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A New Trend for the Silver-Haired Generation Intelligent Warmth is Strong - The Current Usage Status of Intelligent Products by the Elderly

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ABSTRACT

In recent years, with the acceleration of the aging population in China, the demand for intelligent products among the elderly has gradually become an important variable driving economic growth. This study focuses on the current usage status and needs of intelligent products among the elderly, aiming to reveal the core demands and obstacles in the use of smart products through empirical analysis. It seeks to provide data support for optimizing age-friendly product design and improving the smart elderly care service system, thereby contributing to the high-quality development of the "silver economy."

First, this study utilized Python web crawling technology to conduct data mining on relevant literature and user reviews from e-commerce platforms. Simultaneously, secondary data was obtained through literature surveys to lay the foundation for questionnaire design. The questionnaire content covered basic information about the elderly, the current usage status of smart products, product evaluations, and purchasing intentions. After adjusting the questionnaire content based on a pilot survey and determining the sample size, stratified sampling and multi-stage PPS sampling methods were employed, ultimately collecting 723 valid questionnaires.

In the data analysis, this study uses various methods such as descriptive statistics, disordered multi-class classification regression, factor analysis, seM, and system clustering to analyze the price sensitivity, consumer decision-making factors and market segmentation of the elderly. The study found that the elderly have a strong willingness to learn about intelligent products, but they need more training and support. Price is an important factor affecting the purchase decision of the elderly. There are significant differences in the use status and attitude of the elderly towards intelligent products. The acceptance and demand for intelligent products vary among the elderly of different age groups, income levels, and education levels.

The study also used factor analysis and hierarchical clustering methods to divide the elderly population into four groups: undeveloped consumer groups, loyal consumer groups, secondary consumer groups, and potential consumer groups, and characterized each group. The results showed that the undeveloped consumer groups had limited understanding and awareness of smart products, with passive consumption behaviors and attitudes; the loyal consumer groups had higher demand for smart products, focusing on product quality and functionality; the secondary consumer groups had conservative consumption concepts and were price-sensitive; the potential consumer groups were interested in smart products but had not yet made purchases, indicating certain consumption potential.

Based on the research conclusion, this study proposes specific recommendations for the government, enterprises and consumers. The government should promote the popularization and training of intelligent products and provide financial subsidies or preferential policies. Enterprises should optimize the design of product operation processes, strengthen the integration of voice interaction functions, and adjust product pricing and promotion strategies reasonably. Consumers should actively participate in the feedback and suggestions of intelligent products and avoid blindly pursuing high-end products. Through these measures, it is expected to significantly improve the elderly's experience and satisfaction with intelligent products, promote the wider application of

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intelligent products among the elderly population, and ultimately achieve a win-win situation between the elderly population and intelligent product-related enterprises.

KEYWORDS: *Principal Component Analysis, System Clustering, Structural Equation Modeling, Logistic Regression Model, Intelligent Elderly Care Products.*

Part 1: Investigation Preparation

I. Introduction

1. Research Background

A. Demographic change and the rise of the silver economy

According to the 2023 Statistical Bulletin of the People's Republic of China on National Economic and Social Development, the population aged 60 and above in China reached 297 million (accounting for 21.1%), and the population aged 65 and above exceeded 217 million (154%). Both indicators are well above the United Nations standards for an ageing society (10 per cent and 7 per cent, respectively). The population prediction model shows that the population size will exceed 400 million by 2035 and reach a peak of 480 million around 2050 (China Population and Development Research Center, 2023). This fundamental change in population structure, while exacerbating the pressure on the social security system, has given rise to a new form of "silver-haired economy" with significant characteristics of the times.

According to the "Blue Book of Silver Economy (2024)", the current total volume of China's silver economy has reached 7.2 trillion yuan, accounting for a stable proportion of 6.1% of GDP. Based on demand-side model predictions, the market size is expected to exceed 30 trillion yuan by 2035, and the contribution rate of GDP is expected to increase to over 10%, becoming an important driving force supporting the sustained growth of the national economy (Chinese Academy of Social Sciences, 2024). At the policy level, the "14th Five-Year Plan" has built a "Trine" industrial development framework, focusing on the coordinated development of the elderly health industry, elderly care service industry, and elderly products industry. Provide institutional guarantees for the systematic construction of the silver-haired economy (General Office of the State Council, 2022).

