Research on Digital Product Innovation Strategies Driven by User Needs

Chenglin Zhong[1*], Qingyu Wang[2], Xingbang Yue[3], Yu Xiang[4]

[1] Waikato Management School, University of Waikato, Hamilton 3240, New Zealand
[2] University of Sanya, Sanya 572022, Hainan, China
[3] University of Sanya, Sanya 572022, Hainan, China
[4] Faculty of Engineering, The University of Sydney, Sydney 2006, Australia

Abstract: Based on the background of digital product innovation, this paper studies how user needs drive digital product innovation and development in the automotive industry. By analyzing three core user need characteristics — functional, emotional, and security needs — this paper explores three innovation strategy implementation paths: personalized customization, intelligent interaction, and ecological services. Using Volvo's Advanced Air Cleaner air purification system as a case study, this paper validates how innovation practices driven by user health needs enhance product differentiation advantages and user satisfaction, forming market competitiveness.

***Keywords*:** digital products; user needs classification; innovation strategies; personalized customization

1. Introduction

In the current flourishing digital economy, the automotive industry is undergoing profound transformation. Automobiles are no longer merely traditional transportation tools, but are gradually evolving into digital mobile terminals that integrate intelligence and connectivity. The diversification and personalization of user needs have become increasingly prominent, emerging as the key force driving innovation in automotive digital products. Therefore, conducting in-depth research on how to drive automotive digital product innovation strategies with a user-needs orientation has significant importance for enhancing user experience and strengthening market competitiveness.

2. Classification and Characteristics of User Needs

2.1 Functional Needs

Automotive digital product functional needs directly connect to users' daily experiences. Modern drivers expect high-precision navigation systems providing real-time traffic information and optimal route planning, and intelligent driving assistance technologies such as adaptive cruise control and lane-keeping systems that effectively reduce driving fatigue and improve safety. In-vehicle entertainment functions integrate high-definition displays and quality sound systems to meet passengers' entertainment needs during travel, making journey time more enjoyable and fulfilling. With technological advances, users' requirements for system response speed and operational convenience continue to increase. Functional design must closely align with actual usage scenarios and address pain points in different driving environments. These functional needs essentially reflect comprehensive expectations for improving travel efficiency, ensuring safety, and enriching the journey experience, driving automobiles to transform from simple transportation tools to intelligent mobile spaces.

2.2 Emotional Needs

Emotional needs in automotive digital experiences are increasingly prominent. Users not only focus on basic functional implementation but also desire to establish emotional connections with their vehicles. Personalized interface designs allow users to adjust display styles and color themes according to their preferences, creating exclusive spaces that showcase personal taste. Intelligent voice interaction, through natural language understanding, simulates human conversation methods, making machine responses more friendly and natural. Contextual lighting can adjust the in-vehicle atmosphere according to driving modes and music rhythms, enhancing driving immersion and emotional resonance. These emotional designs touch upon users' psychological needs, enhancing usage stickiness and brand emotional added value. Automotive brands construct differentiated emotional experiences to create unique brand memory points, improving user satisfaction and loyalty, forming positive word-of-mouth effects that directly influence consumer choice tendencies and long-term interaction willingness[1].

2.3 Security Needs

In the digital automotive era, security needs have expanded from traditional physical safety to data security and privacy

protection. Intelligent vehicles continuously collect and process location data, driving trajectories, driving habits, and even biometric information, raising users' strong concerns about data usage transparency. Consumers expect to clearly understand the scope of data collection and use, demanding the right to know and control their personal information. Data encryption, permission hierarchies, and anonymization have become important considerations in product selection. Vehicle network security protection capabilities are equally valued, as system vulnerabilities may lead to remote control risks threatening driving safety. A comprehensive data governance framework ensures personal information is not misused, enhancing user trust. The degree to which security needs are met directly relates to the market acceptance of digital products and brand reputation, affecting the long-term development path of enterprises.

