatrix} 0.5903 \\ 0.4097 \end{bmatrix} = \begin{bmatrix} 1.1806 \\ 0.8195 \end{bmatrix}$$

$$\lambda_{max} = \frac{1}{n} \sum_{i=1}^n \frac{[\bar{A}W]_i}{W_i} = \frac{1}{2} \left(\frac{1.1806}{0.5903} + \frac{0.8195}{0.4097} \right) = 2$$

Consistency test of judgment matrix CI

$$CI = \frac{\lambda_{max} - n}{(n - 1)} = \frac{2 - 2}{2 - 1} = 0$$

$$CR = \frac{CI}{RI} = \frac{0}{0} = 0 < 0.1$$

For a second-order matrix, RI for 0, Because the consistency of the second-order matrix is always perfect, this means: CI it should be 0, therefore CR also for 0. Therefore CR= 0<0.1, After passing the consistency test, the weights of the first-level indicators are reasonable, so the weights of the first-level indicators are determined as follows:

According to the same calculation steps of the first-level index, the judgment integration matrix and weight calculation results of the second-level index are as follows:

(1) Buying participants weight of the level1 indicators

Table 5.8 : PDa1-PPa2 Judge the Integration Matrix $\lambda_{max}=2$ CR=0≤0.1

Bs	PDa ₁	PPa ₂	Weight
PDa ₁	1	1.4411	0.5903
PPa ₂	0.6939	1	0.4097

(2) Users weight of the level2 indicators

Table 5.9 : PD_{b1}-PP_{b2} Judge the Integration Matrix $\lambda_{\max} = 2$ CR=0≤0.1

U _s	PD _{b1}	PP _{b2}	Weight
PD _{b1}	1	0.6553	0.3959
PP _{b2}	1.5261	1	0.6041

5.6.4 Weight Calculation of Level 2 Indicators

(1) Buy Participant Weight of the Level 2 Indicators

Table 5.10 : FD_{a1}-FD_{a4} Judge the Integration Matrix $\lambda_{\max} = 4.0078$ CI=0.0026 CR=0.0029≤0.1

PD _{a1}	FD _{a1}	FD _{a2}	FD _{a3}	FD _{a4}	Weight
FD _{a1}	1	0.9289	1.2297	0.8978	0.2491
FD _{a2}	1.0766	1	1.4753	1.3036	0.2969
FD _{a3}	0.8132	0.6778	1	0.7622	0.1993
FD _{a4}	1.1138	0.7671	1.3120	1	0.2547

Table 5.11 : FP_{a1}-FP_{a6} judge the integration matrix $\lambda_{\max} = 6.0813$ CI= 0.0163 CR= 0.0129 ≤0.1

PP _{a2}	FP _{a1}	FP _{a2}	FP _{a3}	FP _{a4}	FP _{a5}	FP _{a6}	Weight
FP _{a1}	1	1.0731	0.3927	0.5809	0.6399	1.1503	0.1164
FP _{a2}	0.9319	1	0.4788	0.7909	0.6059	1.0065	0.1199
FP _{a3}	2.5462	2.0885	1	1.6693	1.7336	3.6315	0.3027
FP _{a4}	1.7215	1.2644	0.5991	1	0.6213	0.9639	0.1486
FP _{a5}	1.5628	1.6505	0.5768	1.6095	1	2.3019	0.2058
FP _{a6}	0.8694	0.9935	0.2754	1.0374	0.4344	1	0.1067

(2) Users Weight of the Level3 Indicators

Table 5.12 : FD_{b1}-FD_{b4} Judge the Integration Matrix $\lambda_{\max} = 4.0404$ CI= 0.0135 CR= 0.0151 ≤0.1

PD _{b1}	FD _{b1}	FD _{b2}	FD _{b3}	FD _{b4}	Weight
FD _{b1}	1	0.7346	1.5028	1.8654	0.2606
FD _{b2}	1.3612	1	3.8769	4.0428	0.4675
FD _{b3}	0.6654	0.2579	1	1.1834	0.1460
FD _{b4}	0.5361	0.2474	0.8450	1	0.1259

Table 5.13 : FPb1-FPb4 Judge the Integration Matrix $\lambda_{\max} = 4.0094$ CI=0.0031 CR=0.0035 $\leq$ 0.1

PP _{b2}	FP _{b1}	FP _{b2}	FP _{b3}	FP _{b4}	Weight
FP _{b1}	1	1.2599	1.9802	0.9520	0.2930
FP _{b2}	0.7937	1	1.9165	0.7634	0.2450
FP _{b3}	0.5050	0.5218	1	0.3525	0.1303
FP _{b4}	1.0504	1.3100	2.8366	1	0.3317

5.6.5 Weight Calculation of Level 3 Indicators

(1) Buy Participant Weight of the Level 3 Indicators

Table 5.14 : DEa1-DEa3 Judge the Integration Matrix $\lambda_{\max} = 3.0018$ CI= 0.0009 CR= 0.0017 $\leq$ 0.1

FD _{a1}	DE _{a1}	DE _{a2}	DE _{a3}	Weight
DE _{a1}	1	1.1550	1.6095	0.4002
DE _{a2}	0.8658	1	1.5828	0.3615
DE _{a3}	0.6213	0.6318	1	0.2383

Table 5.15 : DEa4 -DEa6 Judge the Integration Matrix $\lambda_{\max} = 3.0073$ CI= 0.0037 CR= 0.0071 $\leq$ 0.1

FD _{a2}	DE _{a4}	DE _{a5}	DE _{a6}	Weight
DE _{a4}	1	1.5687	2.7006	0.4915
DE _{a5}	0.6375	1	2.2260	0.3414
DE _{a6}	0.3703	0.4492	1	0.1671

Table 5.16 : DEa7-DEa9 Judge the Integration Matrix $\lambda_{\max} = 3.0066$ CI= 0.0033 CR= 0.0063 $\leq$ 0.1

FD _{a3}	DE _{a7}	DE _{a8}	DE _{a9}	Weight
DE _{a7}	1	2.2170	0.6087	0.3329
DE _{a8}	0.4511	1	0.3503	0.1629
DE _{a9}	1.6429	2.8545	1	0.5042

Table 5.17 : DEa10-DEa13 Judge the Integration Matrix $\lambda_{\max} = 4.1121$ CI= 0.0374 CR= 0.0420 ≤ 0.1

FD _{a4}	DE _{a10}	DE _{a11}	DE _{a12}	DE _{a13}	Weight
DE _{a10}	1	1.4072	0.3924	0.1902	0.1185
DE _{a11}	0.7107	1	0.5729	0.3632	0.1291
DE _{a12}	2.5487	1.7454	1	0.3913	0.2391
DE _{a13}	5.2576	2.7537	2.5557	1	0.5134

Table 5.18 : PEa1-PEa3 Judge the Integration Matrix $\lambda_{\max} = 3$ CI=0 CR=0 ≤ 0.1

FP _{a1}	PE _{a1}	PE _{a2}	PE _{a3}	Weight
PE _{a1}	1	0.2857	0.5514	0.1584
PE _{a2}	3.5005	1	1.9300	0.5544
PE _{a3}	1.8137	0.5181	1	0.2872

Table 5.19 : PEa4-PEa7 Judge the Integration Matrix $\lambda_{\max} = 4.0576$ CI= 0.0192 CR= 0.0216 ≤ 0.1

FP _{a2}	PE _{a4}	PE _{a5}	PE _{a6}	PE _{a7}	Weight
PE _{a4}	1	1.2889	1.9893	0.3593	0.2180
PE _{a5}	0.7759	1	1.5657	0.3657	0.1816
PE _{a6}	0.5027	0.6387	1	0.3880	0.1322
PE _{a7}	2.7835	2.7344	2.5773	1	0.4682

Table 5.20 : PEa8-PEa10 Judge the Integration Matrix $\lambda_{\max} = 3.0157$ CI= 0.0079 CR= 0.0151 ≤ 0.1

FP _{a3}	PE _{a8}	PE _{a9}	PE _{a10}	Weight
PE _{a8}	1	1.0448	0.5508	0.2712
PE _{a9}	0.9572	1	0.7679	0.2943
PE _{a10}	1.8156	1.3022	1	0.4344

Table 5.21 : PEa11-PEa13 Judge the Integration Matrix $\lambda_{\max} = 3.0005$ CI= 0.0002 CR= 0.0004 ≤ 0.1

FP _{a4}	PE _{a11}	PE _{a12}	PE _{a13}	Weight
PE _{a11}	1	0.2230	0.3037	0.1136
PE _{a12}	4.4849	1	1.4524	0.5204
PE _{a13}	3.2930	0.6885	1	0.3661

Table 5.22 : PEa14-PEa16 Judge the Integration Matrix $\lambda_{\max} = 3.0109$ CI= 0.0055 CR= 0.0105 $\leq$ 0.1

FP _{a5}	PE _{a14}	PE _{a15}	PE _{a16}	Weight
PE _{a14}	1	3.4089	2.3250	0.5837
PE _{a15}	0.2934	1	0.9334	0.1901
PE _{a16}	0.4301	1.0714	1	0.2261

Table 5.23 : PEa17-PEa22 Judge the Integration Matrix $\lambda_{\max} = 6.2330$ CI= 0.0466 CR= 0.0370 $\leq$ 0.1

FP _{a6}	PE _{a17}	PE _{a18}	PE _{a19}	PE _{a20}	PE _{a21}	PE _{a22}	weight
PE _{a17}	1	1.4473	2.0229	0.3736	1.9504	1.3206	0.1771
PE _{a18}	0.6910	1	1.8654	0.2521	1.4966	1.3561	0.1390
PE _{a19}	0.4943	0.5361	1	0.2511	1.4438	1.1562	0.1033
PE _{a20}	2.6766	3.9670	3.9819	1	2.5710	1.9129	0.3627
PE _{a21}	0.5127	0.6682	0.6926	0.3890	1	1.6778	0.1092
PE _{a22}	0.7572	0.7374	0.8649	0.5228	0.5960	1	0.1087

(2) Users Weight of the Level3 Indicators

Table 5.24 : DEb1-DEb3 Judge the Integration Matrix $\lambda_{\max} = 3.0007$ CI= 0.0003 CR= 0.0006 $\leq$ 0.1

FD _{b1}	DE _{b1}	DE _{b2}	DE _{b3}	Weight
DE _{b1}	1.0000	0.3946	0.4547	0.1746
DE _{b2}	2.5344	1.0000	1.0676	0.4314
DE _{b3}	2.1991	0.9367	1.0000	0.3939

Table 5.25 : DEb4-DEb6 Judge the Integration Matrix $\lambda_{\max} = 3.0123$ CI= 0.0061 CR= 0.0118 $\leq$ 0.1

FD _{b2}	DE _{b4}	DE _{b5}	DE _{b6}	Weight
DE _{b4}	1.0000	1.9552	1.5113	0.4622
DE _{b5}	0.5115	1.0000	1.0777	0.2641
DE _{b6}	0.6617	0.9279	1.0000	0.2737

Table 5.26 : DEb7-DEb9 Judge the Integration Matrix $\lambda_{\max} = 3.0180$ CI= 0.0090 CR= 0.0173 $\leq$ 0.1

FD _{b3}	DE _{b7}	DE _{b8}	DE _{b9}	Weight
DE _{b7}	1	0.3616	0.3166	0.1444
DE _{b8}	2.7656	1	1.3085	0.4566
DE _{b9}	3.1588	0.7643	1	0.3990

Table 5.27 : DE_{b10}-DE_{b13} $\lambda_{\max} = 4.0143$ CI= 0.0048 CR= 0.0054 $\leq$ 0.1

FD _{b4}	DE _{b10}	DE _{b11}	DE _{b12}	DE _{b13}	Weight
DE _{b10}	1	0.3632	1.4198	0.5066	0.1611
DE _{b11}	2.7537	1	2.6737	1.4310	0.4060
DE _{b12}	0.7043	0.3740	1	0.4241	0.1303
DE _{b13}	1.9738	0.6988	2.3579	1	0.3026

Table 5.28 : PE_{b1}-PE_{b4} $\lambda_{\max} = 4.0218$ CI= 0.0073 CR= 0.0082 $\leq$ 0.1

FP _{b1}	PE _{b1}	PE _{b2}	PE _{b3}	PE _{b4}	Weight
PE _{b1}	1	1.9031	1.4411	2.1117	0.3651
PE _{b2}	0.5255	1	0.6598	1.6670	0.2052
PE _{b3}	0.6939	1.5157	1	2.0987	0.2869
PE _{b4}	0.4735	0.5999	0.4765	1	0.1428

Table 5.29 : PE_{b5}-PE_{b10} $\lambda_{\max} = 6.1627$ CI= 0.0325 CR= 0.0258 $\leq$ 0.1

FP _{b2}	PE _{b5}	PE _{b6}	PE _{b7}	PE _{b8}	PE _{b9}	PE _{b10}	Weight
PE _{b5}	1	3.7898	5.0608	2.8654	0.5102	1.8954	0.2579
PE _{b6}	0.2639	1	2.0582	2.1819	0.2162	0.5790	0.0968
PE _{b7}	0.1976	0.4859	1	1.3429	0.1633	0.4771	0.0618
PE _{b8}	0.3490	0.4583	0.7446	1	0.2633	0.5122	0.0668
PE _{b9}	1.9599	4.6253	6.1249	3.7983	1	2.2957	0.3726
PE _{b10}	0.5276	1.7271	2.0959	1.9525	0.4356	1	0.1442

Table 5.30 : PE_{b11}-PE_{b14} $\lambda_{\max} = 4.1056$ CI= 0.0352 CR= 0.0395 $\leq$ 0.1

FP _{b3}	PE _{b11}	PE _{b12}	PE _{b13}	PE _{b14}	Weight
PE _{b11}	1	2.7955	0.5255	4.1022	0.3321
PE _{b12}	0.3577	1	0.3721	1.9077	0.1504
PE _{b13}	1.9031	2.6875	1	3.0663	0.4217
PE _{b14}	0.2438	0.5242	0.3261	1	0.0958

Table 5.31 : PE_{b15}-PE_{b20} $\lambda_{\max} = 6.0307$ CI= 0.0061 CR= 0.0049 $\leq$ 0.1

FP _{b4}	PE _{b15}	PE _{b16}	PE _{b17}	PE _{b18}	PE _{b19}	PE _{b20}	Weight
PE _{b15}	1	0.7063	0.1616	0.2016	0.4187	0.4844	0.0517
PE _{b16}	1.4159	1	0.1628	0.2189	0.4292	0.6063	0.0615
PE _{b17}	6.1881	6.1416	1	1.5518	3.8136	4.0438	0.3939
PE _{b18}	4.9595	4.5682	0.6444	1	2.0621	3.1325	0.2700
PE _{b19}	2.3882	2.3301	0.2622	0.4849	1	1.5035	0.1279
PE _{b20}	2.0643	1.6495	0.2473	0.3192	0.6651	1	0.0950

5.6.6 Random Forest Indicator Weights

According to the random forest, the importance of each feature (element) can be calculated during the model training process, and the element importance obtained by the random forest reflects the global influence of the feature on the overall prediction result of the model. This global evaluation is obtained by combining the results of all decision trees, obtained through multiple random sampling and model training, providing a stable and reliable feature importance indicator that helps us better understand the data, interpret the model, and make feature selection, and the results have a high degree of objectivity and reliability.

