



Consumer Psychological Drive and Commercial Innovation Response in the Development of Flavonoid Plant Resources

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Abstract. With the continuous improvement of consumer health awareness and the further increase in personalized demand, the development and application of flavonoid plant resources have gradually become a market hotspot. This article provides an overview of the types of flavonoids and their distribution in different plants, emphasizing their potential application value in the pharmaceutical and food industries. Subsequently, consumer psychological driving factors were analyzed, and business innovation response strategies were proposed in conjunction with AI technology, laying a solid foundation for enterprises to achieve sustainable development.

Keywords: Flavonoid plants; Resource development; Consumer psychological drive; Business Innovation Response

1 Introduction

Consumer psychological drive refers to the psychological needs and behavioral tendencies exhibited by consumers when purchasing and using products, especially in the development process of flavonoid plant resources. Consumer psychological drive plays a crucial role, as consumers' pursuit of healthy, natural, and safe products drives the commercialization process of flavonoid plant resources. Meanwhile, business innovation response refers to the innovative strategies and market behaviors adopted by enterprises in the face of consumer psychological drivers, effectively meeting consumer needs and further enhancing market competitiveness. Based on this, this article will explore the consumer psychological drive and commercial innovation response in the development of flavonoid plant resources, analyze the specific manifestations of consumer psychological drive, actively introduce AI technology, analyze the strategies for commercial innovation response, promote product innovation, marketing innovation, and channel innovation to develop towards informatization, and thus meet the actual needs of consumers.

2 Flavonoids and Their Applications

Flavonoids are involved in various biological activities such as anti-inflammatory, anti-tumor, antibacterial, antiviral, etc. These characteristics make them potentially valuable in the treatment of various diseases. Compounds such as quercetin and kaempferol flavonols have been proven to have significant anti-inflammatory and anti-tumor effects, while anthocyanins are widely used in cosmetics due to their strong antioxidant capacity. In the food industry, flavonoids are not only used as natural pigments and flavor compounds, but also as additives in functional foods, further enhancing the health benefits of products. For example, flavonoids rich berries and tea are widely used in the production of health drinks and functional foods. Flavonoids and plant resources refer to plant resources containing flavonoids, which are natural compounds widely present in plants and have various biological activities. According to their chemical structure and biological activity, flavonoids are divided into flavonoids, flavonols, isoflavones, anthocyanins, flavanones, etc. These compounds mainly exist in the form of glycosides in plants, and can be hydrolyzed to release bioactive flavonoids. At present, flavonoid plant resources are widely distributed worldwide, with different types of flavonoids found in plants grown in different regions and climatic conditions. Citrus fruits, berries, tea, soybeans, grapes, and other plants are rich in flavonoids and have shown great potential in the field of medicine. The biological activity of flavonoids is one of the important reasons for their high attention. Studies have shown that flavonoids have significant antioxidant effects, can clear free radicals in the body, and reduce oxidative stress damage to cells. Flavonoids are involved in various biological activities such as anti-inflammatory, anti-tumor, antibacterial, antiviral, etc. These characteristics make them potentially valuable in the treatment of various diseases. Compounds such as quercetin and kaempferol flavonols have been proven to have significant anti-inflammatory and anti-tumor effects, while anthocyanins are widely used in cosmetics due to their strong antioxidant capacity. In the food industry, flavonoids are not only used as natural pigments and flavor compounds, but also as additives in functional foods, further enhancing the health benefits of products. For example, flavonoids rich berries and tea are widely used in the production of health drinks and functional foods.

3 Consumer Psychological Driving Factors

3.1 Health Awareness Enhancement

In recent years, with the continuous improvement of living standards and the comprehensive popularization of health knowledge, consumers' attention to health has significantly increased. This is not only reflected in changes in daily diet and lifestyle, but also in the demand for health products. Consumers are increasingly inclined to choose natural, additive free health products to scientifically prevent diseases and improve their quality of life. In the context of increasing health awareness, consumers' demand for natural and healthy products has significantly increased. Natural products are consid-

ered safe and healthy due to their natural origin and lack of chemical additives. Flavonoids, as a natural plant compound, have gradually gained popularity among consumers due to their health benefits such as antioxidant and anti-inflammatory effects. Especially with the increasing demand for natural products, the development of flavonoid plant resources has been further promoted. Meanwhile, the antioxidant and anti-inflammatory effects of flavonoids are one of the main reasons for their high attention. The antioxidant effect can effectively eliminate free radicals in the body, slow down cell aging, and prevent various chronic diseases; The anti-inflammatory effect helps to alleviate inflammatory reactions, relieve pain and discomfort. Consumers' awareness of these health benefits further drives their demand for flavonoid products (as shown in Figure 1).