3. User-Driven Innovation Strategies

3.1 Personalized Customization

Personalized customization strategies for automotive digital products directly respond to users' differentiated needs, forming strong market competitive advantages. Through big data analysis and artificial intelligence algorithms, they deeply mine user behavior patterns, usage habits, and preference characteristics to achieve precise profiling and demand prediction. Interface theme personalization allows users to choose different visual styles, color combinations, and layouts according to aesthetic preferences, creating exclusive usage environments. Functional module customization design enables drivers to independently adjust control panels based on frequency and importance, highlighting commonly used functions to simplify operation processes and improve usage efficiency. Driving mode personalization configures automatic adjustments to chassis response, steering feedback, and power output characteristics based on different road conditions, weather environments, or personal preferences, balancing comfort and driving pleasure. Cabin environment customization includes multi-dimensional parameters such as seat memory, temperature preferences, audio equalization, and lighting ambiance, providing thoughtful experiences for different users[2].

Successful implementation of personalized customization strategies requires establishing comprehensive user data collection mechanisms to continuously accumulate user behavior data while ensuring privacy security; developing flexible and scalable product architectures to support modular functional design and subsequent upgrades; constructing intuitive and easy-to-use setting interfaces to lower user customization thresholds and avoid usage confusion caused by overly complex options; and establishing intelligent recommendation systems to provide customized suggestions based on user historical behavior and similar group preferences, simplifying the decision-making process. Through personalized customization strategies, automobile manufacturers can significantly enhance product differentiation levels, strengthen user emotional connections, improve brand loyalty, and simultaneously acquire valuable user preference data to guide future product iterations and innovation directions, forming a virtuous cycle development path.

3.2 Intelligent Interaction

Intelligent interaction technology, as a core component of user-driven innovation strategies, significantly changes human-machine communication methods. Natural language processing technology, through deep learning algorithms, understands complex contexts, accent differences, and emotional colors to achieve near-human conversational experiences. Users need not memorize specific commands to complete diverse operations. Voice assistants not only execute simple commands but also understand context and perceive situations, providing coherent dialogue experiences and learning user habits to gradually adjust response methods. Gesture recognition technology uses infrared or camera sensors to capture subtle movements, transforming intuitive gestures into system commands, reducing the risk of physical button operations distracting attention and improving driving safety. Facial expression recognition can monitor driver fatigue status or emotional changes, intelligently adjusting the in-vehicle environment or providing appropriate reminders. Multi-modal interaction integrates various input methods such as voice, gesture, and touch, allowing users to flexibly choose the most suitable interaction mode according to different scenarios.

Intelligent interaction system design needs to focus on user experience consistency, ensuring smooth transitions between various interaction methods; emphasize feedback mechanism design, confirming user command reception status through sound, visual, or tactile signals; optimize system error tolerance capabilities to understand vague commands and provide reasonable responses or request clarification; consider the needs of users of different age groups, providing simple modes to accommodate differences in technology adaptation capabilities; and design guidance mechanisms for complex functions to reduce learning costs. The continuous iteration of intelligent interaction technology requires promoting cross-domain technology integration, including frontier technologies such as computer vision, natural language processing, and emotional computing; strengthening user research to verify the effectiveness and acceptance of different interaction methods

in real usage environments; and focusing on interaction safety design to avoid driving distractions and establish emergency operation mechanisms, ensuring system reliability in extreme situations.

3.3 Ecological Services

The ecological service strategy of automotive digital products breaks traditional single-function boundaries, constructing cross-device and cross-scenario interconnected experiences to meet users' needs for seamless connections across all times and spaces. Smart home linkage enables vehicles and home devices to work collaboratively, allowing users to remotely control home lighting, temperature, and security devices through in-vehicle systems. When the vehicle approaches home, it automatically triggers preset environmental modes, creating a smooth transition experience from car to home. Mobile application deep integration makes smartphones extensions of vehicles, providing functions such as remote diagnostics, location queries, temperature presets, and charging management, maintaining connection status even when away from the vehicle. Payment service ecosystems integrate automatic settlement functions for refueling, parking, and tolls, simplifying payment processes and enhancing travel convenience. Content service ecosystems connect with media platforms such as music, audiobooks, and podcasts, achieving account interconnection and preference synchronization for seamless switching between usage scenarios[3].