Weight Calculation of Level 3 Indicators - The element level indicator importance obtained in this paper is normalised according to the AHP hierarchy and the corresponding grouped data to obtain four levels of indicator weights.

Table 5.32 : DEa1- PEa22, DEb1- PEb20 Level 3 Indicator Weights

Element	Weight	Element	Weight
DE _{a1}	0.3331	DE _{b1}	0.0506
DE _{a2}	0.4985	DE _{b2}	0.6857
DE _{a3}	0.1685	DE _{b3}	0.2637
DE _{a4}	0.4988	DE _{b4}	0.5874
DE _{a5}	0.4615	DE _{b5}	0.2868
DE _{a6}	0.0038	DE _{b6}	0.1258
DE _{a7}	0.2864	DE _{b7}	0.1130
DE _{a8}	0.1874	DE _{b8}	0.0538
DE _{a9}	0.5262	DE _{b9}	0.8332
DE _{a10}	0.1944	DE _{b10}	0.1881
DE _{a11}	0.0760	DE _{b11}	0.4735
DE _{a12}	0.3274	DE _{b12}	0.1255
DE _{a13}	0.4021	DE _{b13}	0.2129
PE _{a1}	0.0377	PE _{b1}	0.5134
PE _{a2}	0.5771	PE _{b2}	0.1584
PE _{a3}	0.3852	PE _{b3}	0.2669
PE _{a4}	0.3224	PE _{b4}	0.0613
PE _{a5}	0.1389	PE _{b5}	0.4095
PE _{a6}	0.0480	PE _{b6}	0.1735
PE _{a7}	0.4907	PE _{b7}	0.3030

Table 5.32 : Continued

PE _{a8}	0.1056	PE _{b8}	0.0179
PE _{a9}	0.2838	PE _{b9}	0.0177
PE _{a10}	0.6106	PE _{b10}	0.0784
PE _{a11}	0.1266	PE _{b11}	0.3582
PE _{a12}	0.6997	PE _{b12}	0.0297
PE _{a13}	0.1737	PE _{b13}	0.4918
PE _{a14}	0.6641	PE _{b14}	0.1203
PE _{a15}	0.0371	PE _{b15}	0.0142
PE _{a16}	0.2988	PE _{b16}	0.0411
PE _{a17}	0.3246	PE _{b17}	0.3113
PE _{a18}	0.0421	PE _{b18}	0.2105
PE _{a19}	0.0427	PE _{b19}	0.2800
PE _{a20}	0.5062	PE _{b20}	0.1429
PE _{a21}	0.0419		
PE _{a22}	0.0426		

Weight Calculation of Level 2 Indicators - Through the importance value of the level 4 indicators, corresponding to the grouping of the third-level indicators, the average value is calculated, and the weights of the level 3 indicators are normalised to obtain the weights of the third-level indicators

Table 5.33 : FD_{a1} - FP_{a6}, FD_{b1}- FP_{b4} Level 2 Indicator Weights

Factors	Weight	Element	Weight
FD _{a1}	0.1338	FD _{b1}	0.2483
FD _{a2}	0.3834	FD _{b2}	0.3600
FD _{a3}	0.2966	FD _{b3}	0.1467
FD _{a4}	0.1863	FD _{b4}	0.2450
FP _{a1}	0.1659	FP _{b1}	0.2543
FP _{a2}	0.1559	FP _{b2}	0.2369
FP _{a3}	0.2141	FP _{b3}	0.2065
FP _{a4}	0.2032	FP _{b4}	0.3023
FP _{a5}	0.1820		
FP _{a6}	0.0789		

Table 5.34 : PD_{a1}- PP_{a2}, PD_{b1}- PP_{b2} Level 1 Indicator Weights

Products	Weight	Element	Weight
PD _{a1}	0.5643	PD _{b1}	0.5017
PP _{a2}	0.4357	PP _{b2}	0.4983

5.6.7 Customer Satisfaction Hierarchy Portfolio Weights

AHP weights are: $W_{AHP}=[W_{AHP1}, W_{AHP2}, \dots, W_{AHPn}]$

The random forest weights are: $W_{RF}=[W_{RF1}, W_{RF2}, \dots, W_{RFn}]$

Through the AHP weights and random forest weights, the comprehensive weights of customer satisfaction can be calculated W:

$$W = \frac{W_{AHP} + W_{RF}}{2} \quad (5.21)$$

Table 5.35 : Customer Satisfaction Hierarchy Portfolio Weights

Level 1 Indicator 2		Level 1 Indicator 3			Level 1 Indicator 4	
Standardised layer		Sub-standardised layer			Elemental Layer	
Bs	PD _{a1}	0.5773	FD _{a1}	0.1914	DE _{a1}	0.3666
					DE _{a2}	0.4300
					DE _{a3}	0.2034
		0.3401	FD _{a2}	0.3401	DE _{a4}	0.4951
					DE _{a5}	0.4014
					DE _{a6}	0.1034
		0.2479	FD _{a3}	0.2479	DE _{a7}	0.3097
					DE _{a8}	0.1751
					DE _{a9}	0.5152
		0.2205	FD _{a4}	0.2205	DE _{a10}	0.1565
					DE _{a11}	0.1026
					DE _{a12}	0.2832
					DE _{a13}	0.4578
	PP _{a2}	0.4227	FP _{a1}	0.1411	PE _{a1}	0.0981
					PE _{a2}	0.5658
					PE _{a3}	0.3362
		0.1379	FP _{a2}	0.1379	PE _{a4}	0.2702
					PE _{a5}	0.1602
					PE _{a6}	0.0901
					PE _{a7}	0.4795
		0.2584	FP _{a3}	0.2584	PE _{a8}	0.1884
					PE _{a9}	0.2891
					PE _{a10}	0.5225
		0.1759	FP _{a4}	0.1759	PE _{a11}	0.1201
					PE _{a12}	0.6100
					PE _{a13}	0.2698
		0.1939	FP _{a5}	0.1939	PE _{a14}	0.6239
					PE _{a15}	0.1136
					PE _{a16}	0.2625

Table 5.35 : Continued

			FP _{a6}	0.0928	PE _{a17}	0.2508
					PE _{a18}	0.0905
					PE _{a19}	0.0730
					PE _{a20}	0.4345
					PE _{a21}	0.0755
					PE _{a22}	0.0756
U _s	PD _{b1}	0.4488	FD _{b1}	0.2545	DE _{b1}	0.1126
					DE _{b2}	0.5586
	PP _{b2}	0.5512	FD _{b2}	0.4137	DE _{b3}	0.3288
					DE _{b4}	0.5248
					DE _{b5}	0.2755
					DE _{b6}	0.1997
			FD _{b3}	0.1464	DE _{b7}	0.1287
					DE _{b8}	0.2552
					DE _{b9}	0.6161
			FD _{b4}	0.1854	DE _{b10}	0.1746
					DE _{b11}	0.4398
					DE _{b12}	0.1279
					DE _{b13}	0.2577
			FP _{b1}	0.2737	PE _{b1}	0.4392
					PE _{b2}	0.1818
					PE _{b3}	0.2769
					PE _{b4}	0.1021
			FP _{b2}	0.2410	PE _{b5}	0.3337
					PE _{b6}	0.1351
					PE _{b7}	0.1824
					PE _{b8}	0.0423
					PE _{b9}	0.1952
					PE _{b10}	0.1113
			FP _{b3}	0.1684	PE _{b11}	0.3451
					PE _{b12}	0.0901
					PE _{b13}	0.4568
					PE _{b14}	0.1080
			FP _{b4}	0.3170	PE _{b15}	0.0330
					PE _{b16}	0.0513
					PE _{b17}	0.3526
					PE _{b18}	0.2403
					PE _{b19}	0.2040
					PE _{b20}	0.1112

5.6.8 Customer Level Indicator Importance Fuzzy Evaluation

After the index set is established, the evaluation framework is established according to the same logic to carry out systematic fuzzy comprehensive evaluation

Level 4: Elemental Evaluation

$$U_{DEn} = [U_{DEn1} \ U_{DEn2} \ \cdots \ U_{DEnm}] \quad (5.22)$$

$$U_{PEn} = [U_{PEn1} \ U_{PEn2} \ \cdots \ U_{PEnm}] \quad (5.23)$$

U_{DEn} representative product demand element layer evaluation set, U_{PEn} represents the product preference element layer evaluation set.

Level 3: Sub-Standardised Layer-Factors Evaluation

$$U_{FDn} = \begin{bmatrix} U_{DE01} \\ U_{DE02} \\ U_{DE03} \\ \cdots \\ U_{DEn} \end{bmatrix} \quad (5.24)$$

$$U_{FPn} = \begin{bmatrix} U_{PE01} \\ U_{PE02} \\ U_{PE03} \\ \cdots \\ U_{PEn} \end{bmatrix} \quad (5.25)$$

U_{FDn} U_{FPn} evaluation sets of factors representing product needs and preferences are, respectively.

Level 2: Standardised Layer Evaluation

$$U_{PD} = [U_{FD1} \ U_{FD2} \ U_{FD3} \ \cdots \ U_{FDn}] \quad (5.26)$$

$$U_{PP} = [U_{FP1} \ U_{FP2} \ U_{FP3} \ \cdots \ U_{FPn}] \quad (5.27)$$

P_D represents the set of product requirements, P_P represents a set of product preferences. Each consists of a set of factors against the target.

Level 1: Sub-Target Level Evaluation

$$U_{BS} = [U_{PD1} \ U_{PP1}] \quad (5.28)$$

$$U_{US} = [U_{PD2} \ U_{PP2}] \quad (5.29)$$

U_{BS} On behalf of the purchase participant satisfaction evaluation set, U_{US} represents the set of user satisfaction.

- (1) Establishing a collection of reviews - In this paper, a five-point Likert scale was used to set up the comment set $R = \{R_1, R_2, R_3, R_4, R_5\}$

Table 5.36 : Characteristic Grade

Grade	Characteristic Performance
R_1	Very unimportant
R_2	Less important
R_3	Average
R_4	More Important
R_5	Very Important

Very Unimportant (R_1): These features contribute little to the core value of the product or service. Customers usually do not pay attention to these features, may not even know they exist, and they have little impact on overall satisfaction.

Less Important (R_2): These features have some impact on the customer's decision-making process and usage experience but are not decisive. Customers may notice these features, but not as the main reason for choosing a product. If these features perform

poorly, they may be bothersome to a small number of customers but will not lead to serious dissatisfaction.

Average (R3): These features play a moderate role in the customer's experience. They are neither decisive key factors nor insignificant additional features. If these features perform well, they can significantly increase customer satisfaction; conversely, if they perform poorly, they may lead to customer dissatisfaction. Optimising these features can lead to significant satisfaction gains.

More Important (R4): These features contribute more to the core value of the product or service. Customers carefully consider the performance of these features when choosing a product. Improving the performance of these features can significantly increase customer satisfaction, while poor performance can lead to significant dissatisfaction. Optimising these features should be a priority.

Very Important (R5): These features are the core and key elements of a product or service. One of the main reasons customers choose a product is the performance of these features. Good performance can significantly increase customer satisfaction and loyalty, while poor performance can lead to significant dissatisfaction and customer churn.

(2) Confirmation of customer importance evaluation criteria - According to Chapter 4, around a class of product customer frequency data, in the data, select the comprehensive feedback satisfaction (≥ 7) data, through the customer data characteristics of customers who have purchased the product and are satisfied with the analysis of customer satisfaction needs to be clearer. The higher the frequency of

customer group concern, represents the higher degree of influence on customer satisfaction, and vice versa, the lower the degree of influence. Therefore, in the same product sales to meet the needs of customer groups with a higher frequency of attention, customer purchase intention is stronger, at the same time, if the customer demand deviates from the regular characteristics of the performance, the overall purchase satisfaction and purchase intention will be reduced.

The statistical data from Chapter 4 were obtained and scatter plots were drawn using the percentage data to observe the data distribution characteristics of the assessment tier.

Data dispersion: the distribution of data points is more dispersed, showing a greater variability in the frequency values of the assessment layer elements.

Mean: the blue dashed line in the graph represents the overall mean, with an overall data point mean of 22.

Clustering: although the distribution of data points is more spread out, most of the data points are clustered between 10 and 30 on the vertical axis, showing a major range of concentration in the frequency values.

Outliers: there are some points that are significantly higher than others, located above the frequency value of 50, and these points can be considered outliers or elements of the assessment layer for high frequency values.

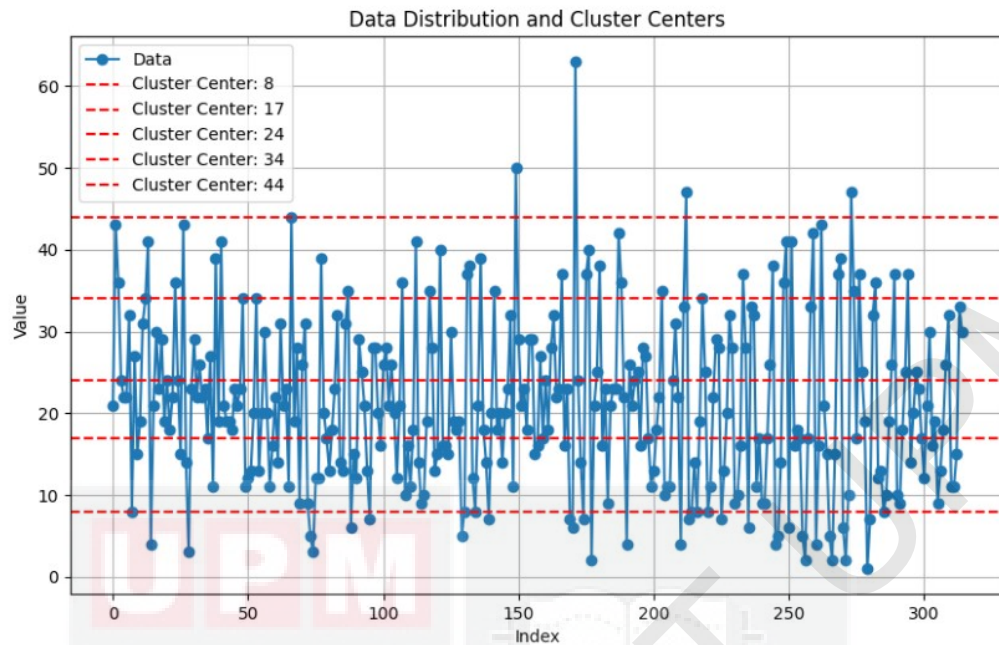


Figure 5.10 : K-Means Evaluation Layer Importance Grade Standard Calculation
(Source by author)

The goal of K-means is to divide the data points into K clusters such that each data point belongs to the centre of the cluster nearest to it. Each cluster can be viewed as a segment with similar features or attributes. K-means generating multiple segments can be understood as dividing the dataset into K clusters based on the features and similarities of the data points. The distance of data points within each cluster is small with respect to the centre of the cluster, while the distance of data points between different clusters is large. Therefore, based on the 5 stages of the rubric set, a total of 165 rows of data in the assessment layer of the purchasing participant and 151 rows of data in the assessment layer of the user, we divide the data of the importance characteristics of the two customer groups into 5 levels, which allows us to better understand and analyse the characteristics of the assessment layer of the customer groups.