II. Research significance

2. Literature Review

With the rapid development of artificial intelligence technology, its applications in various fields of society are becoming increasingly widespread. Against the backdrop of an aging population, the demand for artificial intelligence among the elderly has become a focal point of attention for both academia and society. This paper summarizes the research conducted by relevant scholars on the demand for intelligent products among the elderly, which mainly includes the following aspects:

In the research on enterprise and industry development, Hu Yue [2] analyzed the current state of enterprise development from two aspects: enterprise layout and product distribution, and pointed out the difficulties encountered in the development of intelligent products in detail. Luo Shan and Liu Jihong [3] systematically discussed the current application status, effects, issues, and future development directions of intelligent products in the elderly care industry.

In the field of social policy and elderly care services, Wang Jing and Liu Zheng [4] explored the development of smart elderly care in China through field investigations, emphasizing the leading role of the government in smart elderly care and how policies can promote the application and development of smart elderly care technologies. This perspective provides new insights and directions for research and practice in the field of smart elderly care.

In terms of industry development status and challenges, Bian Jianjun and Tang Wenyi [5] use problem analysis and model construction methods to analyze the needs of the elderly and construct intelligent community elderly care models. Zhu Yong [6] By analyzing the demand for elderly care services and the development trend of intelligent elderly care industry, he summarized the problems and challenges faced by intelligent elderly care

In terms of the development opinions of intelligent products, Gao Chuansheng [7] analyzed the data on changes in China's population structure using comparative research and logical reasoning methods, combined with domestic and foreign elderly care models and intelligent elderly care practice cases, explored the application and development prospects of intelligent elderly care in China, and proposed relevant countermeasures and suggestions. Chen Yan'er, Chen Xi [8] put forward corresponding strategic suggestions by analyzing the causes and impacts of the "triple gap" in the process of integration and development of intelligent products and silver-haired economy, aiming to bridge the gap and promote the deep integration and sustainability of the two Development.

In summary, while intelligent products are rapidly developing, the difficulties faced by the elderly in

using them should also be considered. It requires joint efforts from enterprises, the government, and society to enable the elderly to fully enjoy intelligent products.

III. Research Content and Ideas

This study focuses on the dual background of population aging and intelligent technology iteration, and conducts a systematic investigation on the demand characteristics, usage behavior, and market acceptance of intelligent products among the elderly population. Based on the party's 20th national congress report, the research aims to reveal the core demands and obstacles of the elderly in using smart products, provide data support for optimizing the design of aging-friendly products and improving the smart elderly care service system.

The research content mainly includes four dimensions: analysis of the current situation of intelligent product use, preference for intelligent product demand, research on training and support system, and evaluation of market acceptance, aiming to explore the factors affecting the intelligent elderly care product market. Through questionnaire design and sampling survey, the researchers analyzed the impact of these factors on the use and acceptance of intelligent elderly care products by the elderly population from the perspective of gender, age, education, and region. At the same time, attention is also paid to the differences in the willingness of the elderly to purchase intelligent products, as well as the challenges and future development prospects faced by the market.

In terms of research implementation, multi-stage sampling was employed to ensure the representativeness of the sample. The research team conducted pre-surveys and questionnaire evaluations to continuously improve the content of the questionnaire. A detailed survey schedule was established, encompassing survey organization, data entry, review, analysis, and report writing. For quality control, measures were taken during the sampling and data collection phases to ensure the accuracy and reliability of the data.

In the process of investigating the current situation and demand of intelligent products used by the elderly, this research specially designed a scientific research technology route to standardize the research process and ensure the systematic and completeness of the research work. As shown in Figure 1, the research plan system presents the whole process from preparation, scheme design, survey implementation, data analysis to conclusion and recommendation, covering various research methods such as literature research, questionnaire survey, and data mining, providing a clear technical route and implementation framework for the entire research project.

In summary, this study reveals the real needs and pain points of the elderly population for intelligent products through empirical data, providing a scientific basis for technology companies to optimize age-friendly designs and for the government to formulate smart elderly care policies. It also offers practical pathways for the elderly to integrate into the smart society and achieve "smart and comfortable elderly care," demonstrating significant academic and social application value.