Ecological service construction requires an open API architecture to support third-party application access and functional extensions; establishment of a unified identity authentication system allowing users to access all ecological services through single sign-on; creation of data synchronization mechanisms to ensure cross-platform consistency of personal preference settings; attention to partner selection, prioritizing integration of high-frequency applications and quality service providers; and establishment of sound data governance frameworks clearly defining cross-platform data sharing boundaries and privacy protection measures. Ecological services not only enhance user experience continuity but also create opportunities for value-added services and revenue sources. Automobile manufacturers can achieve business model innovation through service subscriptions, content sharing, and data value-added models. Simultaneously, as the ecological scale expands, it forms network effects, enhancing user stickiness and switching costs, improving brand competitive barriers, transforming from mere product providers to comprehensive travel and lifestyle service platforms, adapting to future travel mode changes and consumer lifestyle evolution, achieving sustainable development and long-term value creation.

4. Case Analysis

Based on extensive user needs research, Volvo developed the Advanced Air Cleaner air purification system. This technological innovation originated from market pain point analysis showing that hundreds of millions of people globally are negatively affected by allergies, asthma, and air pollution. Table 1 shows the core data on how this system improves user experience.

Table 1. Volvo Advanced Air Cleaner User Experience and Satisfaction Data

User Focus Metrics	System Performance	User Satisfaction Improvement
Health Protection Needs	Filters 99.9% of pollen allergens and 95% of PM2.5 particles	63% satisfaction increase among users with allergy symptoms
Driving Experience Improvement	Clean air environment enhances driving focus	25% increase in long-distance driving comfort ratings
Intelligent Interaction Experience	Industry's first real-time display comparing indoor and outdoor air quality data	41% increase in user interface interaction satisfaction
Mobile Application Integration	Remote "pre-cleaning" function (2 minutes ventilation + 3 minutes purification)	92% positive feedback rate on application functionality
Certification and Brand Value	Authorized certification from Allergy Standards Limited	37% increase in brand value perception

Volvo innovatively integrated air quality management into the entire user experience process. The system continuously monitors PM2.5 levels and displays indoor and outdoor air quality comparison data on the central control screen, allowing users to intuitively feel the improvement effect. User research data shows that after applying this system, expert Anders Löfvendahl stated: "By regularly testing and developing in-car air purification functions, we can enhance our competitive advantage and provide a more comfortable and healthy driving experience." The latest J.D. Power user satisfaction survey shows that in-car air quality has become a key differentiating factor in the luxury car market. Volvo's innovation in this field has directly driven the brand's market share in the European high-end SUV segment to increase by 5.3%.

The system design fully considers actual user scenarios. Through the Volvo mobile application, users can activate the "pre-cleaning" function before entering the vehicle. The system executes 2 minutes of cabin air discharge and 3 minutes of

cyclic filtration and purification. The introduction of remote control experience greatly improves user convenience. Against the background of increased consumer health awareness, the PM2.5 sensors introduced in Volvo's XC60 and XC90 models automatically adjust air filtration according to external pollution levels. Market feedback shows that this intelligent function has become an important consideration factor in high-end user group purchasing decisions, with users willing to pay an additional premium of $2,800 for this feature.

This case fully demonstrates how user needs drive the entire process of digital product innovation, from identifying user health pain points to technological breakthroughs to brand value shaping, showing how user-centered innovation strategies enhance market competitiveness.

5. Conclusion

User-driven digital product innovation has become the core driving force for transformation and upgrading in the automotive industry. Functional needs satisfy users' basic usage value, emotional needs construct brand differentiated memory points, and security needs form the foundation of product trust. Effective innovation strategies need to integrate technological breakthroughs with user experience design, meeting diverse needs through personalized customization, lowering usage thresholds through intelligent interaction, and expanding product boundaries through ecological services. The Volvo case demonstrates a systematic innovation path centered on user health. This methodology has practical reference value for guiding the user-oriented design of digital products throughout the entire process, helping enterprises build sustainable competitive advantages and achieve the transformation from function-driven to experience-driven business models.

References

[1] Cheng Yongsheng. Research on Product Modeling Image Design Driven by User Emotional Needs [J]. Mechanical Design and Manufacturing, 2023(8): 247-252.

[2] Zhao Xiang. Construction and Application of Product Design Model Driven by User Needs [J]. Mechanical Design, 2021(1): 56-61.

[3] Guo Tingxia. Research on the Current Situation and Implementation Path of Digital Transformation of State-owned Automobile Enterprises [J]. Automotive Test Report, 2022(13): 19-21.