Table 5.37 : K-Means Significance Feature Criteria Table

Data Characteristics	Grade	Standard Eigenvalue	Importance
Lowest frequency:	R ₁	8	Very unimportant
Low frequency:	R ₂	17	Less important
Medium frequency	R ₃	24	Average
Higher frequency:	R ₄	34	More Important
Highest frequency:	R ₅	44	Very Important

(Source by author)

5.6.9 Constructing an Affiliation Function

As mentioned earlier, the affiliation function is exceptionally important for fuzzy comprehensive evaluation, which is a transition between exactness and fuzziness. Because of the importance of the affiliation function, to achieve fuzzy comprehensive evaluation in the evaluation, it is also necessary to construct the affiliation function of the comment set for the corresponding elements in each indicator of the k-client evaluation. Here, the formula for constructing the affiliation function for the specific comment set corresponding to the content of the first-level indicators in the previous section is as follows.

$$V_5 = \begin{cases} 1 & (44 < x) \\ \frac{x - 34}{44 - 34} & (34 < x \leq 44) \\ 0 & (x < 34) \end{cases}$$

$$V_4 = \begin{cases} \frac{x - 24}{34 - 24} & (24 \leq x \leq 34) \\ \frac{44 - x}{44 - 34} & (34 < x \leq 44) \\ 0 & (x < 24, x > 44) \end{cases}$$

$$V_3 = \begin{cases} \frac{x-17}{24-17} & (17 \leq x \leq 24) \\ \frac{34-x}{34-24} & (24 < x \leq 34) \\ 0 & (x < 17, x > 34) \end{cases}$$

$$V_2 = \begin{cases} \frac{x-8}{17-8} & (8 \leq x \leq 17) \\ \frac{34-x}{34-24} & (24 \leq x \leq 34) \\ 0 & (x < 8, x > 34) \end{cases}$$

$$V_1 = \begin{cases} 0 & (x > 17) \\ \frac{17-x}{17-8} & (8 \leq x \leq 17) \\ 1 & (x < 8) \end{cases}$$

The perform matrix addition by evaluating the results of the evaluation matrices of the layer customer groups and finally derive the evaluation matrices of the elemental layers.

$$U_{Den1} = \begin{bmatrix} V_{11} & V_{12} & V_{13} & V_{14} & V_{15} \\ V_{21} & V_{22} & V_{23} & V_{24} & V_{25} \\ \vdots & & & & \\ V_{n1} & V_{n2} & V_{n3} & V_{n4} & V_{n5} \end{bmatrix} = [V_{den1} \ V_{nden2} \ V_{nden3} \ V_{den4} \ V_{den5}] \quad (5.30)$$

5.6.10 Hierarchical Fuzzy Integrated Evaluation Calculations

Evaluate the indicator layer according to the set of rubrics, quantify the indicators to get the affiliation degree of the i th factor for the j th evaluation, where the affiliation degree F is the ratio of the number of people who scored the j th evaluation for the i th factor in the total number of people participating in the evaluation, to establish a fuzzy relationship matrix:

$$R_{ij} = \begin{bmatrix} r_{i1}^{j1} & r_{i1}^{j2} & \dots & r_{i1}^{j5} \\ r_{i2}^{j1} & r_{i2}^{j2} & \dots & r_{i2}^{j5} \\ \dots & \dots & \dots & \dots \\ r_{in}^{j1} & r_{in}^{j2} & \dots & r_{in}^{j5} \end{bmatrix} \quad (5.31)$$

Assign the weights W_i with fuzzy matrices R_{ij} . Fuzzy operations are performed to obtain row vectors U_i fuzzy evaluation results, Therefore according to U_E derive the factor layer U_F , Criteria layer U_P evaluation, Finally get the criterion layer U evaluation results, According to the principle of maximum membership, the maximum value in the U -row vector is obtained as the final evaluation result comment.

The representative formula is as follows:

$$U_i = W_i \circ R_{ij} = [u_i^1 \ u_i^2 \ u_i^3 \ \dots \ u_i^n] \quad (5.32)$$

$$U = W \circ U_i^j = \begin{bmatrix} U_1^1 & U_1^2 & \dots & U_1^5 \\ U_2^1 & U_2^2 & \dots & U_2^5 \\ \dots & \dots & \dots & \dots \\ U_n^1 & U_n^2 & \dots & U_n^5 \end{bmatrix} \quad (5.33)$$

Select the most used weighted average operator, Perform fuzzy operations.

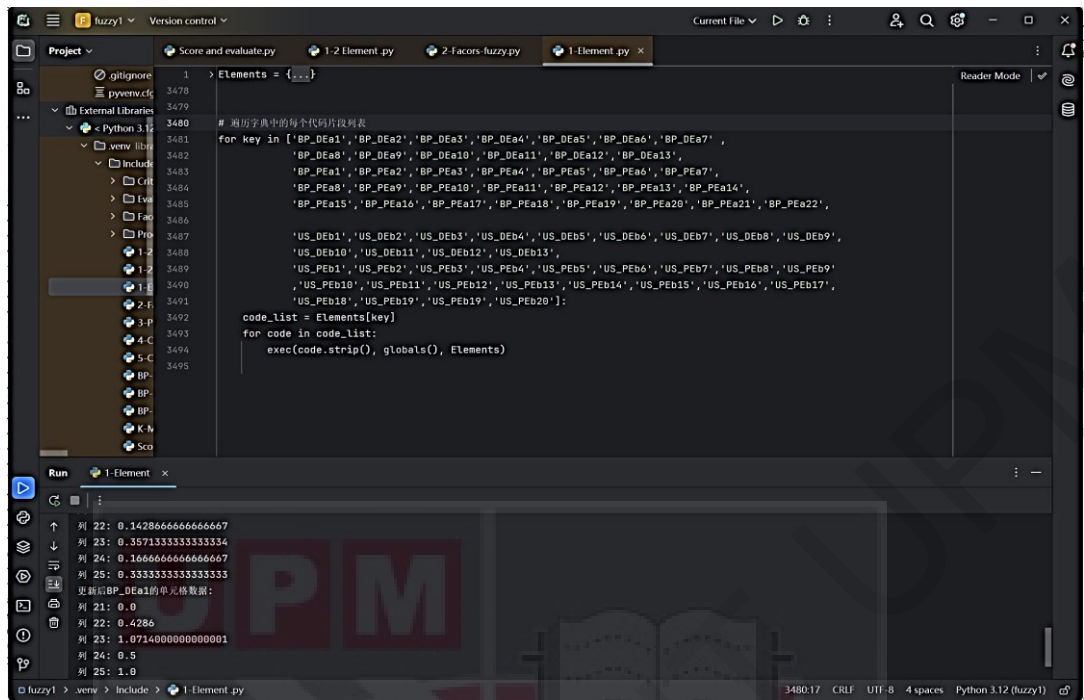


Figure 5.11 : Fuzzy Comprehensive Evaluation Calculator
(Source by author)

Table 5.38 : Elemental Importance Fuzzy Evaluation Matrix

	Elements	Weight	V1	V2	V3	V4	V5
Product demand (PD _{a1})	DE _{a1}	0.3666	0.0000	0.1429	0.3571	0.1667	0.3333
	DE _{a2}	0.4300	0.0000	0.2500	0.5000	0.2500	0.0000
	DE _{a3}	0.2034	0.0667	0.5333	0.3400	0.0600	0.0000
	DE _{a4}	0.4951	0.0000	0.2857	0.4143	0.3000	0.0000
	DE _{a5}	0.4014	0.0278	0.2937	0.4286	0.1750	0.0750
	DE _{a6}	0.1034	0.5000	0.0000	0.2500	0.0000	0.2500
	DE _{a7}	0.3097	0.4667	0.1333	0.0000	0.2200	0.1800
	DE _{a8}	0.1751	0.0278	0.3294	0.3679	0.1750	0.1000
	DE _{a9}	0.5152	0.1778	0.1937	0.6285	0.0000	0.0000
	DE _{a10}	0.1565	0.0000	0.0952	0.2381	0.3333	0.3333
	DE _{a11}	0.1026	0.2000	0.0857	0.6543	0.0600	0.0000
	DE _{a12}	0.2832	0.1556	0.4444	0.2600	0.1400	0.0000
	DE _{a13}	0.4578	0.2444	0.3841	0.1714	0.1800	0.0200
Product Preferences (PP _{a2})	PE _{a1}	0.0981	0.2667	0.1905	0.4029	0.1400	0.0000
	PE _{a2}	0.5658	0.6000	0.0000	0.0200	0.1800	0.2000
	PE _{a3}	0.3362	0.2667	0.2762	0.2371	0.2200	0.0000
	PE _{a4}	0.2702	0.3333	0.1238	0.3629	0.1800	0.0000
	PE _{a5}	0.1602	0.2889	0.2254	0.2457	0.2400	0.0000
	PE _{a6}	0.0901	0.3556	0.2444	0.1200	0.2200	0.0600
	PE _{a7}	0.4795	0.3333	0.2667	0.0600	0.3400	0.0000

Table 5.38 : Continued

	PE _{a8}	0.1884	0.3556	0.2444	0.1600	0.1600	0.0800
	PE _{a9}	0.2891	0.4667	0.1333	0.0000	0.2200	0.1800
	PE _{a10}	0.5225	0.2222	0.5492	0.0286	0.0600	0.1400
	PE _{a11}	0.1201	0.4000	0.2000	0.0200	0.2200	0.1600
	PE _{a12}	0.6100	0.2667	0.4191	0.1143	0.0200	0.1800
	PE _{a13}	0.2698	0.4444	0.1556	0.0000	0.2400	0.1600
	PE _{a14}	0.6239	0.5556	0.0444	0.0000	0.1800	0.2200
	PE _{a15}	0.1136	0.2000	0.3429	0.2371	0.1600	0.0600
	PE _{a16}	0.2625	0.4000	0.2000	0.0400	0.3200	0.0400
	PE _{a17}	0.2508	0.3556	0.1873	0.2171	0.1800	0.0600
	PE _{a18}	0.0905	0.3333	0.2381	0.2086	0.1600	0.0600
	PE _{a19}	0.0730	0.0667	0.4762	0.4371	0.0200	0.0000
	PE _{a20}	0.4345	0.1333	0.4952	0.2514	0.1200	0.0000
	PE _{a21}	0.0755	0.2667	0.3048	0.2286	0.2000	0.0000
	PE _{a22}	0.0756	0.3111	0.2889	0.1000	0.3000	0.0000
Product Demand (PD _{b1})	DE _{b1}	0.1126	0.0000	0.1429	0.1905	0.3000	0.3667
	DE _{b2}	0.5586	0.0000	0.1429	0.6572	0.2000	0.0000
	DE _{b3}	0.3288	0.2444	0.2984	0.2571	0.2000	0.0000
	DE _{b4}	0.5248	0.2500	0.1072	0.1429	0.3250	0.1750
	DE _{b5}	0.2755	0.0000	0.2143	0.5107	0.2750	0.0000
	DE _{b6}	0.1997	0.0000	0.2857	0.4643	0.2000	0.0500
	DE _{b7}	0.1287	0.3111	0.2889	0.2000	0.0200	0.1800
	DE _{b8}	0.2552	0.0000	0.1072	0.7179	0.1750	0.0000
	DE _{b9}	0.6161	0.1333	0.3524	0.4543	0.0600	0.0000
	DE _{b10}	0.1746	0.0000	0.2381	0.0952	0.2667	0.4000
	DE _{b11}	0.4398	0.0000	0.5714	0.4286	0.0000	0.0000
	DE _{b12}	0.1279	0.2445	0.2698	0.2857	0.2000	0.0000
	DE _{b13}	0.2577	0.1778	0.4508	0.1714	0.2000	0.0000
Product Preferences (PP _{b2})	PE _{b1}	0.4392	0.1556	0.4159	0.3086	0.1200	0.0000
	PE _{b2}	0.1818	0.2000	0.3143	0.3457	0.1400	0.0000
	PE _{b3}	0.2769	0.2222	0.2064	0.2214	0.1000	0.2500
	PE _{b4}	0.1021	0.0000	0.0000	0.4000	0.1000	0.5000
	PE _{b5}	0.3337	0.5778	0.0222	0.0600	0.1400	0.2000
	PE _{b6}	0.1351	0.2222	0.4920	0.0857	0.1000	0.1000
	PE _{b7}	0.1824	0.1555	0.4445	0.2400	0.1600	0.0000
	PE _{b8}	0.0423	0.3333	0.2667	0.0600	0.3200	0.0200
	PE _{b9}	0.1952	0.2000	0.2857	0.3943	0.1200	0.0000
	PE _{b10}	0.1113	0.2222	0.2921	0.3257	0.1600	0.0000
	PE _{b11}	0.3451	0.0000	0.1072	0.6929	0.2000	0.0000
	PE _{b12}	0.0901	0.2667	0.3333	0.2000	0.1600	0.0400
	PE _{b13}	0.4568	0.2222	0.5492	0.0286	0.0600	0.1400

Table 5.39 : Continued

	PE _{b14}	0.1080	0.3333	0.2095	0.1771	0.2600	0.0200
	PE _{b15}	0.0330	0.1778	0.6222	0.0000	0.0800	0.1200
	PE _{b16}	0.0513	0.0444	0.6127	0.2229	0.1200	0.0000
	PE _{b17}	0.3526	0.5111	0.0889	0.0000	0.2600	0.1400
	PE _{b18}	0.2403	0.2667	0.3905	0.1429	0.1000	0.1000
	PE _{b19}	0.2040	0.2000	0.4000	0.2000	0.1800	0.0200
	PE _{b20}	0.1189	0.2000	0.3429	0.2971	0.1600	0.0000

(Source by author)