Part Two: Scheme Design and Implementation

3. Investigation Scheme Design

(1) Research Objectives and Scope With the rapid advancement of technology, smart devices such as smart home appliances, health monitoring systems, and smartphones have become ubiquitous, profoundly transforming lifestyles and quality of life. The demand for these intelligent products continues to grow. However, amid the aging population and the wave of technological integration, elderly users exhibit unique needs for smart products that are often overlooked. Understanding these needs is therefore crucial for enhancing the quality of life for seniors and advancing social development. This study examines elderly consumers 'awareness of smart products, their purchasing participation, satisfaction levels, usage willingness, functional needs, and decision-making processes. Key findings include: analyzing how factors like gender, age, education, disposable income, and region influence acceptance of smart products; identifying nationwide differences in elderly consumers' purchase willingness; and assessing current challenges and future prospects in the smart product market for seniors. Given the survey's constraints in manpower, budget, and time, the research focuses on elderly consumers across China's 30 provincial-level regions (excluding Hainan Province, Hong Kong SAR, Macao SAR, and Taiwan Province).

(2) Survey Content and Questionnaire Design Based on the survey objectives, the main survey contents were determined, including: the current usage status of intelligent products, demand preferences, functions and appearance, price and purchase intention, training and support, and suggestions.

This scenario evaluation and related assessments were conducted to better measure survey content and ensure accurate information collection. In line with relevant policy documents including the "Action Plan for the Development of Smart Health and Elderly Care Industry (2021-2025)" [9], the "Notice on Implementing Solutions to Address Elderly

Challenges in Using Smart Technologies" [10], and the "Guidelines for Developing the Silver Economy to Enhance Elderly Well-being" [11], the survey content was systematically categorized and refined into a preliminary questionnaire. Subsequently, by analyzing past news reports and public discourse on elderly use of smart products, we identified practical difficulties and needs. After revising and refining the questionnaire, the final version was finalized. The questionnaire includes sections for personal information such as gender, age, education level, residential area, and health status. For detailed survey content, see Appendix 1: "Intelligent Guidance, Smart Elderly Care: A Survey on the Demand for Smart Products Among the Elderly." To systematically present the research design for investigating the current usage status and demand for smart products among elderly users, this study developed a questionnaire framework (Figure 2). The structural diagram comprehensively outlines the logical architecture and content modules of the questionnaire, covering core dimensions such as product usage status, demand preferences, functional features and appearance, pricing and purchase intention, along with supplementary elements like training support and recommendations. This framework visually demonstrates the scientific rigor and comprehensiveness of the questionnaire design, providing a standardized measurement tool foundation for subsequent survey implementation and data analysis.

IV. Survey Implementation and Data Organization

(1) Preliminary Survey and Questionnaire Evaluation In mid-January 2024, the research team conducted a pilot survey using an initial questionnaire with a small sample size. Based on the preliminary findings and feedback from participants, the original four-dimensional questionnaire was refined into a finalized version comprising six dimensions and 39 items covering personal basic information. The pilot results demonstrated strong reliability of the scale, ensuring the questionnaire's continued validity for implementation.

(2) Organization and Implementation of the Investigation1. Survey Implementation Progress This survey combines online and offline questionnaire methods, primarily using self-administered online questionnaires supplemented by offline interviews. The detailed progress is shown in the figure below:

Investigation Organization and Division of Labor After thoroughly understanding the objectives and characteristics of the investigation project, our team acquired essential knowledge and interview techniques through literature review and consultations with instructors, thereby enhancing our professional expertise and research capabilities. Prior to the formal investigation, we implemented a well-structured division of labor based on members' competencies, as detailed in the diagram below:

Quality Control of Survey Quality control refers to the strict management and monitoring of all stages in the survey process, aiming to minimize human errors, obtain more objective and accurate data, enhance the scientific validity of survey results, and avoid wasting human and material resources.

(1) Quality control before investigation We had in-depth group discussion to determine the research object, obtain the information and purpose of the investigation; organized training among the members to improve their ability to deal with emergencies; drafted the questionnaire and conducted the pre-investigation to prepare for the formal investigation.

(2) Quality control of the survey: By combining online self-filled questionnaire with offline auxiliary questionnaire, we not only ensured the efficiency and scientificity of the survey, but also considered the characteristics of the special group of the elderly, which provided a strong guarantee for obtaining reliable and effective survey results.

(3) Quality control after survey. After the survey, we screened the collected data and removed the low-quality or invalid questionnaires by controlling the time of filling in the questionnaires to ensure the accuracy of the data.

V. Data Processing The total number of questionnaires distributed in this survey was 750, and the final valid questionnaires were 723, with a validity rate of 96.4%.