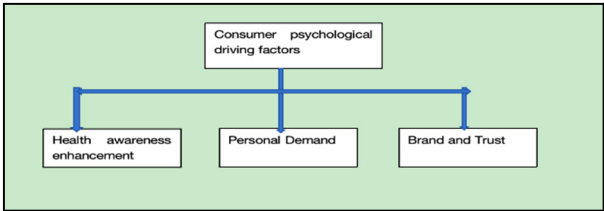


Fig. 1. Psychological Drivers of Consumers

3.2 Personal Demand

Personalized demand plays an important role in the development of flavonoid plant resources, mainly reflected in two aspects: consumer attention to specific health issues and market demand for customized products. In terms of paying attention to specific health issues, consumers are increasingly concerned about their own health status and seeking products that can address specific health problems in a targeted manner. For example, cardiovascular health is a key concern for many consumers, and flavonoids have characteristics such as antioxidant and anti-inflammatory properties, which are considered beneficial for cardiovascular health. Therefore, flavonoid products targeting cardiovascular health are widely welcomed. And skin care is also an important area of concern for consumers. Flavonoids have anti-aging and antioxidant effects, which can improve skin conditions. People are increasingly paying attention to flavonoid products for skin care. With the diversification of consumer demand, customized products have gradually become a new trend in the market. Consumers hope to choose products that are suitable for themselves according to their own needs, especially in the development of flavonoid products. Customized products can better meet the personalized needs of consumers, such as developing flavonoid products with different formulas and doses for consumers of different ages and health conditions, further improving consumer satisfaction and comprehensively enhancing the market competitiveness of products.

3.3 Brand and Trust

In the development of flavonoid plant resources, brand and trust have become important factors driving consumer psychology. When consumers choose flavonoid products, they prioritize brands with good reputations. Enterprises with high brand trust can usually gain long-term support from consumers and gain an advantage in market competition. But in the process of establishing brand trust, relevant enterprises need to start from multiple aspects such as product quality, service level, and brand image. Firstly, enterprises need to ensure product quality. The efficacy of flavonoid products is the most concerning factor for consumers, and companies need to establish strict quality control systems and scientific research data to prove the effectiveness of their products. Secondly, focus on shaping the brand image. By collaborating with authoritative institutions and participating in industry standard setting, we aim to enhance the professionalism of our brand; Finally, by utilizing transparent information disclosure and consumer interaction, the brand's transparency can be comprehensively enhanced.

4 Business Innovation Response Strategy

4.1 Product Innovation

4.1.1 Develop New Flavonoid Products. With the increasing demand for healthy beverages from consumers, developing functional beverages rich in flavonoids has become an effective product innovation strategy. Enterprises should launch fruit juices, tea drinks, and sports drinks containing high concentrations of flavonoids, emphasizing their antioxidant, anti-inflammatory, and immune enhancing effects. On the basis of meeting consumers' demand for healthy beverages, they should use their unique functionality as a selling point to attract target customers. At the same time, flavonoids have great potential for application in the field of health products. Enterprises focus on developing health products containing flavonoids, such as capsules, tablets, powders, etc., to provide solutions for specific health problems. For example, in response to the needs of cardiovascular health, immune enhancement, and anti-aging, companies launch health products containing specific flavonoid components, and verify their efficacy through clinical trials and scientific research to enhance the market competitiveness of the products. Because flavonoids have antioxidant and anti-inflammatory properties, enterprises can use the above characteristics to develop anti-aging face cream, repair essence and sunscreen products containing flavonoids, emphasize their positive impact on skin health, actively cooperate with dermatologists and beauty experts, further improve the professionalism of products, and attract high-end consumer groups.