Table 5.40 : Factors Importance Fuzzy Evaluation Matrix

		Factors	Weight	V1	V2	V3	V4	V5
B _S	PD _{a1}	FD _{a1}	1.2253	0.0678	0.7023	0.6917	0.2296	0.1222
		FD _{a2}	0.3401	0.0629	0.6837	1.0184	0.6644	0.0560
		FD _{a3}	0.2479	0.2410	0.1988	0.3882	0.0988	0.0733
		FD _{a4}	0.2205	0.1765	0.3254	0.2565	0.1804	0.0613
	PP _{a2}	FP _{a1}	0.1411	0.4553	0.1115	0.1306	0.1895	0.1132
		FP _{a2}	0.1379	0.3282	0.2195	0.1770	0.2699	0.0054
		FP _{a3}	0.2584	0.3180	0.3715	0.0451	0.1251	0.1403
		FP _{a4}	0.1759	0.3306	0.3217	0.0721	0.1034	0.1722
		FP _{a5}	0.1939	0.4744	0.1192	0.0374	0.2145	0.1546
		FP _{a6}	0.0928	0.2258	0.3633	0.2393	0.1510	0.0205
U _S	PD _{b1}	FD _{b1}	0.2545	0.0804	0.1940	0.4731	0.2113	0.0413
		FD _{b2}	0.4137	0.1312	0.1724	0.3084	0.2863	0.1018
		FD _{b3}	0.1464	0.1222	0.2817	0.4888	0.0842	0.0232
		FD _{b4}	0.1854	0.0771	0.4436	0.2858	0.1237	0.0698
	PP _{b2}	FP _{b1}	0.2737	0.1662	0.2970	0.3005	0.1161	0.1203
		FP _{b2}	0.2410	0.3291	0.2545	0.1911	0.1442	0.0811
		FP _{b3}	0.1684	0.1615	0.3405	0.2893	0.1389	0.0697
		FP _{b4}	0.3170	0.3170	0.2995	0.1219	0.1802	0.0814

(Source by author)

Table 5.41 : Product Importance Fuzzy Evaluation Matrix

	Factors	Weight	V1	V2	V3	V4	V5
B _s	PD _{a1}	0.5773	0.133	0.488	0.6315	0.3342	0.0741
	PP _{a2}	0.4227	0.3628	0.2554	0.0966	0.1701	0.1151
U _s	PD _{b1}	0.4488	0.1069	0.2442	0.3725	0.2075	0.0690
	PP _{b2}	0.5512	0.2525	0.2949	0.2157	0.1470	0.0900

(Source by author)

Table 5.42 : Criterion Importance Fuzzy Evaluation Matrix

	Customer	V1	V2	V3	V4	V5
C _s	B _s	0.2301	0.3897	0.4054	0.2648	0.0914
	U _s	0.1972	0.3721	0.3861	0.2589	0.0896

(Source by author)

5.6.11 Customer Satisfaction Fuzzy Composite Evaluation

Combined with 4.65 Product Satisfaction Assessment Indicator ≥ 7 as satisfactory, and in conjunction with the expert consultation, the confirmed satisfaction interval

Table 5.43 : Level of Satisfaction

	V1	V2	V3	V4	V5
Satisfaction	Very unsatisfied	Unsatisfied	Average	Satisfied	Very satisfied
Score	2	4	6	8	10

(Source by author)

Table 5.44 : Scope of Satisfaction Evaluation

Number	Range of Deviation	Satisfaction Degree
1	0 - 2	Very Unsatisfied
2	2.1 - 4.0	Unsatisfied
3	4.1 - 6.0	Average
4	6.1 - 8.0	Satisfied
5	≥ 8.1	Very Satisfied

(Source by author)

Table 5.45 : Comprehensive Satisfaction Evaluation of Customer Purchase Decision

User Buying Participant	Very satisfied	Satisfied	Average	Unsatisfied	Very unsatisfied
Very Satisfied	Higher purchase Intention	Have Intention to buy	Have Intention to buy	Low purchase intention	No intention to buy
Satisfied	Have Intention to buy	Have Intention to buy	Have Intention to buy	Low Purchase intention	No intention to buy

Table 5.44 : Continued

Average	Low purchase Intention	Have Intention to buy	Low Purchase intention	No intention to buy	No intention to buy
Unsatisfied	Low purchase Intention	Low purchase intention	No intention to buy	No intention to buy	No intention to buy
Very Unsatisfied	Low purchase Intention	Low purchase intention	No intention to buy	No intention to buy	No intention to buy

(Source by author)

Higher purchase intention: the purchase participant or user is very satisfied with the product or service and shows a high willingness to buy.

Intention to buy: Buying participants or users are satisfied with the product or service, but their willingness to buy may be affected by some factors, such as price, competing products, and so on.

Low purchase intention: Purchase participants or users are less satisfied with the product or service, so their purchase intention is also relatively low.

No purchase intention: Buying participants or users have a very low level of satisfaction with the product or service and therefore they do not intend to purchase it.

These assessments help organisations to understand how well their products or services are performing with customers, and to take marketing or improvement measures to increase satisfaction and purchase intent according to specific objectives.

5.6.12 Customer Satisfaction Comprehensive Evaluation Results

Table 5.46 : Elements Satisfaction Fuzzy Comprehensive Evaluation Results

Sub-Standardised layer (F)			Elemental Layer (E)		
FD _{a1}	User Goals	7.8820	DE _{a1}	User Group	7.3340
			DE _{a2}	Target	7.9320
			DE _{a3}	Type	7.2854
FD _{a2}	Technology Demand	8.1204	DE _{a4}	Safety	8.0320
			DE _{a5}	Capabilities	7.8959
			DE _{a6}	Environments	6.1820
FD _{a3}	Product Resources	6.9484	DE _{a7}	Important Resources	6.5454
			DE _{a8}	Guarantee	7.9709
			DE _{a9}	Demand Source	6.7209
FD _{a4}	Purchase Impact	7.7271	DE _{a10}	Group Influence	9.0987
			DE _{a11}	Services	6.7520
			DE _{a12}	Price	7.0898
			DE _{a13}	Size	6.8742
FP _{a1}	Security Aspects	7.1668	PE _{a1}	Normalisation	6.6453
			PE _{a2}	Security level	5.9920
			PE _{a3}	Alert	6.8054
FP _{a2}	Functional Aspects	7.4894	PE _{a4}	Integrated	6.4586
			PE _{a5}	Customisation	6.7565
			PE _{a6}	Compatibility	6.6298
			PE _{a7}	Updated	6.7786
FP _{a3}	Design Aspects	6.5114	PE _{a8}	Visual	6.5698
			PE _{a9}	Usability	6.5454
			PE _{a10}	Personalised	7.0831
FP _{a4}	Brand Aspects	7.4750	PE _{a11}	Brand	6.7520
			PE _{a12}	Concept	6.9454
			PE _{a13}	Experts	6.6142
FP _{a5}	Economic Aspects	7.2053	PE _{a14}	Budget	6.2298
			PE _{a15}	Payment	7.1320
			PE _{a16}	Cycle	6.5920
FP _{a6}	Service Preference	7.3805	PE _{a17}	Feedback	6.5498
			PE _{a18}	Delivery	6.5986
			PE _{a19}	Intelligent	7.2054
			PE _{a20}	Remote	7.1386
			PE _{a21}	Onsite	6.7654
			PE _{a22}	Aftersales	6.7875
FD _{b1}	User Goals	7.2001	DE _{b1}	Groups	6.1320
			DE _{b2}	Target	7.8320
			DE _{b3}	Type	6.8542
FD _{b2}	Technology Demand	6.5114	DE _{b4}	Safety	7.6070
			DE _{b5}	Capabilities	7.9820
			DE _{b6}	Environments	7.9820
FD _{b3}	Product Resources	6.9243	DE _{b7}	Important Resources	6.7676
			DE _{b8}	Guarantee	7.7820
			DE _{b9}	Demand Source	7.0186
FD _{b4}	Purchase Impact	7.0720	DE _{b10}	Group Influence	9.1653
			DE _{b11}	Services	7.4320

Table 5.45 : Continued

FP _{b1}	Work Habits	7.2219	DE _{b12}	Price	6.8542
			DE _{b13}	Size	7.1210
			PE _{b1}	Work Time	7.0498
			PE _{b2}	Address	6.9120
			PE _{b3}	Terminal	7.4931
FP _{b2}	Operating Habits	7.2001	PE _{b4}	Teamwork	7.1320
			PE _{b5}	Keyboard	6.0009
			PE _{b6}	Speech	7.0430
			PE _{b7}	Touch	7.1298
			PE _{b8}	Failure	6.7987
FP _{b3}	Interface Preferences	6.9243	PE _{b9}	Access	6.8720
			PE _{b10}	Stay	6.8631
			PE _{b11}	Theme	7.8320
			PE _{b12}	Colour	6.8053
			PE _{b13}	Layout	7.0831
FP _{b4}	Assist Service	7.7271	PE _{b14}	Rate	6.6786
			PE _{b15}	Robot frequency	7.2410
			PE _{b16}	Robot Time	7.4942
			PE _{b17}	Field frequency	6.3275
			PE _{b18}	Field Time	6.8654
			PE _{b19}	Remote frequency	7.0520
			PE _{b20}	Remote Time	6.9520

(Source by author)

Table 5.6 : Customer Satisfaction Comprehensive Evaluation Results

CS	Evaluation Result	Actual result	Satisfaction Degree
BS	7.1838	7.06	Satisfied (>7)
US	7.5666	7.62	Satisfied (>7)

(Source by author)

The overall evaluation satisfaction of purchase participation is 7.1838, and the overall evaluation satisfaction of customers is 7.5666. According to the 5.6.11 comprehensive evaluation method in the framework of this paper, when the satisfaction score is between 6.1 and 8.0, which is expressed as “Satisfaction”, the customers are understood to have the intention to buy as “Have Intention to Buy”. The results of the analysis of HMC’s corporate satisfaction statistics data in 4.6.5 compared with the CBDF predictions, the purchasing participant’s evaluation result was 7.1838, and the actual result was 7.06, with a deviation value of 0.1238; and the customer’s assessed

result was 7.5666, and the actual result was 7.62, with a deviation value of 0.0534. Although the difference between the evaluation result of the BS group and the US group and the actual result deviations, their actual satisfaction ratings were higher than 7, so both groups were rated as “satisfactory”. This is consistent with the predictions of the framework and further validates the validity of the framework. It also proves that the framework can help developers understand the satisfaction level of customers in their purchase decisions by analysing product needs and customer preferences, and formulate reasonable marketing strategies, accordingly, thus increasing the purchase conversion rate.

5.7 Conclusion

The product purchase decision outcome depends on whether the product satisfies the customer’s product demand and preference. Product demand provides essential security for product decisions through the objective existence of real needs, while preferences determine the product preferences of different customer groups, and preferences influence the willingness to make purchase decisions. Sales and product people can achieve customer satisfaction in the buying decision process by considering the product needs (DEs) and product preferences (PEs) of successful buying customers. These two can help sales and product personnel to establish an efficient feedback mechanism with customers in the purchase decision process, it can clearly identify the characteristics of the customer group in the purchase decision process and clarify the characteristics of the product elements of the customer satisfaction type (CS), which can improve the customer’s purchase intention and the success rate of product sales. The Customer Satisfaction Assessment Methodology was developed to facilitate sales and product personnel to quickly obtain satisfaction

results to quickly judge customer purchase intent, and it provides a complete process to enable reliable and accurate analysis of the product needs and preferred elements of the purchasing participant and the customer. This chapter validates the new methodology of customer satisfaction by using the data from the research of companies with purchase intention and proves that the influence of the product needs and preferences of the companies is highly fitted to the data of satisfaction criteria, and the comprehensive satisfaction results are in line with the purchase intention. In addition, by using the research data of enterprises without purchase intention, it is proved that the influence of the elements of enterprise product demand and preference deviates from the satisfaction standard data, and the comprehensive satisfaction results deviate. Finally, the Customer Buying Decision Framework (CBDF) in this paper is confirmed to be effective and able to provide strong support for sales and product personnel in customer buying decisions.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.1 Introduction

This chapter concludes from the findings of the study. This is followed by an explanation of the contribution and novelty of the study. Finally, limitations of the study and suggestions for future research are discussed.

6.2 Conclusion

The Chinese enterprise products are more and more difficult to meet the needs of the customers, this is because of only consider part of the customer demand for product development, has not been able to meet the changing needs of customers, the product has lost the long-term product planning and management, so the product application market is facing a greater challenge. Therefore, this paper optimises the customer demand orientation, combines the characteristics of Chinese product demand, based on the scientific product demand methodology, integrated market, development, application and other aspects of the customer group is subdivided into purchase participants, customers (users), customer demand segmentation into product demand (subjective) and preferences (objective), to achieve real-time communication with the customer group to adjust the new product development strategy in the customer purchasing decision-making process in order to improve customer purchase satisfaction. The following are the important conclusions from the three objectives of this paper:

- a) To identify the significance factors of demand and preference for satisfaction of the Chinese enterprise products - Firms are faced with intense competition

and rapidly changing customer demand. To gain customer satisfaction and increase customers' product purchasing power in such an environment, companies must deeply understand the importance factors of product demand and preference in the buying decision process. This paper deepens the customer orientation theory and combines it with practical cases to deeply analyse what are the factors affecting customer satisfaction and purchase decision-making. Eventually, it is found that there are 4 important factors of product demand (objective) and 10 important factors of product preference (subjective), and the importance of these factors is proved through the research of several enterprise customers who have already purchased the existing business logic-based products. Purchasing participants, customers are regarded as an important part of the purchasing decision maker, and their different perspectives and weighted purchasing intentions provide a stronger guarantee and more unexpected ideas for the innovative development of new products, thus creating higher product value and quality for the new product, improving customer satisfaction from intention to purchase, and reducing market uncertainty. The study also found that customer groups from the problem identification to the product purchase of the entire decision-making process, the most important source of decision-making information scientific product needs and preferences, that is, the satisfaction of 14 important factors, to meet these needs is the key to customer satisfaction of the enterprise.

- b) To investigate the element of demand and preference for satisfaction of the Chinese enterprise products - For a company to win customers and to win customers and increase their satisfaction, companies must have a deep understanding of the key elements of product demand and preference that influence in the buying decision process toward customer satisfaction. The product needs and preferences profile of successful buying customers, established through a collaborative effort between HMC's customers and industry experts, ultimately revealed that there were 13 elements included in the product needs factor and 42 elements included in the preferences factor, i.e., 55 elements of satisfaction. However, by investigating the data from HMC's existing two (2) corporate customers and applying the Random Forest algorithm for element importance identification, it was found that the

ranking of element importance characteristics varied among different customer groups: those with a high impact on the satisfaction of purchase participant elements were safety, capabilities, concept, demand source, personalised, and budget; and for customer element satisfaction, safety, keyboard, field frequency, work time, target remote frequency, and services. In addition, from the results of the 300 questionnaires of purchase participants and customers respectively, it was found that the importance of different customer groups' element importance characteristics ranked differently. 300 questionnaires each, it was found that the data results of different customer groups for the same product demand elements varied greatly, and the data characteristics of product preference elements were obvious. These element characteristics are recognised as important elements for establishing product satisfaction characteristics in the purchasing decision process, and certainly help to improve the success rate of new products.