1. **After the completion of the survey,** the team leader will conduct a preliminary review of the completed questionnaires. Subsequently, the team will recheck the questionnaires for completeness, logical consistency, and accuracy, including verifying if answers match the questions, if responses are consistent, and if they align with the actual situation.
2. **Questionnaire coding and data entry:** For categorical data such as "gender" (coded as 1 for male and 2 for female), and multi-choice items like "age" and "income" (coded as 1, 2, 3, etc.), options are assigned corresponding codes.

For single-choice questions, code options in order starting from 1. For multiple-choice questions, divide each option into a sub-question and code it as 0 or 1, where 0 indicates no selection and 1 indicates

selection.This survey utilized Wenjuanxing for questionnaire completion, with data collection and entry processed concurrently, eliminating the need for manual data entry. However, due to partial discrepancies with Wenjuanxing's built-in coding standards, a dual-machine coding process was implemented to ensure accuracy, supplemented by third-party spot checks.

PART III DATA ANALYSIS

VI. Descriptive Statistical Analysis

(1) Sample Distribution This survey collected 723 valid questionnaires, with provincial sample sizes detailed in the table below. As the survey employed non-probability sampling—a method incapable of estimating or controlling sampling errors and thus unable to infer population characteristics from quantitative data—the findings are presented as exploratory research with qualitative analysis. Gender distribution: Among the valid responses, 390 males (53.94%) and 333 females (46.06%) participated. The nearly 1:1 male-to-female ratio indicates comparable interest in smart elderly care products across genders, with no significant gender bias. This suggests the market for intelligent elderly care products may appeal to a broad audience rather than being gender-specific.

Geographically, according to national geographical divisions, the 30 provinces and municipalities collected were divided into East China (Shandong, Jiangxi, Fujian, Anhui, Zhejiang, Jiangsu, Shanghai), North China (Inner Mongolia, Shanxi, Hebei, Tianjin, Beijing), South China (Guangxi, Guangdong), Central China (Hunan, Hubei, Henan), Southwest China (Xizang, Yunnan, Guizhou, Sichuan, Chongqing), Northwest China (Xinjiang, Ningxia, Qinghai, Gansu, Shaanxi), and Northeast China (Liaoning, Jilin, and Heilongjiang). The sample size ratio across these regions was 4:4:4:2:2:1:1. Since the sample size ratio largely aligns with the actual population distribution, this survey covers different regions of China, providing a comprehensive reflection of the attention and demand for intelligent elderly care products in each area.

In terms of income, with 4,000 yuan as the dividing line (the national average monthly income for residents in 2024 was 3,470.7 yuan), approximately 40% of the population has a monthly disposable income below this threshold, while about 60% exceed it. This indicates that in the smart elderly care product market, a significant proportion of elderly consumers belong to low-income groups, whereas the majority are high-income seniors. This suggests that most elderly individuals have the financial capacity to purchase smart elderly care products.

Notably, the majority of elderly population (73%) have junior high school education or lower. This indicates that smart elderly care products must meet strict usability standards and be designed to accommodate seniors with limited educational backgrounds.

2. Functional Preferences: Voice control and large fonts/icons rank as the two most desired features among seniors, with 28% and 30% preference respectively. This highlights their core focus on ease of use and visual clarity when using smart devices. Safety-focused features like location tracking systems, automated switches, and clear voice prompts also receive over 20% support, reflecting seniors' emphasis on security and assistive functions. For example, location tracking prevents wandering, while clear voice prompts help seniors with hearing impairments better understand device feedback. The data indicates that voice control, large fonts/icons, and location systems are the most urgently needed features for older adults. Therefore, companies should prioritize these functions in smart product development and position them as core selling points.

Regarding design aesthetics, lightweight and portable features rank as the most desired characteristics among seniors, with 52% prioritizing portability. This highlights their emphasis on convenience and ease of use when selecting smart products. Lightweight designs effectively reduce physical burdens and enhance user experience. Material safety and eco-friendliness account for 51% of preferences, reflecting seniors 'heightened awareness of product safety and environmental sustainability. They demand non-toxic, harmless, and eco-friendly materials to prevent potential health risks. Both moderate size and eye-catching colors receive approximately 40% preference, indicating seniors seek smart products that are neither oversized nor undersized—perfectly sized for both operation and portability. In conclusion, companies should holistically consider all design aspects to optimize the elderly's user experience when developing smart products.

