production systems emphasize standardization and scale, consumer demand is increasingly oriented toward personalization and differentiation, creating a structural mismatch that constrains value chain coordination and value enhancement (Gabellini and Scaramuzzi, 2022).

6.2 Changes in market demand and consumer preferences

With consumption upgrading and accelerating urbanization, the *Phalaenopsis* market is shifting from traditional single potted plant consumption toward more diversified and scenario-based applications. Classic large-flowered white or pastel cultivars still dominate the mainstream market, but consumer interest in novel flower colors, compact combinations, and locally bred cultivars is steadily increasing (Nurmalinda et al., 2023). This trend indicates that the market is transitioning from a primarily standardized model to a dual structure combining standardization and differentiation, thereby placing higher demands on cultivar innovation.

Consumer behavior exhibits clear segmentation. Mass-market consumers tend to prioritize price, flower number, and ease of maintenance, with a strong emphasis on product stability and cost-effectiveness. In contrast, high-end consumers and hobbyists place greater value on rarity, uniqueness of flower color, and morphological novelty, and are willing to pay premium prices for distinctive traits. In gift-giving and emotional consumption contexts, *Phalaenopsis* has evolved from a purely ornamental plant into a product carrying cultural symbolism and emotional value, significantly enhancing its added value. This stratification of consumer demand is driving the market toward more refined and multi-tiered structures.

Meanwhile, application scenarios and sales channels continue to expand. *Phalaenopsis* has extended from traditional festive gifts to broader uses such as home decoration, commercial space design, and cultural–creative products. The rapid development of e-commerce and new retail models has increased the importance of visual presentation and packaging design, while also imposing higher requirements on product uniformity and logistics performance. In addition, green consumption concepts and cultural value recognition are gradually becoming important factors influencing consumer choices, promoting the industry toward sustainability and cultural integration (Gabellini and Scaramuzzi, 2022).

6.3 Future development directions

The future development of the *Phalaenopsis* industry will center on breeding innovation, with a focus on expanding the genetic base and alleviating cultivar homogenization. Interspecific and intergeneric hybridization to introduce rare flower colors, complex patterns, and desirable plant architectures represents an important pathway for achieving trait breakthroughs (Wu et al., 2022). Meanwhile, advances in genomics and molecular marker technologies, including QTL mapping and core germplasm resource development, are providing a solid foundation for marker-assisted breeding and precision selection (Hsu et al., 2022; Lai et al., 2024). Future breeding strategies are expected to shift from experience-based approaches toward data-driven and goal-oriented frameworks, thereby improving breeding efficiency and trait controllability.

At the technological level, the integration of conventional breeding with modern biotechnologies will become a major trend. Genome editing technologies such as CRISPR/Cas9 offer new opportunities for precise trait improvement, although they are still constrained by limitations in transformation efficiency and regeneration systems (Lou et al., 2023). At the same time, precision production systems based on environmental control and data analysis will contribute to improving flowering synchronization and quality stability (Cembrowska-Lech et al., 2023; Kaya, 2025). The application of high-throughput phenotyping and data modeling is also expected to provide more scientific decision support for production management.

From an industrial perspective, intelligent production and sustainable development will be key future directions. The application of the Internet of Things (IoT) and automated systems can enable precise environmental control, improve production efficiency, and reduce resource consumption. The integration of genomic, phenotypic, and environmental data will further promote the development of intelligent breeding and precision management systems (Xu et al., 2022; Farooq et al., 2024). In addition, optimizing resource use efficiency, developing circular agriculture models, and expanding cultural-creative and design-oriented horticultural products can enhance