- c) To develop a new framework that integrates the elements of demand and preference for satisfaction the Chinese enterprise products - Satisfaction. By defining product satisfaction through the buying decision process, Mapping the Elements of Product Demand and Preference is developed to establish a satisfaction-based product identification process. Through AHP combined with fuzzy synthesis algorithm, subjective and objective weight calculation, K-mean and affiliation degree to calculate the importance and finally to quickly evaluate the customer's satisfaction situation in the buying process and to predict the customer's predicted purchase intention. In this research, the effectiveness of the method is verified by analysing the data of customer groups with satisfaction scores greater than seven (7). The results found that there is an intention to buy customer results identified features and satisfaction standard line is a better fit and found that the integrated satisfaction in the standard threshold range, the data successfully proved that the customer has the intention to buy. It shows that Customer Buying Decision Framework (CBDF), which can respond to customer buying decision satisfaction and predict customer buying intention, provides effective product demand support for new product development.

6.3 Research Contribution to the Knowledge

The analytical framework of product demand and preference in the purchasing decision process not only enriches the customer demand-oriented theory theoretically, but also provides guidance for enterprises on market strategy and product development mainly in practice, and the research fills the gap of previous studies. At the same time, this framework improves the market adaptability and quality of products in terms of products and enhances the comprehensive awareness and innovation ability of employees in terms of personnel, which promotes the overall competitiveness of enterprises. Through this comprehensive analysis, enterprises can better understand their customers, meet market demands and realise long-term development. The research contribution will be explained in detail in the following four (4) aspects:

- a) Theoretical contribution - Identifying and analysing the influencing factors of product demand and preference in the purchasing decision process helps to construct a new theoretical framework. This framework can systematically explain customer behaviour and provide new perspectives and explanations for the decision-making process of different customer choices, which enhances the practical application value of the theory and enriches the existing customer-oriented demand theory.
- b) Practical contribution - By identifying the key elements of product demand and preference in the purchasing decision process, companies can conduct product development and marketing activities with a deeper understanding of the dynamic trends in demand and preference of customers for successful products, thereby improving sales performance. Enterprises can better manage customer relationships and personalize innovations and improve services in a more targeted manner among their buying customer bases.
- c) Product contribution - Through in-depth analysis of customers' product needs and preferences, enterprises can develop products that are more in line with market demand and improve the market adaptability and competitiveness of

their products. Identifying customers' unsatisfied needs and preferences can stimulate innovative thinking and develop new product functions and features to meet customers' changing needs. According to customers' quality needs and basic functional needs, enterprises can focus on quality control and functional optimization in the product design and development process to improve the overall quality and performance of the product and return to the market demand in a way that maximizes the benefits for both parties.

- d) Personnel contribution - By applying the purchase decision framework, the marketing team can more accurately locate the target market and customer groups, formulate more effective marketing strategies, and improve the marketing effect; the product personnel can better understand the market dynamics and customer expectations, and improve the market awareness and the ability to serve the rapid correspondence. The R&D team can improve the quality of R&D, reduce rework rate, and improve delivery speed.

6.3.1 The Research Novelty

The novelty of this study is that the whole application framework of Customer Buying Decision (CBDF) has been created. The design of CBDF is based on the theoretical foundation of customer demand orientation to define the concept of purchase satisfaction and the process influencing factors, and to establish the characteristics of product demand (DEs) and preference characteristics (PEs) through the product demand characteristics for successful sales, to improve the customer purchase intention and increase the probability of successful product sales. Preferences (PEs), to improve customer purchase intention and increase the probability of product sales success. The framework integrates two types of groups: purchase participants and users, and combines product personnel, business experts, and researchers to build the product demand (objective influence) and the preference (subjective influence) demand of different groups of corporate customers, respectively. The framework also

serves as a purchasing decision-making tool in which sales and product personnel can identify the characteristics of a new product that meets the needs of users and determine the likelihood that the product will be sold successfully. As demonstrated by the validation study discussed in Chapter 5.4.4, sales and product personnel will quickly obtain satisfaction assessment results and quickly optimize product strategies to communicate efficiently with customers and R&D personnel, ultimately leading to a new product development solution. Customer Buying Decision Framework (CBDF) Innovation Service Process: Comparative analysis shows that the CBDF purchase decision response path pays more attention to the refinement of customer demands and preferences, and adds a satisfaction assessment link, which makes feedback and adjustment more flexible and helps to improve customer satisfaction.

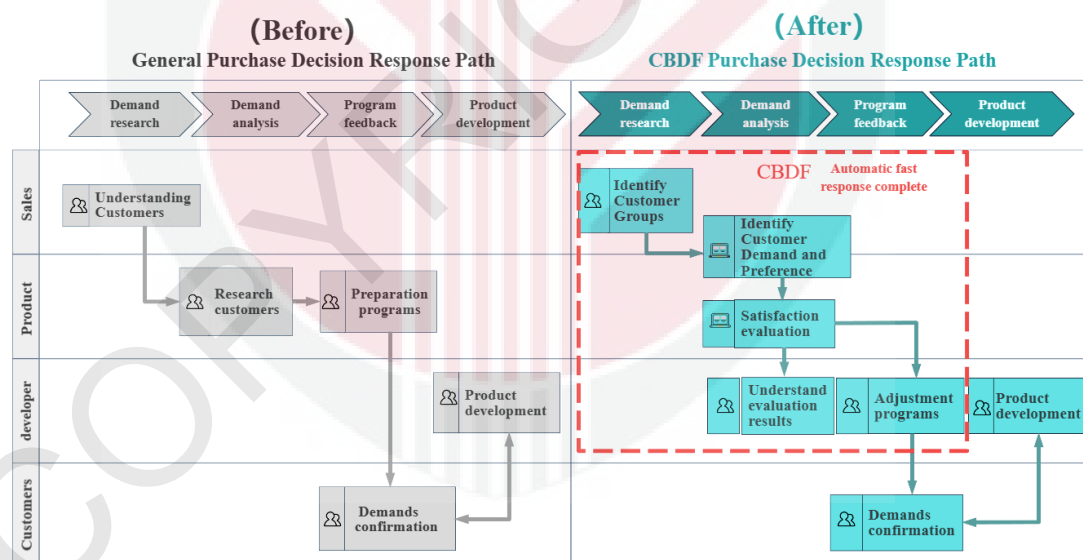


Figure 6.1 : Purchase Decision Process Evaluation Comparison
(Source by author)

Figure 6.1 compares the Traditional Purchase Decision Response Path (General Purchase Decision Response Path) with the CBDF Purchase Decision Response Path, demonstrating the differences between the two purchasing processes in terms of

requirements identification, feedback mechanisms, and product development. The difference between the two purchasing processes in terms of demand identification, feedback mechanisms and product development are demonstrated. The CBDF Purchase Decision Response Path relies on direct communication between the sales force and the customer, with the product personnel conducting the requirement study and then formulating a proposal, which is confirmed by the customer and then enters the product development stage. On the other hand, the CBDF purchasing path introduces customer group identification, demand preference analysis and satisfaction assessment to optimize the purchasing process through a data-driven approach and improve the accuracy of demand matching.

Compared with the traditional path, CBDF procurement decision path has obvious advantages in the refinement of demand analysis, the perfection of feedback mechanism and the flexibility of product adjustment. the CBDF method not only helps suppliers understand customer demand more accurately, but also reduces procurement failures due to demand deviation and improves procurement efficiency and customer satisfaction through satisfaction assessment and program adjustment. Therefore, the CBDF procurement path is more scientific and data-oriented, which can optimize supply chain management and lay the foundation for the precision of the enterprise procurement process.

6.3.2 The Framework Work

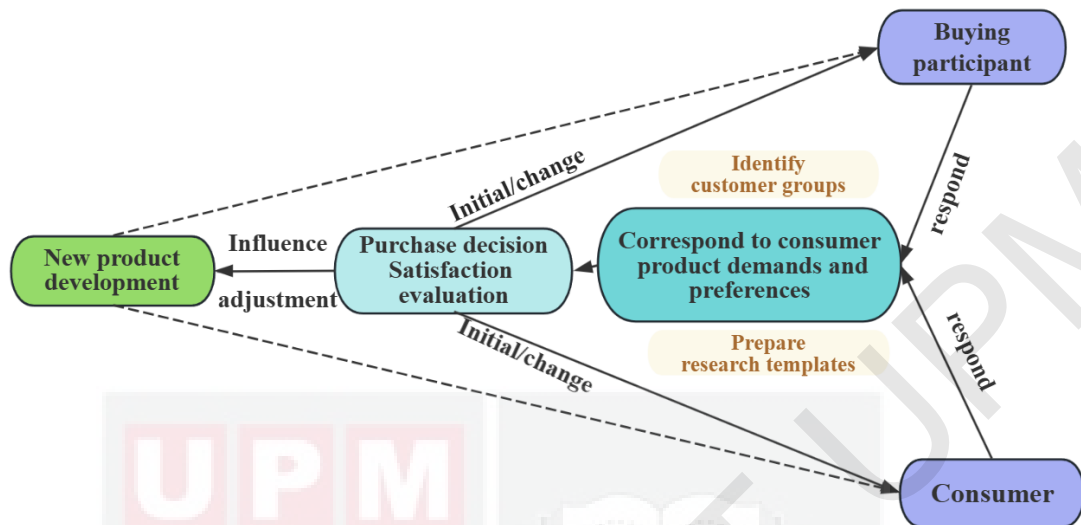


Figure 6.2 : Customer Buying Decision Framework (CBDF) Based on Product Demand and Preference toward Satisfaction
(Source by author)

Identifying customer segments, gathering information, categorising, and assessing customer needs and preferences are key steps in the marketing and product development process. These steps are designed to ensure that a company's products and services meet the needs of its customers, thereby increasing satisfaction with purchasing decisions. Here are the key steps in this process and what they mean:

Step (1) Identify customer groups: Clarify customer groups based on basic customer information characteristics (e.g., personal information, job information). Ensure that the main needs of customers are understood by studying the needs, pain points and preferences of each customer group.

Step (2) Prepare research templates: Prepare appropriate questionnaire designs around the key content contained in product needs and preferences; or prepare interview

phrases for communicating with customers around key information to obtain more important and effective information.

Step (3) Information collection and categorisation: Collect initial information about customers' product needs and preferences through questionnaires, interviews, and focus groups. According to different elements of needs and preferences, the collected information is categorised, and key elements are identified.

Step (4) Evaluation of product demands and preferences: Evaluate the needs and preferences of customer groups for the product, which involves the results of the elements of the two categories of purchasing participants, customers.

Step (5) Purchase decision satisfaction assessment: An assessment form is used to measure customer satisfaction in the purchase decision. The assessment form contains indicators such as ratings and satisfaction levels. Based on the assessment results, the customer's satisfaction with the purchase decision is analysed and the feedback scheme is optimised.

Step (6) Multiple communications and adjustments: Maintain communication with customers throughout the process, and based on customer feedback, iteratively adjust product requirements and preference element options to ensure customer expectations are met.

Step (7) Determine final satisfaction interval: Confirm the element weight and satisfaction score according to the satisfaction requirements.

Step (8) Develop efficient intent options: Based on the results of satisfaction assessment and customer needs and preference elements, customise products and services to ensure that the expectations of different customer groups are met, and develop efficient sales strategies to meet customers' purchase intentions.

Step (9) Rapid improvement to enhance customer satisfaction: Continue to collect feedback from customer groups after product trials or sales to ensure continuous improvement of products and services. Adjust sales and product strategies according to changes in customer needs to ensure that customer satisfaction is maintained.

Step (10) Adjustment of new product development: Adjusting the new product development process to be oriented to customer needs and preferences can significantly improve product market competitiveness and customer satisfaction.

6.4 Limitations of Research

There are three (3) limitations to the experience of conducting this study, which are identified and described as follows.

- a) Limitations of the research object
 - i) The research object of this study focuses on the standard products and customer groups in the medical field of HMC. Although the standard products involved include business platforms, social service products, basic products, etc., which cover a part of the business in the medical industry, because HMC, as a nationwide business service platform, has complex service contents and business models, is oriented to a diverse group of customers, and is involved in a certain degree of specificity in terms of demand and bias. Therefore, the results of this study can only reflect the demand characteristics of specific products and customer

groups in the medical field of HMC and have certain limitations. There are certain differences in analysing the customer needs and preferences of companies in different fields, sizes, and stages of development, and the conclusions of this study may not be fully applicable. Therefore, future research needs to be extended to different types of products and industries to fully understand the diversity of customer needs.

- ii) The medical industry has its own uniqueness, involving regulations, technical standards, and market demands with a high degree of complexity and strict requirements. For example, medical products need to comply with national and local regulatory requirements, clinical standards and ethical norms, which makes the technical research and development, product design and marketing in the industry somewhat unique. With changing market demands and technological advances, the medical industry has become more stringent in its demands for innovation and quality. Therefore, the applicability of the results of this study in other industries or market environments may be somewhat limited. For example, other industries may not have the same stringent regulatory and standard requirements as the healthcare industry and may face different market competition patterns and consumer demands. In order to ensure the broad applicability of the results of this study, future research should further validate and adjust the cross-industry validation by comparing the research framework of the healthcare industry with other industries to adjust the research methodology or results, so as to provide more generalized references and lessons for enterprises in different fields.

b) Dynamic changes in customer demands and preferences

- i) Customer demands and preferences are inherently dynamic and are influenced by a variety of factors, including the market environment, technological advances, changes in consumer behaviour, and macroeconomic fluctuations. While the influencing factors and elements involved in this study can effectively reflect the characteristics of customer demand at specific points in time, they need to be continuously

and dynamically supplemented and updated as the market environment and customer demand continue to evolve. Static analytics cannot capture real-time changes in customer needs and preferences in a timely manner, which may result in analytical results that do not accurately reflect current market conditions. For example, as consumers pay more attention to new technologies and innovative products, the functional requirements of products may change rapidly, and if the analytical framework is not updated in a timely manner, it may not be able to effectively guide companies in making strategic adjustments. Therefore, to more accurately capture customer demand, future research needs to focus on the dynamic nature of customer demand and adopt more adaptable analytical methods.