4.1.2 Product Differentiation Strategy. Product differentiation is an important strategy for enterprises to stand out in fierce market competition. By utilizing differentiation, enterprises can further highlight the unique advantages of their products and meet the needs of different consumers. In terms of ingredient differentiation, companies scientifically select different plant resources and extraction processes to develop flavonoid

products with unique ingredients. Flavonoids in certain plants have specific health benefits, and companies use scientific research to extract these unique ingredients and create products with differentiated advantages. In terms of functional differentiation, companies develop flavonoid products with specific functions based on different consumer needs. For example, for elderly consumers, companies launch anti-aging health products containing high concentrations of flavonoids; For young consumers, the company has launched functional beverages containing flavonoids, emphasizing their ability to enhance immunity. In terms of brand differentiation, enterprises should actively shape their brand story and image to achieve product differentiation.

AI technology plays an important role in consumer behavior analysis and product feature design. Enterprises adopt natural language processing (NLP) technology to extract consumer preference information from social media, e-commerce platforms, and user reviews, and construct accurate user profiles. Based on these data, AI recommendation systems can provide functional design suggestions for enterprises, such as launching high concentration flavonoid anti-aging health products for elderly consumers to meet their needs for enhancing immunity; At the same time, AI algorithms can simulate the market acceptance of different functional formulas, optimize product portfolio strategies, and ensure that product functions are highly compatible with the needs of target groups. For example, in the development process of flavonoid functional beverages, natural language processing (NLP) technology is used to extract keywords from user comments on platforms such as JD.com and Taobao, identifying "refreshing taste", "boosting immunity", and "refreshing" as the core experiences that young office workers are concerned about. Based on this, the enterprise optimized the formula design and launched a flavonoid beverage with a light taste, added green tea extract, and suitable for office use. With the help of AI simulation, the market acceptance of the product was predicted to reach 7.8/10 among young people, providing empirical guidance for product development.

4.1.3 Market Positioning Optimization. For a wide range of consumer groups, cloud computing platforms integrate data resources from e-commerce platforms and large retailers, and combine AI technology to achieve multi-dimensional data analysis. Based on consumer purchasing behavior, AI systems automatically generate dynamic pricing strategies to provide real-time decision support for enterprises. In terms of formula design, AI algorithms simulate the effects of different ingredient combinations, optimize product functionality, and launch affordable and practical flavonoid products. In deep cooperation between enterprises, large retailers, and e-commerce platforms, AI recommendation systems can accurately push product information based on user profiles, comprehensively enhancing market penetration. Targeting consumers of specific age groups, genders, or health needs, enterprises apply machine learning technology to segment their market positioning. AI algorithm clustering analysis of massive consumer data identifies segmented markets with significant features. For the middle-aged and elderly population, AI can combine health monitoring data to develop flavonoid products that enhance immunity; For young female consumers, AI focuses on product de-

sign with beauty and skincare functions. Through AI driven precision marketing strategies, enterprises can clarify their market positioning, meet the diverse needs of segmented markets, and achieve steady growth in market share[1].

4.2 Marketing Innovation

4.2.1 Utilize Social Media and KOLs for Brand Promotion. Social media, as the core platform of modern marketing, provides an important channel for brand promotion of flavonoid plant resource products with its wide user coverage and efficient dissemination capabilities. WeChat, Weibo, Tiktok and other platforms are not only bridges between brands and consumers, but also key tools to achieve precision marketing based on artificial intelligence (AI) technology. Through AI algorithm, in-depth analysis of user behavior data can help brands accurately locate target audiences, optimize content investment strategies, and improve promotion efficiency. For example, AI driven recommendation systems can push information about the health benefits of flavonoids, product usage methods, and user feedback to potential consumers based on their interests and preferences, significantly improving information reach and conversion rates. Key Opinion Leaders (KOLs), with their professional knowledge and influence, establish a high level of trust among specific groups. Brands collaborate with KOLs in the health field to convey professional information about flavonoid products through their influence. During this process, the application of AI technology further improved the effectiveness of the work. AI uses natural language processing (NLP) technology to analyze the emotional tendencies of KOL's published content and optimize content creation strategies; At the same time, machine learning models are used to predict the collaboration effectiveness of different KOLs and screen out the most influential partners.