Market research data shows that 75.242% of surveyed seniors or their family members have used smart devices (including smartphones, smart TVs, fitness trackers, and smart home appliances). This demonstrates both high awareness and widespread adoption of smart products among the elderly population.

(1) Data Collection In the current era of big data, online platforms have accumulated massive amounts of user review data. This study primarily collects user review data for elderly-friendly smart wristbands, smart home devices, and health monitoring

instruments through e-commerce platforms such as Taobao, as well as social media platforms like TikTok and Xiaohongshu. Through in-depth mining and analysis of these data, the aim is to simplify the information acquisition process, helping businesses and researchers quickly grasp the core needs of elderly users, while also providing data support for age-friendly improvements of smart products and optimization of market strategies.

Building on the aforementioned research context, this study utilizes Python web scraping technology to collect raw review data, followed by text analysis through keyword extraction and frequency statistics using the jieba word segmentation tool. This analytical approach not only systematically documents elderly users' experiences with smart products but also identifies their latent needs, providing a scientific foundation for age-friendly product design and market promotion strategies.

Data Processing: By aggregating information from e-commerce platforms and social media, this study collected 9,812 data entries. Given the platforms' strict review mechanisms for default comments, the collected data were predominantly valid. Selected comment results (using smartwatches as an example) are shown in Figure 8.

The images above demonstrate the complexity of online comment data. Unprocessed text data typically contains duplicate comments, meaningless content (e.g., numbers, punctuation, and internet-specific symbols), and other noise, necessitating preprocessing. The system extracts valid information from crawled data by filtering out comments containing only numbers, punctuation, or internet-specific characters. After removing duplicate tokens and stop words, 7,796 valid entries remain for text mining analysis.

(III) Text Data Mining 1. Text Segmentation This study employs Python-based natural language processing (NLP) technology to systematically analyze review texts. The implementation process is as follows: First, the original text undergoes segmentation using the Jieba tool. To enhance analytical efficiency and ensure semantic integrity, a minimum segmentation length of 2 characters is set to filter out meaningless single-character results. During preprocessing, a dedicated stopword dictionary is constructed to eliminate distracting vocabulary. After completing basic processing, high-frequency feature words are extracted through word frequency statistics, and word cloud diagrams are generated via visualization techniques to intuitively present keyword distribution patterns. Table 6 demonstrates the keyword frequency statistics obtained through this workflow (using smartwatches as an example). This analytical approach effectively enhances the structuralization of text data, laying a solid data foundation for subsequent analyses.

2. Text Data Analysis Through word frequency analysis of elderly users 'reviews on Tmall's smartwatch platform, we have identified key findings regarding the current usage patterns and needs of senior consumers for smart devices.

(1) The core functional requirements, notably highlighted by high-frequency terms like 'location' (726 times), 'call' (150 times), and 'error' (196 times), reveal that elderly users prioritize smartwatches 'positioning accuracy and communication capabilities. Additionally, terms such as' functionality '(406 times) and' practicality '(155 times) underscore their strong emphasis on the product's practical features.

(2) Consumer experience pain points such as "operation" (247 instances), "simplicity" (199 instances), and "configuration" (120 instances) frequently emerge, indicating that the ease of use of smart products has become a key factor influencing elderly consumers 'purchasing decisions. Additionally, the high frequency of "customer service" (122 instances) reflects elderly users' strong reliance on after-sales support, highlighting the need for businesses and manufacturers to enhance their after-sales and training services.

The study also identified key performance concerns. The metrics 'error' (196 instances), 'accuracy' (156 instances), and 'precision' (140 instances) highlight measurement accuracy as a primary pain point for elderly users. Meanwhile, 'battery life' (145 instances) and 'sound quality' (150 instances) reveal how design details like battery capacity and volume settings impact user experience.

(3) Consumer attitudes and satisfaction. Positive feedback such as 'not bad' (391 responses), 'like' (148 responses), and 'satisfied' (127 responses) indicates strong overall acceptance of smart products among elderly users. Meanwhile, terms like 'convenient' (366 responses) and 'suitable' (171 responses) suggest these products have largely met the needs of older users.

(4) The intergenerational usage patterns of terms like 'home' (123 instances) and 'elderly' (135 instances) indicate that products are predominantly purchased by children for parental use. This suggests that manufacturers and businesses could target middle-aged consumers as a key marketing demographic.