- ii) Data collection and analysis mechanisms have certain limitations. First, the process of data collection may be constrained by technology, resources and time, and the construction of a comprehensive and efficient data collection system may face high costs and technical challenges, especially in large enterprises or those operating across geographical boundaries. In addition, although data on customer needs and preferences can be regularly updated, obtaining fully accurate data in a timely manner remains difficult due to the rapid changes in the marketplace and the uncertainty of customer behaviour. For example, the needs of certain consumers may change drastically in a short period of time, and a company's response time cannot fully match this change. Second, the accuracy of data analysis also depends on the quality and source of data. Incomplete or biased data collection may lead to inaccurate analysis results, which in turn may affect the correctness of decision-making. Therefore, although the data analysis mechanism can provide some decision support, it still faces limitations in terms of data timeliness, accuracy and coverage, and needs to be combined with other market insights and professional experience to make more comprehensive and rational decisions.

- c) Limitations of the elemental Weighting Algorithm
- i) The element weighting algorithm used in this study needs to be continuously trained and optimised with the changes in customer data to improve its adaptability and accuracy. The effectiveness of the Random Forest Algorithm depends on high-quality data and sufficient sample size, if the data quality is not high or the sample size is insufficient, it may lead to inaccurate analysis results and affect the effectiveness of decision-making. The initial algorithm model may have certain deviations, which need to be corrected and optimised by a large amount of actual data.
 - ii) Although the AHP comprehensive evaluation algorithm is widely used in multifactor decision analysis, there are certain limitations in its use. First, the application process of AHP is complicated, especially when multiple evaluation indicators and levels are involved, a detailed hierarchical model needs to be constructed and many comparisons and judgments need to be made, which is a lengthy and time-consuming process. Secondly, the AHP algorithm relies on expert judgment and experience, which may lead to the results being affected by subjective bias, and the difference in judgment between different experts may cause inconsistency in the results. In addition, the calculation process of AHP involves matrix operations and weight normalization, which may lead to bias and affect the effectiveness of decision-making if the data are inaccurate or have errors. Finally, AHP is suitable for relatively well-defined decision-making problems, but its limitations are more obvious in complex and dynamically changing environments, and it needs to be combined with other methods to make up for its shortcomings.

6.5 Recommendations for Future Research

Future research should focus on identifying the impact of product features and functions on customer value to ensure that companies can develop more competitive products in the marketplace and accurately meet the needs of different customer groups. Through in-depth analysis of customer feedback and purchasing behaviour, it is possible to determine which key factors best drive customer satisfaction and loyalty, providing a scientific basis for product development, market strategy, and customer relationship management.

- a) **Product perspective: Enhancing competitiveness and market adaptability -**
From a product perspective, research should focus on the impact of core features (e.g., performance, stability, reliability, scalability, and user experience) on customer value. For example, high-performance products can enhance usage efficiency and market appeal, while stability and reliability are directly related to long-term user retention. In addition to basic functionality, product innovation, customization capabilities, and the feasibility of technological upgrades are also important factors that influence customers' purchasing decisions. For example, enterprise customers may pay more attention to whether the product supports modular upgrades, data compatibility and system integration capabilities, while individual customers may prefer appearance design, convenient operation and personalized settings. Using big data analysis and market feedback, we can accurately identify the demand preferences of different customer groups for product features, optimise product design and improve market acceptance. In addition, future product development should pay more attention to green, intelligent and sustainable development. As consumers' awareness of environmental protection increases, products with low energy consumption and high efficiency will be more favoured by the market. Meanwhile, intelligent products (e.g., AI-driven, automated tuning, self-learning algorithms, etc.) can enhance the user experience and provide customers with a more convenient way of using them. By enhancing their technological innovation

capabilities, companies can create differentiated competitive advantages and capture a larger market share.

- b) Customer perspective: Precise demand insights and personalised service - From a customer perspective, research should focus on customers' purchasing behaviour, usage habits and satisfaction feedback to clarify which factors drive customer loyalty the most. For example, enterprise customers are more concerned about the long-term value of the product, data security and service support, while individual customers prefer intuitive operating experience, convenient after-sales support and flexible payment methods. Therefore, it is necessary to provide personalized solutions for different customer groups to improve customer stickiness. Market segmentation will be one of the key directions for future research. For example, for the B-support (enterprise-type customers), accurate recommendations based on data analysis, customized services and long-term strategic cooperation support can be provided; while for the C-support (individual users), market acceptance can be enhanced through AI intelligent recommendations, enhanced user experience and optimized social marketing strategies.
- c) Optimisation of customer demand management application: Intelligent and efficient interaction - In terms of customer demand management applications, it is necessary to further optimise the interaction experience between salespeople, product personnel and customers to ensure efficient delivery of demand information and accurate feedback. In the future, the customer demand management process can be optimised in the following ways: using AI and machine learning technology to automatically analyse customers' historical purchase data, predict potential demand, and provide personalized product recommendations. Creating a more concise and efficient user interface to reduce user learning costs, enabling sales, product teams and customers to quickly input, query and adjust requirements. Intelligently recommend the most appropriate product solutions based on customer preferences and provide a variety of personalised adjustment options. Combining AI customer service and natural language processing technology,

it provides intelligent Q&A and personalised consultation to improve customer communication efficiency.

Future research should focus on the identification of high-value product features, the analysis of demand differences among different customer groups, and the optimization of intelligent demand management tools. By continuously optimising product features, customer experience, and demand management processes, developers can accurately align with market demand, enhance customer satisfaction, and occupy a more favourable position in the competitive market environment. In addition, future product development should not only focus on technology and function optimization, but also consider market trends, industry development direction and policy environment to ensure that products have long-term competitiveness. For example, enterprises can focus on innovative applications in the fields of intelligent manufacturing, digital transformation, green energy, etc., and layout in advance to seize the first opportunity. In short, the future direction of research and optimization should be based on scientific data analysis and market insights, combined with product innovation, customer experience optimization and intelligent demand management, to form a comprehensive competitive advantage and lay a solid foundation for the sustainable development of enterprises.

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APPENDICES

Appendix A

Buying Participant Demand and Preference Survey

Dear Purchaser:

So, thank you for choosing our product; to better understand your usage and satisfaction, we have created this questionnaire, and we hope you will take a few minutes to fill it out. Your comments and suggestions are very important to us, and we will continuously improve our products and services based on your feedback. Please choose or fill in the answer that best suits your actual situation after each question, thank you for your cooperation!

Name :	
Company Name :	
E-mail :	
Contact Number :	

Basic Information

1.Sex	
Male	Female

2.Age				
18-25 years old	26-35 years old	36-45 years old	46-55 years old	Over 56 years old

3.Degree				
Junior high school and below	High School/ Technical Secondary School	College Specialty	University Courses	Graduate student or above

Job Information

4.Position				
Management	Technical	Services	Operations	Other

5.Work experience				
Less than 1 year	1-3 years	3-5 years	5-10 years	More than 10 years

Product demand research
Product requirements - user goals

6. What do you think is the core user group of the product?		
Grassroots workers	Employee managers	Senior leadership

7. What do you think is the application target of the product?			
Effective daily work	Meet the policy assessment	Enterprise strategic planning	Achieve industry competition

8. What type of product do you think is needed?				
Functional	Operational	Data oriented	Social	Safe

Product demand - Technical demand

9. What do you think are the most effective safety measures for your products?			
Role permission control	Data security encryption	Abnormal behaviour warning	Business process control

10. What do you think the product must have capabilities?			
Application of intelligent technology	Localization adaptation	Stable infrastructure	Complex business support

11. What do you think the product needs to support the environment?			
On-premises	Deploy in the cloud	Private network deployment	Internet Deployment

Product Requirements - Product Resources

12. What do you think is the most important product resource?				
Hardware Resources	Human Resources	Technical Resources	Financial Resources	Market Resources

13. What do you think is important when product resources guarantee is limited?			
Sound business logic	Complete effective functions	Control financial costs	Deliver tasks on time

14. What do you think is the effective source of demand?			
User requirements.	Adjustment of policy	Expert feedback Market Analysis -	Competitor analysis

Product demand - purchase impact

15. Who do you think most influences purchasing decisions group?		
Grassroots workers	Employee managers	Senior leadership

16. What do you think are the products services that affect the purchase?				
Product features	Product availability	Product reliability	Product performance	Added value Of the product

17. What price do you think is acceptable price when buying?				
Less than 100,000	110,000-300,000	310,000-500,000	510,000-1,000,000	More than 1,000,000

18. What do you think is the acceptable size of the business when buying?				
10-50 people	51-100 people	101-200 people	201-300 people	More than 301 people

Customer Purchase Influence - Product Preference Survey

Product preference - Security aspects

19. In your opinion, the product business normalization needs to be met?				
Enterprise-grade standards	Group standards	Provincial standards	National standards	International standards

20. What do you think is the information security level standard should be met?				
Level 1	Level 2	Level 3	Level 4	Level 5

21. What do you think are the requirements for breach alerting and blocking?				
Very unimportant	Not very important	Medium important	Fairly important	Very important

Product preference - functional aspects

22. What do you think is the integrated scalability of the product?				
Very unimportant	Not very important	Medium important	Fairly important	Very important

23. What do you think is the customization capability of the product?				
Very unimportant	Not very important	Medium important	Fairly important	Very important

24. What do you think, product compatibility?				
Very unimportant	Not very important	Medium important	Fairly important	Very important

25. How often do you think the product is updated?				
Very unimportant	Not very important	Medium important	Fairly important	Very important

Product preference - design aspects

26. What do you think about the visual design of the product?				
Very unimportant	Not very important	Medium important	Fairly important	Very important

27. What do you think about the ease of use of the product?				
Very unimportant	Not very important	Medium important	Fairly important	Very important

28. What do you think about personalized design of the product?				
Very unimportant	Not very important	Medium important	Fairly important	Very important

Product preference - brand aspects

29. What do you think is the brand influence of the product?				
Very unimportant	Not very important	Medium important	Fairly important	Very important

30. What do you think is the brand concept of the product?				
Very unimportant	Not very important	Medium important	Fairly important	Very important

31. What do you think is experts on the recognition of the product?				
Very unimportant	Less important	Medium important	More important	Very important

Product preference - economic aspects

32. what is the impact of budget on the purchase of products?				
Very unimportant	Less important	Medium important	More important	Very important

33. What do you think is the best payment method for the product?				
Lump sum payment	instalment	Pay as you go	Try it for free	other

34. What do you think is the best life cycle for the product?				
Less than 1 year	1-3 years	4-5 years	6-8 year	More than 9 years

Product preference - service aspects

35.What do you think is the speed of communication and feedback of the product?				
Very unimportant	Less important	Medium important	More important	Very important

36. What do you think is the delivery speed of the product?				
Very unimportant	Less important	Medium important	More important	Very important

37. What do you think of the product's intelligent customer service?				
Very unimportant	Less important	Medium important	More important	Very important

38. What do you think about the remote customer service of the product?				
Very unimportant	Less important	Medium important	More important	Very important

39. What do you think about the onsite customer service of the product?				
Very unimportant	Less important	Medium important	More important	Very important

40. What do you think is the timeliness of after-sales service?				
Very unimportant	Less important	Medium important	More important	Very important

41. Do you rate your satisfaction with an existing product?									
1	2	3	4	5	6	7	8	9	10



Appendix B

User Demand and Preference Survey

Dear Clients:

So, thank you for choosing our product; to better understand your usage and satisfaction, we have created this questionnaire, we hope you will take a few minutes to fill it out. Your comments and suggestions are very important to us, and we will continuously improve our products and services based on your feedback. Please choose or fill in the answer that best suits your actual situation after each question, thank you for your cooperation!

Name	:	
Company Name	:	
E-mail	:	
Contact Number	:	

Basic Information

1.Sex	
Male	Female

2.Age				
18-25 years old	26-35 years old	36-45 years old	46-55 years old	Over 56 years old

3.Degree				
Junior high school and below	High School/ Technical Secondary School	College Specialty	University Courses	Graduate student or above

Job Information

4.Position				
Management	Technical	Services	Operations	Other

5.Work experience				
Less than 1 year	1-3 years	3-5 years	5-10 years	More than 10 years

Product demand research
Product requirements - user goals

6. What do you think is the core user group of the product?		
Grassroots workers	Employee managers	Senior leadership

7. What do you think is the application target of the product?			
Effective daily work	Meet the policy assessment	Enterprise strategic planning	Achieve industry competition

8. What type of product do you think is needed?				
Functional	Operational	Data oriented	Social	Safe

Product demand - Technical demand

9. What do you think are the most effective safety measures for your products?			
Role permission control	Data security encryption	Abnormal behaviour warning	Business process control

10. What do you think the product must have capabilities?			
Application of intelligent technology	Localization adaptation	Stable infrastructure	Complex business support

11. What do you think the product needs to support the environment?			
On-premises	Deploy in the cloud	Private network deployment	Internet Deployment

Product Requirements - Product Resources

12. What do you think is the most important product resource?				
Hardware Resources	Human Resources	Technical Resources	Financial Resources	Market Resources

13. What do you think is important when product resources guarantee is limited?			
Sound business logic	Complete effective functions	Control financial costs	Deliver tasks on time

14. What do you think is the effective source of demand?			
User requirements.	Adjustment of policy	Expert feedback Market Analysis -	Competitor analysis

Product demand - purchase impact

15. Who do you think most influences purchasing decisions group?		
Grassroots workers	Employee managers	Senior leadership

16. What do you think are the products services that affect the purchase?				
Product features	Product availability	Product reliability	Product performance	Added value Of the product

17. What price do you think is acceptable price when buying?				
Less than 100,000	110,000-300,000	310,000-500,000	510,000-1,000,000	More than 1,000,000

18. What do you think is the acceptable size of the business when buying?				
10-50 people	51-100 people	101-200 people	201-300 people	More than 301 people

Appendix C

Buyer Participant Evaluation Layer Weight and Fuzzy Evaluation

Demand & Preferences	Element Attribute	Weight	V1	V2	V3	V4	V5
User Group	Grassroots workers	0.0369	0.0000	0.0000	0.0000	0.0000	1.0000
	Employee managers	0.0246	0.0000	0.0000	0.5000	0.5000	0.0000
	Senior leadership	0.0123	0.0000	0.4286	0.5714	0.0000	0.0000
Target	Effective daily work	0.0368	0.0000	0.1429	0.8571	0.0000	0.0000
	Meet the policy assessment	0.0184	0.0000	0.8571	0.1429	0.0000	0.0000
	Enterprise strategic planning	0.0553	0.0000	0.0000	0.5000	0.5000	0.0000
	Achieve industry competition	0.0737	0.0000	0.0000	0.5000	0.5000	0.0000
Type	Functional	0.0062	0.2222	0.7778	0.0000	0.0000	0.0000
	Operational	0.0125	0.1111	0.8889	0.0000	0.0000	0.0000
	Data oriented	0.0311	0.0000	0.0000	0.7000	0.3000	0.0000
	Social	0.0187	0.0000	1.0000	0.0000	0.0000	0.0000
	Safe	0.0249	0.0000	0.0000	1.0000	0.0000	0.0000
Safety	Role permission control	0.0488	0.0000	0.8571	0.1429	0.0000	0.0000
	Data security encryption	0.1464	0.0000	0.0000	0.6000	0.4000	0.0000
	Abnormal behaviour warning	0.1952	0.0000	0.0000	0.2000	0.8000	0.0000
	Business process control	0.0976	0.0000	0.2857	0.7143	0.0000	0.0000
Capabilities	Application of intelligent technology	0.0897	0.0000	0.1429	0.8571	0.0000	0.0000
	Localization adaptation	0.1794	0.0000	0.0000	0.0000	0.7000	0.3000