4.2.2 Health Education and Consumer Education. Health education and consumer education are important means to enhance market awareness of flavonoid products. By utilizing systematic health education, consumers can effectively understand the biological activity and health benefits of flavonoids, as well as how to use related products correctly. This will help consumers make informed purchasing decisions and enhance their loyalty to the brand. In terms of health education, the brand uses a combination of online and offline methods, and online education uses WeChat official account, brand website, social media and other platforms to release health knowledge, scientific research results, and product use guidelines about flavonoids; Offline education utilizes forms such as holding health lectures and product experience activities to directly interact with consumers, answer their questions, and enhance their trust in the product. Meanwhile, consumer education focuses on guiding consumers to use flavonoid products correctly and avoid various adverse reactions caused by improper use (as shown in Table 1). Brands utilize various channels such as product manuals, user guides, and customer service inquiries to provide consumers with detailed product information and usage advice; Through consumer feedback and market research, continuously optimize products and services to meet consumer needs[2].

Table 1. Analysis of Consumer Psychological Driving Factors.

Driving factors	Description	Im- portance score (1-5)	Impact level (high/medium/low))
Health aware- ness	Consumers' pursuit of a healthy lifestyle, especially their demand for natural and antioxidant foods.	4.8	high
Environmental awareness	Consumers' attention to sustainable development and environmentally friendly products.	4.5	medium
Brand trust	Consumer trust and loyalty towards well-known brands.	4.2	medium
Price sensitivity	The sensitivity of consumers to product prices.	3.5	low
Product diver- sity	Consumer demand for product variety and flavor diversity.	4.0	medium

By analyzing the above data, health awareness and environmental awareness are the main driving factors for consumers to choose flavonoid products, with importance scores of 4.8 and 4.5, respectively, and the degree of influence is high and medium; Brand trust and product diversity also have high importance ratings, with scores of 4.2 and 4.0 respectively, and a moderate level of influence; The price sensitivity is relatively low, with a rating of 3.5 and a low degree of impact. In the development of flavonoid plant resources, emphasis should be placed on consumers' health and environmental awareness, and market competitiveness should be enhanced through strategies such as product function enhancement, environmentally friendly packaging, and brand joint marketing.

4.3 Supply Chain Innovation

Supply chain innovation plays a crucial role in the development of flavonoid plant resources, involving not only the entire process from raw material procurement to final product delivery, but also quality control, cost optimization, sustainability, and other aspects. It significantly improves the utilization efficiency of flavonoid plant resources, enhances product quality, and promotes their sustainable development. Flavonoid plant resources are widely distributed, but the quality and yield of resources vary greatly in different regions. Establishing an efficient supply chain network, selecting suitable planting bases and suppliers are key points to ensure stable resource supply. Relevant enterprises should actively introduce modern information technology, such as the Internet of Things (IoT) and big data analysis, to monitor the growth environment of plants in real time and scientifically optimize the planting and harvesting process. The extraction and processing process of flavonoids is complex and easily affected by environmental factors and human operations, leading to unstable product quality. Therefore, staff must strictly control quality standards at all stages of the supply chain. For

example, in the stage of raw material procurement, establish a strict quality inspection system to ensure that the quality of raw materials meets industry standards; In the production and processing stage, advanced extraction and purification technologies are adopted to enhance product purity and stability of active ingredients; In the product delivery phase, further improve the logistics and warehousing management system to ensure that the products are not contaminated during transportation[3].

The development of flavonoid plant resources must balance environmental protection and sustainable resource utilization. In supply chain management, relevant enterprises should prioritize environmentally friendly planting and processing technologies to scientifically reduce negative impacts on the environment. For example, promoting organic planting and green processing technologies, reducing the use of chemical pesticides and fertilizers; Adopting renewable energy and energy-saving equipment to reduce energy consumption and carbon emissions; Establish a comprehensive waste treatment and recycling system to achieve the circular utilization of resources. It can be seen that supply chain innovation is of great significance in the development of flavonoid plant resources. Scientific optimization of supply chain management, ensuring product quality, and achieving sustainable development can significantly improve the utilization efficiency of flavonoid plant resources[4].

4.4 Technological Innovation

4.4.1 Research and Development of Efficient Extraction and Purification Technology. In recent years, with the rapid advancement of technology, various new extraction and purification technologies have emerged, significantly improving the yield and purity of flavonoids, scientifically reducing production costs, and providing a solid technical foundation for the commercial development of flavonoid resources. The application of supercritical fluid extraction (SFE) technology in flavonoid extraction has achieved significant results, utilizing the high solubility of supercritical fluids (such as carbon dioxide) under high pressure and high temperature conditions to efficiently extract flavonoids from plants. Compared with traditional solvent extraction, SFE technology has the advantages of high extraction efficiency, good selectivity, and no solvent residue. SFE technology achieves selective extraction of different flavonoid compounds by scientifically adjusting pressure and temperature, thereby improving product purity [5].