(5) The top improvement priorities were 'appearance' (156 times) and 'clarity' (117 times), highlighting the need for companies to prioritize age-friendly design.

Meanwhile, these frequently mentioned functional terms also provide clear optimization directions for product iteration.

3. Research on Price Sensitivity Among the Elderly Using Disordered Multicategorical

(1) Model Selection When assessing elderly consumers 'price tolerance for newly upgraded smart products, the multinomial choice model proves optimal for multi-category variables. While the Probit model is applicable in multinomial discrete choice models, its application faces limitations due to the need for comprehensive normal distribution evaluation and high computational complexity. In contrast, the Logit model better captures utility-maximizing distributional choices, making it the most widely adopted multinomial discrete choice model. The Logit model's strength lies in its likelihood function's rapid and stable convergence, particularly when dealing with large numbers of alternatives or decision-making individuals, ensuring computational efficiency and simplicity.

(2) The multivariate Logistic model establishes the dependent variable as 'the maximum price you (your elderly family member) are willing to pay for this upgraded smartwatch.' Specifically, y = 1 for '300-350 yuan,' y = 2 for '350-400 yuan,' y = 3 for '400-450 yuan,' and y = 4 for 'over 400 yuan.'

Since the questionnaire survey set up in this paper has a large number of data as categorical variables, the establishment of the model is based on a number of basic assumptions, such as the assumption that the numerical influence degree of the dependent variable is uniform in five age intervals. This study divides the age into five categories, and the coding of the five options is 1, 2, 3, 4, 5, which are included as independent variables in the analysis.

Model Evaluation: Using SPSS for model fitting, the evaluation results are presented in the table below. The P-value of the model is 0.000*, significantly lower than 0.05, indicating excellent model fit.

model	model fitting condition	likelihood ratio test		
	negative logarithm likelihood	negative logarithm likelihood	negative logarithm likelihood	significance
Intercept only	1880.043			
ultimately	1732.511	147.532	81	0.000*

Research on Price Sensitivity Among the Elderly By incorporating all relevant variables, the multivariate logistic regression analysis results are presented in the appendix's Logistic Regression Results Table. The findings reveal the following conclusions:

VII. Analysis of Intelligent Product Purchase Behavior Mechanisms Based on the SOR-SEM Model

(1) Model Construction The Stimuli-Organism-Response (SOR) model describes how stimuli are perceived and processed by an organism, ultimately triggering a response. This response then influences the organism's perception and attitude toward the stimuli, creating a feedback loop. As a research framework for consumer behavior analysis, the model helps us understand how consumers make decisions by examining the relationships between external stimuli, internal states, and final behavioral responses. S (stimulus): refers to factors in the external environment that influence consumers, which capture their attention and shape their emotions and attitudes. O (organism): refers to the emotional changes within the organism itself. R (reaction): refers to consumers' responses to stimuli and their own characteristics, i.e., their behaviors and decisions. This study examines elderly satisfaction with smart product features by constructing a SOR theory-based model to analyze consumption behavior. The model identifies six key factors: medication/medical reminders, daily task management, emergency assistance, remote control, voice interaction, and health monitoring (S), as stimulus variables. The willingness to adopt new smart products (O) is defined as organic variables, while satisfaction with current products (R) serves as the outcome variable. The model reveals that satisfaction with smart products negatively influences willingness to adopt new features, whereas willingness to adopt new features positively impacts satisfaction with existing products. (2) Normality Test of Variables This study employs the P-P plot method to assess the normality of variables. The P-P plot normality test compares the cumulative distribution function (CDF) of sample data with the CDF of the theoretical normal distribution to determine whether the variables follow a normal distribution. If the data points approximate the diagonal, it indicates normality; if they deviate significantly from the diagonal, it suggests non-normality. Using SPSS to perform the P-P plot test, we found that the observed values of the variables are almost entirely on or near the P-P diagonal, confirming the normal distribution of the variables. (3) Correlation Analysis: Pearson correlation analysis was conducted to explore the relationships among variables across dimensions, with the results presented in the table below.