	Stable software architecture	0.0449	0.1111	0.8889	0.0000	0.0000	0.0000
	Complex business support	0.1346	0.0000	0.1429	0.8571	0.0000	0.0000
Environ-ments	On-premises	0.0084	1.0000	0.0000	0.0000	0.0000	0.0000
	Deploy in the cloud	0.0042	1.0000	0.0000	0.0000	0.0000	0.0000
	Private network deployment	0.0168	0.0000	0.0000	0.0000	0.0000	1.0000
	Internet Deployment	0.0126	0.0000	0.0000	1.0000	0.0000	0.0000
important Resources	Hardware Resources	0.0704	0.3333	0.6667	0.0000	0.0000	0.0000
	Human Resources	0.0469	1.0000	0.0000	0.0000	0.0000	0.0000
	Technical Resources	0.0938	0.0000	0.0000	0.0000	0.7000	0.3000
	Financial Resources	0.1173	0.0000	0.0000	0.0000	0.4000	0.6000
	Market Resources	0.0235	1.0000	0.0000	0.0000	0.0000	0.0000
Guarantee	Sound business logic	0.0307	0.0000	0.4286	0.5714	0.0000	0.0000
	Complete effective functions	0.0460	0.0000	0.0000	0.9000	0.1000	0.0000
	Control financial costs	0.0614	0.0000	0.0000	0.0000	0.6000	0.4000
	Deliver tasks on time	0.0153	0.1111	0.8889	0.0000	0.0000	0.0000
Demand source	User requirements	0.0993	0.0000	0.1429	0.8571	0.0000	0.0000
	Adjustment of policy	0.0331	0.8889	0.1111	0.0000	0.0000	0.0000
	Expert feedback	0.0662	0.0000	0.4286	0.5714	0.0000	0.0000
	Market Analysis	0.1324	0.0000	0.1429	0.8571	0.0000	0.0000
	Competitor analysis	0.1655	0.0000	0.1429	0.8571	0.0000	0.0000
Group Influence	Grassroots workers	0.0400	0.0000	0.0000	0.0000	0.2000	0.8000

	Employee managers	0.0267	0.0000	0.0000	0.0000	0.8000	0.2000
	Senior leadership	0.0133	0.0000	0.2857	0.7143	0.0000	0.0000
Services	Product features	0.0052	1.0000		0.0000	0.0000	0.0000
	Product availability	0.0261	0.0000	0.0000	0.8000	0.2000	0.0000
	Product reliability	0.0104	0.0000	0.4286	0.5714	0.0000	0.0000
	Product performance	0.0156	0.0000	0.0000	1.0000	0.0000	0.0000
	Added value of the product	0.0209	0.0000	0.0000	0.9000	0.1000	0.0000
Price	Less than 100,000	0.0449	0.1111	0.8889	0.0000	0.0000	0.0000
	110,000-300,000	0.1123	0.0000	0.0000	0.6000	0.4000	0.0000
	310,000-500,000	0.0898	0.0000	0.0000	0.7000	0.3000	0.0000
	510,000-1,000,000	0.0674	0.0000	1.0000	0.0000	0.0000	0.0000
	More than 1,000,000	0.0225	0.6667	0.3333	0.0000	0.0000	0.0000
Size	10-50 people	0.0246	0.4444	0.5556	0.0000	0.0000	0.0000
	51-100	0.0369	0.0000	0.8571	0.1429	0.0000	0.0000
	101-200	0.0492	0.0000	0.2857	0.7143	0.0000	0.0000
	201-300	0.0616	0.0000	0.0000	0.0000	0.9000	0.1000
	More than 301 people	0.0123	0.7778	0.2222	0.0000	0.0000	0.0000
Normalization	Enterprise-grade standards	0.0020	0.6667	0.3333	0.0000	0.0000	0.0000
	Group standards	0.0040	0.6667	0.3333	0.0000	0.0000	0.0000
	Provincial standards	0.0080	0.0000	0.0000	1.0000	0.0000	0.0000
	National standards	0.0100	0.0000	0.0000	0.3000	0.7000	0.0000
	International standards	0.0060	0.0000	0.2857	0.7143	0.0000	0.0000
Security level	Level 1	0.0286	1.0000	0.0000	0.0000	0.0000	0.0000
	Level 2	0.1145	0.0000	0.0000	0.1000	0.9000	0.0000
	Level 3	0.1431	0.0000	0.0000	0.0000	0.0000	1.0000
	Level 4	0.0572	1.0000	0.0000	0.0000	0.0000	0.0000
	Level 5	0.0859	1.0000	0.0000	0.0000	0.0000	0.0000

Alert	Very unimportant	0.0409	0.3333	0.6667	0.0000	0.0000	0.0000
	Less important	0.0204	1.0000	0.0000	0.0000	0.0000	0.0000
	Moderately important	0.0613	0.0000	0.7143	0.2857	0.0000	0.0000
	More important	0.1022	0.0000	0.0000	0.0000	1.0000	0.0000
	Very important	0.0817	0.0000	0.0000	0.9000	0.1000	0.0000
Integrated	Very unimportant	0.0214	1.0000	0.0000	0.0000	0.0000	0.0000
	Less important	0.0429	0.6667	0.3333	0.0000	0.0000	0.0000
	Moderately important	0.0643	0.0000	0.2857	0.7143	0.0000	0.0000
	More important	0.1072	0.0000	0.0000	0.5000	0.5000	0.0000
	Very important	0.0857	0.0000	0.0000	0.6000	0.4000	0.0000
Customization	Very unimportant	0.0092	1.0000	0.0000	0.0000	0.0000	0.0000
	Less important	0.0185	0.4444	0.5556	0.0000	0.0000	0.0000
	Moderately important	0.0277	0.0000	0.5714	0.4286	0.0000	0.0000
	More important	0.0462	0.0000	0.0000	0.2000	0.8000	0.0000
	Very important	0.0369	0.0000	0.0000	0.6000	0.4000	0.0000
Compatibility	Very unimportant	0.0032	0.8889	0.1111	0.0000	0.0000	0.0000
	Less important	0.0064	0.7778	0.2222	0.0000	0.0000	0.0000
	Moderately important	0.0096	0.1111	0.8889	0.0000	0.0000	0.0000
	More important	0.0160	0.0000	0.0000	0.0000	0.7000	0.3000
	Very important	0.0128	0.0000	0.0000	0.6000	0.4000	0.0000
Updated	Very unimportant	0.0296	1.0000	0.0000	0.0000	0.0000	0.0000
	Less important	0.1481	0.0000	0.0000	0.1000	0.9000	0.0000
	Moderately important	0.1185	0.0000	0.0000	0.2000	0.8000	0.0000

	More important	0.0593	0.6667	0.3333	0.0000	0.0000	0.0000
	Very important	0.0889	0.0000	1.0000	0.0000	0.0000	0.0000
Visual	Very unimportant	0.0145	0.8889	0.1111	0.0000	0.0000	0.0000
	Less important	0.0072	0.8889	0.1111	0.0000	0.0000	0.0000
	Moderately important	0.0217	0.0000	1.0000	0.0000	0.0000	0.0000
	More important	0.0289	0.0000	0.0000	0.8000	0.2000	0.0000
	Very important	0.0361	0.0000	0.0000	0.0000	0.6000	0.4000
Usability	Very unimportant	0.0194	1.0000	0.0000	0.0000	0.0000	0.0000
	Less important	0.0389	1.0000	0.0000	0.0000	0.0000	0.0000
	Moderately important	0.0583	0.3333	0.6667	0.0000	0.0000	0.0000
	More important	0.0777	0.0000	0.0000	0.0000	0.8000	0.2000
	Very important	0.0972	0.0000	0.0000	0.0000	0.3000	0.7000
Persona-lized	Very unimportant	0.0320	1.0000	0.0000	0.0000	0.0000	0.0000
	Less important	0.1599	0.0000	0.0000	0.0000	0.3000	0.7000
	Moderately important	0.0640	0.1111	0.8889	0.0000	0.0000	0.0000
	More important	0.1279	0.0000	0.8571	0.1429	0.0000	0.0000
	Very important	0.0959	0.0000	1.0000	0.0000	0.0000	0.0000
Brand	Very unimportant	0.0165	1.0000	0.0000	0.0000	0.0000	0.0000
	Less important	0.0082	1.0000	0.0000	0.0000	0.0000	0.0000
	Moderately important	0.0247	0.0000	1.0000	0.0000	0.0000	0.0000
	More important	0.0329	0.0000	0.0000	0.1000	0.9000	0.0000
	Very important	0.0411	0.0000	0.0000	0.0000	0.2000	0.8000
Concept	Very unimportant	0.0355	1.0000	0.0000	0.0000	0.0000	0.0000

	Less important	0.1064	0.1111	0.8889	0.0000	0.0000	0.0000
	Moderately important	0.1773	0.0000	0.0000	0.0000	0.1000	0.9000
	More important	0.1419	0.0000	0.4286	0.5714	0.0000	0.0000
	Very important	0.0709	0.2222	0.7778	0.0000	0.0000	0.0000
Experts	Very unimportant	0.0226	1.0000	0.0000	0.0000	0.0000	0.0000
	Less important	0.0113	1.0000	0.0000	0.0000	0.0000	0.0000
	Moderately important	0.0339	0.2222	0.7778	0.0000	0.0000	0.0000
	More important	0.0452	0.0000	0.0000	0.0000	0.7000	0.3000
	Very important	0.0564	0.0000	0.0000	0.0000	0.5000	0.5000
Budget	Very unimportant	0.0613	1.0000	0.0000	0.0000	0.0000	0.0000
	Less important	0.0307	1.0000	0.0000	0.0000	0.0000	0.0000
	Moderately important	0.0920	0.7778	0.2222	0.0000	0.0000	0.0000
	More important	0.1533	0.0000	0.0000	0.0000	0.0000	1.0000
	Very important	0.1226	0.0000	0.0000	0.0000	0.9000	0.1000
Payment	Lump sum payment	0.0043	0.0000	1.0000	0.0000	0.0000	0.0000
	Payment by installments	0.0108	0.0000	0.0000	0.0000	0.7000	0.3000
	Pay on demand	0.0086	0.0000	0.0000	0.9000	0.1000	0.0000
	Try it for free	0.0065	0.0000	0.7143	0.2857	0.0000	0.0000
	Others	0.0022	1.0000	0.0000	0.0000	0.0000	0.0000
Cycle	Less than 1 year	0.0174	1.0000	0.0000	0.0000	0.0000	0.0000
	1 to 3 years	0.0696	0.0000	0.0000	0.2000	0.8000	0.0000
	4 to 5 years	0.0870	0.0000	0.0000	0.0000	0.8000	0.2000
	6 to 8 years	0.0348	0.5556	0.4444	0.0000	0.0000	0.0000
	More than 9 years	0.0522	0.4444	0.5556	0.0000	0.0000	0.0000
Feedback	Very unimportant	0.0164	1.0000	0.0000	0.0000	0.0000	0.0000
	Less important	0.0328	0.7778	0.2222	0.0000	0.0000	0.0000

	Moderately important	0.0492	0.0000	0.7143	0.2857	0.0000	0.0000
	More important	0.0655	0.0000	0.0000	0.8000	0.2000	0.0000
	Very important	0.0819	0.0000	0.0000	0.0000	0.7000	0.3000
Delivery	Very unimportant	0.0042	0.7778	0.2222	0.0000	0.0000	0.0000
	Less important	0.0021	0.8889	0.1111	0.0000	0.0000	0.0000
	Moderately important	0.0064	0.0000	0.8571	0.1429	0.0000	0.0000
	More important	0.0085	0.0000	0.0000	0.9000	0.1000	0.0000
	Very important	0.0106	0.0000	0.0000	0.0000	0.7000	0.3000
Intelligent	Very unimportant	0.0022	0.3333	0.6667	0.0000	0.0000	0.0000
	Less important	0.0065	0.0000	0.5714	0.4286	0.0000	0.0000
	Moderately important	0.0108	0.0000	0.0000	0.9000	0.1000	0.0000
	More important	0.0086	0.0000	0.1429	0.8571	0.0000	0.0000
	Very important	0.0043	0.0000	1.0000	0.0000	0.0000	0.0000
Remote	Very unimportant	0.0256	0.5556	0.4444	0.0000	0.0000	0.0000
	Less important	0.1022	0.0000	0.4286	0.5714	0.0000	0.0000
	Moderately important	0.1278	0.0000	0.0000	0.4000	0.6000	0.0000
	More important	0.0511	0.1111	0.8889	0.0000	0.0000	0.0000
	Very important	0.0767	0.0000	0.7143	0.2857	0.0000	0.0000
Onsite	Very unimportant	0.0021	0.8889	0.1111	0.0000	0.0000	0.0000
	Less important	0.0042	0.4444	0.5556	0.0000	0.0000	0.0000
	Moderately important	0.0063	0.0000	0.8571	0.1429	0.0000	0.0000
	More important	0.0085	0.0000	0.0000	0.8000	0.2000	0.0000
	Very important	0.0106	0.0000	0.0000	0.2000	0.8000	0.0000
Aftersales	Very unimportant	0.0043	0.6667	0.3333	0.0000	0.0000	0.0000

	Less important	0.0021	0.6667	0.3333	0.0000	0.0000	0.0000
	Moderately important	0.0064	0.2222	0.7778	0.0000	0.0000	0.0000
	More important	0.0107	0.0000	0.0000	0.1000	0.9000	0.0000
	Very important	0.0086	0.0000	0.0000	0.4000	0.6000	0.0000