In terms of the application of microwave-assisted extraction (MAE) technology, it uses microwave radiation to rapidly heat plant cells, further accelerating the release and dissolution of flavonoid compounds. Research has shown that using MAE technology to extract flavonoids can increase the extraction rate by more than 20% and shorten the extraction time to about one-third of traditional methods. Combined with other extraction methods, it can further improve the extraction efficiency. In terms of purification technology, the development of membrane separation technology provides a new solution for the purification of flavonoids. Membrane separation technology uses membranes with different pore diameters to separate the mixture, which has the advantages of simple operation, low energy consumption, no pollution, etc. For example, ultrafiltration and nanofiltration techniques are used to effectively remove large molecular

impurities from flavonoid extract and improve product purity. In the application of high-performance liquid chromatography (HPLC) combined with mass spectrometry (MS) technology, flavonoids are efficiently separated by optimizing the mobile and stationary phases. MS technology can quickly identify the separated flavonoids to ensure product quality; By using HPLC-MS combined technology, efficient purification of flavonoids can be achieved, with a purity of over 99% [6].

4.4.2 The Application of Big Data and Artificial Intelligence in the Analysis and Prediction of Flavonoid Market. The application of artificial intelligence (AI) in flavonoid market analysis and prediction provides a new tool for the commercial development of flavonoid resources. On the one hand, staff should actively utilize big data analysis to comprehensively collect market data, which is beneficial for enterprises to have a detailed understanding of the market demand for flavonoid products. For example, by analyzing user reviews and purchase records on e-commerce platforms and social media, obtaining consumer evaluations of flavonoid products, scientifically adjusting product formulas and marketing strategies, helping enterprises identify emerging markets and potential customer groups, and providing data support for market expansion. On the other hand, artificial intelligence technology. Machine learning and deep learning algorithms can model historical data and predict future market trends, such as building time series models and regression models, allowing companies to predict the demand and price fluctuations of flavonoid products in the coming years, and thus develop reasonable production plans [7].

In practical applications, the combination of big data and artificial intelligence provides powerful tools for analyzing and predicting the flavonoid market. A flavonoid production enterprise discovered through big data analysis that consumers' demand for natural antioxidants is constantly increasing, further increasing its efforts in the research and promotion of flavonoid products (as shown in Table 2). At the same time, the company utilized machine learning algorithms to predict a significant increase in market demand for flavonoid products in the coming years, expanding production scale ahead of schedule and successfully seizing market opportunities[8].

Table 2. Analysis of Business Innovation Response Strategies.

Innovation strategy	Description	Implementation difficulty (1-5)	Expected market response (positive/neutral/negative)
Product feature enhancement	Enhance the health benefits of flavonoid products through technological means, such as improving antioxidant capacity.	4.5	positive
Environmentally friendly packaging	Adopting biodegradable or recyclable packaging materials that meet the environmental protection needs of consumers.	3.8	positive

Brand Joint Marketing	Collaborate with well-known health brands to enhance brand awareness and trust.	3.5	positive
Price strategy adjustment	Reduce costs and provide more competitive prices through large-scale production and supply chain optimization.	4.0	neutral
Product diversification	Develop various flavors and forms of flavonoid products to meet the needs of different consumers.	3.0	positive

Product feature enhancement and environmentally friendly packaging are relatively effective innovative strategies, with implementation difficulties of 4.5 and 3.8, respectively, and expected market response is positive; Brand joint marketing and product diversification strategies also have high market potential, with implementation difficulties of 3.5 and 3.0 respectively, and expected market reactions are positive; The implementation difficulty of price strategy adjustment is 4.0, and the expected market response is neutral, indicating that a simple price adjustment may not be sufficient to significantly enhance market response.

5 Conclusion

In summary, the development of flavonoid plant resources not only meets consumers' demand for health products, but also provides huge business opportunities for enterprises. By deeply understanding consumer psychological driving factors, actively introducing computer technology, and formulating effective business innovation response strategies, they can stand out in the fierce market competition. In the future, with the continuous advancement of technology, the development of flavonoid plant resources will face more opportunities and challenges. Enterprises need to continue to innovate in order to maintain their competitive advantage.

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