Do you need smart products with health monitoring features?	**.604****	**.598****	**.622****	**.644****	**.563****	**1**		
	Do you need smart products to remind you to take medicine or go to the doctor?	Do you need smart products to help you manage your daily tasks	Do you want the smart product to have an emergency help function	Do you need intelligent products with voice interaction?	Do you need smart products with remote control capabilities?	Do you need smart products with health monitoring features?	Are you satisfied?	Are you willing to learn to use new intelligent products?
Do you need smart product reminders to take medication or visit a doctor?	1							
Do you need smart products to help you manage your daily tasks	.573**	1						
Do you want the smart product to have an emergency help function	.576**	.546**	1					
Do you need intelligent products with voice interaction?	.575**	.559**	.567**	1				
Do you need smart products with remote control capabilities?	.549**	.524**	.536**	.537**	1			
Are you satisfied?	-.264**	-.315**	-.248**	-.291**	-.226**	-.296**	1	
Are you willing to learn to use new intelligent products?	-.337**	-.314**	-.270**	-.281**	-.299**	-.302**	.567**	1

Note: ***, **, and * indicate significance levels of 1%,5%, and 10%, respectively.

The results show that the P-value of each variable is less than 0.05, and the null hypothesis is rejected. Therefore, there is a significant relationship among the variables. Except for the variable "whether satisfied?" and the variable "whether willing to learn to use the new intelligent product?" which have a negative correlation with other variables, the correlation coefficient of the other variables is greater than 0, indicating a positive correlation.

VIII. Product Experience Index Analysis and Customer Profile

(1) Determination of the Product Experience Index Based on the organization of questionnaire items and data, we categorized consumption labels into four types. To facilitate subsequent consumer group classification and naming, this study requires establishing a product experience model to clearly demonstrate the relationships among these four categories. Through principal component analysis, we determined the weight of each question and subsequently constructed the product experience index model. 1. To test the suitability of the model, SPSS software was used to perform KMO and Bartlett's test on the nine selected variables to verify whether the selected variables were suitable for factor analysis.

KMO (Kurtosis-Moment of Variance) test for sample appropriateness		0.923
Bartlett sphericity test	approximate chi-square	1877.223
	free degree	36
	conspicuousness	.000

The KMO statistic value is 0.923, which is greater than 0.6. The significance of Bartlett's test is far less than 0.05. The null hypothesis is rejected, which means the correlation coefficient matrix is unit matrix, indicating that there is a correlation between the variables and it is suitable for factor analysis.

The coefficients of indicators in different principal component linear combinations are calculated by explaining the total variance from statistical results and obtaining initial eigenvalues and variance contribution rates. Based on the component matrix, the loadings for each indicator are derived, as detailed in the indicator loadings table. The coefficients of indicators in different principal component linear combinations are ultimately obtained using the following formula:

$$\alpha_j = \frac{\text{载荷数}_j}{\sqrt{\text{初始特征值}_i}} \quad j = 1,2,3\cdots 9; i = 1,2,3,4$$

The final result is four principal components (F) linear combination, the specific formula is shown in the index load table.

total variance explanation									
ingredient	initial eigenvalue			extract load square sum			The sum of the squares of the rotational loads		
	aggregate	variance percentage	accumulate %	aggregate	variance percentage	accumulate %	aggregate	variance percentage	accumulate %
1	4.345	48.282	48.282	4.345	48.282	48.282	2.537	28.184	28.184
2	1.089	12.103	60.385	1.089	12.103	60.385	2.3	25.558	53.743
3	0.923	10.252	70.637	0.923	10.252	70.637	1.016	11.292	65.035
4	0.512	5.685	76.321	0.512	5.685	76.321	1.016	11.286	76.321
5	0.482	5.355	81.676						
6	0.447	4.971	86.647						
7	0.437	4.852	91.499						
8	0.395	4.385	95.884						
9	0.37	4.116	100						

		First principal component F1	Second principal component F2	The third principal component, F3	The fourth principal component, F4
charge number	Training Needs	0.826	0.242	0.067	0.069
	After-sales requirements	0.719	0.358	0.102	0.09
	Recommended willingness	0.701	0.407	-0.087	0.013
	Learning willingness	0.633	0.49	0.047	-0.06
	safety awareness	0.292	0.829	-0.026	-0.034
	degree of satisfaction	0.392	0.758	0.048	0.042
	accumulate	0.448	0.667	0.047	0.095
	operating frequency	0.055	0.021	0.993	0.038
	acceptance price	0.062	0.022	0.038	0.993