Appendix D

User Evaluation Layer Weight and Fuzzy Evaluation

Demand & Preferences	Element Attribute	Weight	V1	V2	V3	V4	V5
User Groups	Grassroots workers	0.2128	0.0000	0.4286	0.5714	0.0000	0.0000
	Employee managers	0.4309	0.0000	0.0000	0.0000	0.1000	0.9000
	Senior leadership	0.3564	0.0000	0.0000	0.0000	0.8000	0.2000
Target	Effective daily work	0.2447	0.0000	0.0000	1.0000	0.0000	0.0000
	Meet the policy assessment	0.2181	0.0000	0.2857	0.7143	0.0000	0.0000
	Enterprise strategic planning	0.2181	0.0000	0.2857	0.7143	0.0000	0.0000
	Achieve industry competition	0.3191	0.0000	0.0000	0.2000	0.8000	0.0000
Type	Functional	0.0798	1.0000	0.0000	0.0000	0.0000	0.0000
	Operational	0.2713	0.0000	0.0000	0.7000	0.3000	0.0000
	Data oriented	0.1489	0.2222	0.7778	0.0000	0.0000	0.0000
	Social	0.1862	0.0000	0.7143	0.2857	0.0000	0.0000
	Safe	0.3138	0.0000	0.0000	0.3000	0.7000	0.0000
Safety	Role permission control	0.3351	0.0000	0.0000	0.0000	1.0000	0.0000
	Data security encryption	0.4096	0.0000	0.0000	0.0000	0.3000	0.7000
	Abnormal behaviour warning	0.0426	1.0000	0.0000	0.0000	0.0000	0.0000
	Business process control	0.2128	0.0000	0.4286	0.5714	0.0000	0.0000
Capabilities	Application of intelligent technology	0.2979	0.0000	0.0000	0.4000	0.6000	0.0000
	Localization adaptation	0.2287	0.0000	0.1429	0.8571	0.0000	0.0000
	Stable	0.2872	0.0000	0.0000	0.5000	0.5000	0.0000

	software architecture						
	Complex business support	0.1862	0.0000	0.7143	0.2857	0.0000	0.0000
Environments	On-premises	0.2394	0.0000	0.0000	1.0000	0.0000	0.0000
	Deploy in the cloud	0.1809	0.0000	0.8571	0.1429	0.0000	0.0000
	Private network deployment	0.2181	0.0000	0.2857	0.7143	0.0000	0.0000
	Internet Deployment	0.3617	0.0000	0.0000	0.0000	0.8000	0.2000
Important Resources	Hardware Resources	0.2447	0.0000	0.0000	1.0000	0.0000	0.0000
	Human Resources	0.1489	0.2222	0.7778	0.0000	0.0000	0.0000
	Technical Resources	0.4309	0.0000	0.0000	0.0000	0.1000	0.9000
	Financial Resources	0.1436	0.3333	0.6667	0.0000	0.0000	0.0000
	Market Resources	0.0319	1.0000	0.0000	0.0000	0.0000	0.0000
Guarantee	Sound business logic	0.2287	0.0000	0.1429	0.8571	0.0000	0.0000
	Complete effective functions	0.2926	0.0000	0.0000	0.5000	0.5000	0.0000
	Control financial costs	0.2181	0.0000	0.2857	0.7143	0.0000	0.0000
	Deliver tasks on time	0.2606	0.0000	0.0000	0.8000	0.2000	0.0000
Demand source	User requirements	0.2234	0.0000	0.2857	0.7143	0.0000	0.0000
	Adjustment of policy	0.2287	0.0000	0.1429	0.8571	0.0000	0.0000
	Expert feedback	0.1702	0.0000	1.0000	0.0000	0.0000	0.0000
	Market Analysis	0.2713	0.0000	0.0000	0.7000	0.3000	0.0000
	Competitor analysis	0.1064	0.6667	0.3333	0.0000	0.0000	0.0000
Group Influence	Grassroots workers	0.3936	0.0000	0.0000	0.0000	0.5000	0.5000
	Employee managers	0.1915	0.0000	0.7143	0.2857	0.0000	0.0000

	Senior leadership	0.4149	0.0000	0.0000	0.0000	0.3000	0.7000
Services	Product features	0.2128	0.0000	0.4286	0.5714	0.0000	0.0000
	Product availability	0.1915	0.0000	0.7143	0.2857	0.0000	0.0000
	Product reliability	0.1862	0.0000	0.7143	0.2857	0.0000	0.0000
	Product performance	0.1755	0.0000	0.8571	0.1429	0.0000	0.0000
	Added value of the product	0.2340	0.0000	0.1429	0.8571	0.0000	0.0000
Price	Less than 100,000	0.2074	0.0000	0.4286	0.5714	0.0000	0.0000
	110,000-300,000	0.2287	0.0000	0.1429	0.8571	0.0000	0.0000
	310,000-500,000	0.3351	0.0000	0.0000	0.0000	1.0000	0.0000
	510,000-1,000,000	0.1117	0.6667	0.3333	0.0000	0.0000	0.0000
	More than 1,000,000	0.1170	0.5556	0.4444	0.0000	0.0000	0.0000
Size	10-50 people	0.1277	0.4444	0.5556	0.0000	0.0000	0.0000
	51-100	0.1968	0.0000	0.5714	0.4286	0.0000	0.0000
	101-200	0.3404	0.0000	0.0000	0.0000	1.0000	0.0000
	201-300	0.1330	0.4444	0.5556	0.0000	0.0000	0.0000
	More than 301 people	0.2021	0.0000	0.5714	0.4286	0.0000	0.0000
Work Time	05:00:00-07:59:59	0.3032	0.0000	0.0000	0.4000	0.6000	0.0000
	11:00:00-12:59:59	0.2021	0.0000	0.5714	0.4286	0.0000	0.0000
	13:00:00-16:59:59	0.1117	0.6667	0.3333	0.0000	0.0000	0.0000
	17:00:00-18:59:59	0.1649	0.1111	0.8889	0.0000	0.0000	0.0000
	19:00:00-22:59:59	0.2181	0.0000	0.2857	0.7143	0.0000	0.0000
Address	Home	0.1436	0.3333	0.6667	0.0000	0.0000	0.0000
	Office	0.3138	0.0000	0.0000	0.3000	0.7000	0.0000
	School	0.2074	0.0000	0.4286	0.5714	0.0000	0.0000
	In public	0.2287	0.0000	0.1429	0.8571	0.0000	0.0000
	On business	0.1064	0.6667	0.3333	0.0000	0.0000	0.0000
Terminal	Computer	0.4415	0.0000	0.0000	0.0000	0.0000	1.0000
	Pad	0.1915	0.0000	0.7143	0.2857	0.0000	0.0000
	Phone	0.2766	0.0000	0.0000	0.6000	0.4000	0.0000

	Wearable devices	0.0904	0.8889	0.1111	0.0000	0.0000	0.0000
Teamwork	Yes 74	0.7400	0.0000	0.0000	0.0000	0.0000	1.0000
	No 26	0.2600	0.0000	0.0000	0.8000	0.2000	0.0000
Keyboard	1-5 times	0.3085	0.0000	0.0000	0.3000	0.7000	0.0000
	6-10 times	0.5160	0.0000	0.0000	0.0000	0.0000	1.0000
	11-15 times	0.0904	0.8889	0.1111	0.0000	0.0000	0.0000
	16-20 times	0.0532	1.0000	0.0000	0.0000	0.0000	0.0000
	More than 20	0.0319	1.0000	0.0000	0.0000	0.0000	0.0000
Speech	1-5 times	0.1170	0.5556	0.4444	0.0000	0.0000	0.0000
	6-10 times	0.1223	0.5556	0.4444	0.0000	0.0000	0.0000
	11-15 times	0.3883	0.0000	0.0000	0.0000	0.5000	0.5000
	16-20 times	0.2021	0.0000	0.05714	0.4286	0.0000	0.0000
	More than 20	0.1702	0.0000	1.0000	0.0000	0.0000	0.0000
Touch	1-5 times	0.1277	0.4444	0.5556	0.0000	0.0000	0.0000
	6-10 times	0.1809	0.0000	0.8571	0.1429	0.0000	0.0000
	11-15 times	0.2287	0.0000	0.1429	0.8571	0.0000	0.0000
	16-20 times	0.3245	0.0000	0.0000	0.2000	0.8000	0.0000
	More than 20	0.1383	0.3333	0.6667	0.0000	0.0000	0.0000
Failure	1-5 times	0.1330	0.4444	0.5556	0.0000	0.0000	0.0000
	6-10 times	0.3085	0.0000	0.0000	0.3000	0.7000	0.0000
	11-15 times	0.3511	0.0000	0.0000	0.0000	0.9000	0.1000
	16-20 times	0.0585	1.0000	0.0000	0.0000	0.0000	0.0000
	More than 20	0.1489	0.2222	0.7778	0.0000	0.0000	0.0000
Access	1-5 times	0.1170	0.5556	0.4444	0.0000	0.0000	0.0000
	6-10 times	0.2926	0.0000	0.0000	0.5000	0.5000	0.0000
	11-15 times	0.2500	0.0000	0.0000	0.9000	0.1000	0.0000
	16-20 times	0.2074	0.0000	0.4286	0.5714	0.0000	0.0000
	More than 20	0.1330	0.4444	0.5556	0.0000	0.0000	0.0000
Stay	1-5 times	0.0745	1.0000	0.0000	0.0000	0.0000	0.0000
	6-10 times	0.2819	0.0000	0.0000	0.6000	0.4000	0.0000
	11-15 times	0.2819	0.0000	0.0000	0.6000	0.4000	0.0000
	16-20 times	0.1968	0.0000	0.5714	0.4286	0.0000	0.0000
	More than 20	0.1649	0.1111	0.8889	0.0000	0.0000	0.0000
Theme	Quiet mode	0.2553	0.0000	0.0000	0.8000	0.2000	0.0000
	Large character mode	0.2766	0.0000	0.0000	0.6000	0.4000	0.0000
	Leisure mode	0.2128	0.0000	0.4286	0.5714	0.0000	0.0000
	Office mode	0.2553	0.0000	0.0000	0.8000	0.2000	0.0000

Colour	Green	0.2021	0.0000	0.5714	0.4286	0.0000	0.0000
	Red	0.1223	0.5556	0.4444	0.0000	0.0000	0.0000
	Black and white	0.2128	0.0000	0.4286	0.5714	0.0000	0.0000
	Blue	0.3617	0.0000	0.0000	0.0000	0.8000	0.2000
	Gray	0.1011	0.7778	0.2222	0.0000	0.0000	0.0000
Layout	Single column layout	0.1649	0.1111	0.8889	0.0000	0.0000	0.0000
	F layout,	0.1064	0.6667	0.3333	0.0000	0.0000	0.0000
	Z layout	0.1809	0.0000	0.8571	0.1429	0.0000	0.0000
	Split screen layout	0.4096	0.0000	0.0000	0.0000	0.3000	0.7000
	Lists	0.1383	0.3333	0.6667	0.0000	0.0000	0.0000
Rate	1024*768	0.0851	0.8889	0.1111	0.0000	0.0000	0.0000
	1280*720	0.1011	0.7778	0.2222	0.0000	0.0000	0.0000
	1366*768	0.1862	0.0000	0.7143	0.2857	0.0000	0.0000
	1920*1080	0.3457	0.0000	0.0000	0.0000	0.9000	0.1000
	2560*1440	0.2819	0.0000	0.0000	0.6000	0.4000	0.0000
Robot frequency	1-5 times	0.1277	0.4444	0.5556	0.0000	0.0000	0.0000
	6-10 times	0.1489	0.2222	0.7778	0.0000	0.0000	0.0000
	11-20 times	0.4043	0.0000	0.0000	0.0000	0.4000	0.6000
	21-30times	0.1596	0.1111	0.8889	0.0000	0.0000	0.0000
	More than 30	0.1596	0.1111	0.8889	0.0000	0.0000	0.0000
Robot Time	1-5s	0.1489	0.2222	0.7778	0.0000	0.0000	0.0000
	6-10s	0.2979	0.0000	0.0000	0.4000	0.6000	0.0000
	11-20s	0.1915	0.0000	0.7143	0.2857	0.0000	0.0000
	21-30s	0.1755	0.0000	0.8571	0.1429	0.0000	0.0000
	More than 30s	0.1862	0.0000	0.7143	0.2857	0.0000	0.0000
Field frequency	1-5 times	0.0532	1.0000	0.0000	0.0000	0.0000	0.0000
	6-10 times	0.0798	1.0000	0.0000	0.0000	0.0000	0.0000
	11-20 times	0.3670	0.0000	0.0000	0.0000	0.7000	0.3000
	21-30times	0.3830	0.0000	0.0000	0.0000	0.6000	0.4000
	More than 30s	0.1170	0.5556	0.4444	0.0000	0.0000	0.0000
Field Time	1-5s	0.0798	1.0000	0.0000	0.0000	0.0000	0.0000
	6-10s	0.2074	0.0000	0.4286	0.5714	0.0000	0.0000
	11-20s	0.3883	0.0000	0.0000	0.0000	0.5000	0.5000
	21-30s	0.1809	0.0000	0.8571	0.1429	0.0000	0.0000
	More than 30s	0.1436	0.3333	0.6667	0.0000	0.0000	0.0000
Remote frequency	1-5 times	0.0691	1.0000	0.0000	0.0000	0.0000	0.0000
	6-10 times	0.1968	0.0000	0.5714	0.4286	0.0000	0.0000
	11-20 times	0.3511	0.0000	0.0000	0.0000	0.9000	0.1000
	21-30times	0.1809	0.0000	0.8571	0.1429	0.0000	0.0000

	More than 30s	0.2021	0.0000	0.5714	0.4286	0.0000	0.0000
Remote Time	1-5s	0.1436	0.3333	0.6667	0.0000	0.0000	0.0000
	6-10s	0.1968	0.0000	0.5714	0.4286	0.0000	0.0000
	11-20s	0.2287	0.0000	0.1429	0.8571	0.0000	0.0000
	21-30s	0.3245	0.0000	0.0000	0.2000	0.8000	0.0000
	More than 30s	0.1064	0.6667	0.3333	0.0000	0.0000	0.0000



BIODATA OF STUDENT

My name is Liu Kun. I was born in Xiong'an New District, Baoding City, Hebei Province, China and I had married. So far, I have engaged in demand analysis, data analysis, product design work for 12 years, details as below:

a) Educational background:

2009.09 - 2013.07 Attended Yanshan University, Liren College, Industrial Design, and received a bachelor's degree

2013.09 - 2016.01 Attended Yanshan University College of Art and Design for Industrial Design. Obtained Master's Degree

2020.04 - 2024-present PhD in Industrial Design, Faculty of Architecture and Design, Universiti Putra Malaysia.

b) Work experience

2012.06 - 2015.05 Beijing Lianyung Technology Co., Ltd, as a product design, mainly responsible for office workers, combined with the finger operating habits of the keyboard and mouse product interaction design and product design, there have been three products successfully marketed and sold.

2015.06 - 2019.05 In Beijing Allianz Curtain Wall Co., Ltd, as a product manager, responsible for customer demand and industry analysis, large-scale architectural shape and effect design, there have been 5 programs on the ground to complete the construction.

2019.06 - 2024 - Hebei Tangshan Qio Technology Co., Ltd, as a product manager, the main complexity of government units-oriented applications and intelligent software systematic design, has completed 8 products, and has been recognized by a number of customers.

LIST OF PUBLICATIONS

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