(1) Indicator Interpretation: Whether Community or Institutions Should Provide Training for Smart Product Usage: This reflects the extent of elderly demand for training on smart product usage. If seniors lack familiarity with operating smart products, they may prefer training provided by communities or institutions to learn how to use them. This demand demonstrates the elderly's acceptance and willingness to learn about smart products. The need for after-sales support for smart products: This measure reflects seniors' demand for after-sales services, which include product repairs, usage guidance, and remote assistance. As elderly users may encounter difficulties with smart devices, their need for after-sales support is particularly high, especially when dealing with complex operations or malfunctions. Would you recommend your current smart products to other seniors? This metric reflects their satisfaction with smart devices and willingness to share them. When seniors are satisfied with their current smart products, they are more likely to recommend them to others. This indicator helps evaluate product reputation and user loyalty. Willingness to adopt new smart products: The elderly's openness to new technologies directly impacts their usage frequency and satisfaction with smart devices. This metric helps gauge their acceptance of innovative products. Elderly people's perception of smart product safety reflects their awareness of security concerns, including data privacy and personal information protection. They show heightened sensitivity to safety, particularly when using devices for health monitoring or home security. Satisfaction with current smart products: The survey evaluates seniors 'overall satisfaction with their smart devices, covering aspects like functionality, user interface, and design aesthetics. High satisfaction indicates the products effectively meet seniors' needs, while low satisfaction suggests room for improvement. How much do you think smart products help your life? This reflects how seniors perceive the actual benefits of smart products. Whether smart products can improve their quality of life, provide convenience, or enhance safety directly affects their evaluation and willingness to use them. The frequency of using intelligent products is: high frequency use indicates that the elderly rely on the products, low frequency use may mean that the products fail to meet the needs of the elderly or there are obstacles to use. The acceptable price range of intelligent products is: Price is one of the important factors affecting the purchasing decision of the elderly. The elderly may be sensitive to price, so the enterprise needs to consider the economic affordability of the elderly when pricing the products.

(2) Analysis of Influencing Factors The product experience index in the smart product market is influenced by multiple factors. Firstly, training needs reflect the external support required by elderly users when using smart products. The level of training needs directly impacts the usage frequency and satisfaction of elderly users with smart products. Secondly, the demand of the elderly for after-sales service reflects their dependence on the intelligent products. The demand of after-sales service not only affects the trust of the elderly to the products, but also directly relates to their loyalty and willingness to recommend the products. Third, the willingness of elderly individuals to recommend smart products to others reflects their high level of acceptance. This recommendation behavior demonstrates their positive attitude in social interactions and indicates their strong satisfaction with these products. Such word-of-mouth influence can indirectly affect the purchasing intentions and market reputation of other seniors. Fourthly, learning willingness directly affects the usage frequency and satisfaction of elderly people with smart products, and also reflects their interest and demand for smart products. The level of learning willingness can help us better understand the acceptance degree of elderly people with smart products. Fifthly, the concern of the elderly about the security of intelligent products reflects their trust demand, and also shows the importance of the security when they use intelligent products. Sixth, satisfaction covers multiple aspects including product functions, operation interface, and appearance design. High satisfaction indicates that the product can provide convenience and assistance to the elderly. The level of satisfaction directly affects the usage frequency and willingness to recommend smart products among the elderly. Seventhly, the perception of the elderly on the help of intelligent products in life reflects the application value of intelligent products in practical life, and also indicates that the elderly rely on these products to a high degree. The help of intelligent products to life is an important index to measure its practical value. Eighth, the usage frequency reflects the popularity of smart products in the daily lives of the elderly, and also indicates that these products can meet the needs of the elderly. High-frequency usage demonstrates the importance of smart products in the lives of the elderly. Finally, price is one of the important factors affecting the purchase decision of the elderly. The reasonable price acceptance indicates that the potential demand of intelligent products in the elderly market is large. The price acceptance can help us better understand the purchase intention of the elderly for intelligent products. Through analyzing the influencing factors

of these nine variables, we can better understand the elderly's demand and usage behavior of smart products. These variables encompass multiple aspects such as training needs, after-sales service requirements, willingness to recommend, learning inclination, safety awareness, satisfaction, perceived life assistance, usage frequency, and price acceptance, comprehensively reflecting the elderly's demand and attitude toward smart products. Therefore, these variables demonstrate high rationality and significant reference value in studying elderly demand for smart products.

(3) Model Establishment First, based on the analysis of the data results of factor analysis, this study combined the data results and the actual content of the questions to divide the nine selected variables into four categories; then, according to the degree of relevance between the questions, the four factors were named, as follows:

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