



Game Industry Market Segmentation Based on Clustering Algorithms: Evidence from VALORANT and Counter-Strike 2

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Abstract. The present research identifies VALORANT and Counter-Strike 2 (CS2) as stand-alike cases in terms of tactical FPS games. Basing on market segmentation and target market strategy, this study employs a comparative-case-study method to systematically investigate discrepancies between the two games in terms of market positioning, player structure and business approach. We found that while they shared the same core gameplay genre, VALORANT and CS2 had a stark contrast in terms of their strategic preferences in choosing player targets and market structure. VALORANT appeals primarily to a Generation Z and more inclusive population with highly visualized look and feel, agent driven skill mechanics, and socio-moral gameplay approach: Its free-to-play model and cosmetics based monetization strongly complements players' consumption motivations and encourages greater player engagement and lifetime value. CS2 on the other hand has traditional FPS type character with realistic shooting strategies and high competitive skill ceiling, for core users who care about technical depth and fair competition. Its Steam-based virtual item trading model also reinforces its consumer logic based on the value of collection and exchange. This study emphasizes the distinct segmentation paths found in the FPS market and that FPS products may coexist through competitive positioning strategies, rather than complete substitution. The findings offer pragmatic insights for long-term product positioning and monetization strategy to game developer and operator.

Keywords: Market segmentation; Target market; FPS games; Player motivation; Business model

1 Introduction

First-person shooter (FPS) games have always been one of the most competitive core genres in the digital gaming world which has attracted countless gamers [1], as their competitive nature and established esports ecosystems have earned them popularity. However, there have been enormous changes in the digital entertainment landscape where player structure, entertainment motivation and motivation have all changed for gamers within the FPS genre. Generation Z has emerged as a key player in the gam-

ing market over the past few years. Gen Z's focus today on emotional experience, visual style, and social interaction versus a shallow competitive depth [2].

Against this background, VALORANT and Counter-Strike 2 both tactical FPS titles have developed along markedly different trajectories. VALORANT attracts younger audiences through its agent skill system, stylized art direction, and cosmetic monetization design, whereas CS2 continues to emphasize realistic shooting and a high competitive skill ceiling while building a stable core-player ecosystem through Steam's trading system. Although the two titles share similar genre characteristics, their market positioning and target player groups differ substantially.

Nevertheless, existing research has largely discussed changes in player structure from a macro perspective, or analyzed game design and monetization strategies from the perspective of single products. There remains limited comparative research applying market segmentation theory to tactical FPS games [4]. In particular, within tactical FPS titles that are highly comparable in core gameplay, how different products achieve differentiated segmentation through design strategy and business models and how such strategies shape the target players' aesthetic preferences and consumption behavior requires further exploration.

Accordingly, this paper addresses the following research questions:

(1) Under highly similar core gameplay conditions, how do VALORANT and CS2 achieve market segmentation and differentiated positioning through game design and business models?

(2) What systematic differences exist between differently positioned FPS games in terms of players' motivational structures, aesthetic preferences, and consumption behavior?

(3) Using VALORANT and CS2 as cases, how consistent are game design and business models with target market positioning, and what FPS market stratification patterns emerge from such differentiation?

2 Literature Review

2.1 FPS Market Trends and Changes in Player Structure

Existing studies show that the gaming market is experiencing increasing diversification of user structures [1]. Industry reports indicate that Gen Z players exhibit high sensitivity to visual style, cultural symbols, and social experience in games [2]. At the same time, the rising proportion of female players has encouraged some games to reduce pure technical barriers while placing greater emphasis on inclusiveness and aesthetic expression [3]. In the FPS domain, this trend has promoted the growth of stylized shooter games and created conditions for the coexistence of products with different positioning strategies.

2.2 Market Segmentation and Player Motivation Research

Market segmentation theory suggests that differences in consumers' motivations and behaviors provide a crucial basis for product positioning. Recent esports studies fur-

ther indicate that players can be categorized into groups oriented toward social entertainment and those oriented toward competitive achievement [5]. In FPS games, players' product choice often depends on whether the game satisfies their demands for entertainment, competition, or identity recognition.

2.3 Esports Image and Genre Differences

Studies also show some genre differences as it is possible in esports that different players will have their specific public images. On the other hand, the gaming industry generally associates traditional FPS games with high competitiveness and masculinity and stylized esports projects are frequently associated with entertainment and social aspects [6-7]. Such genre-image divergences amplify the internal stratification logic in the FPS game.

3 Research Method

This study utilizes a comparative case study design of VALORANT (Riot Games) and Counter-Strike 2 (Valve) as the research objects. These two games are tactical FPS games; therefore they are comparable in the gameplay. At the same time, they have massive differences in visual style, role systems, monetization mechanisms, and player structure. Both titles also have established esports ecosystems and well-established user bases and are therefore more representative and informative in terms of research.

3.1 Methodology for Market Segmentation Using Clustering Algorithms

Market segmentation using clustering algorithms aims to identify homogeneous player groups based on multi-dimensional behavioural and attitudinal features. In this study, clustering is applied as an unsupervised learning method to uncover latent segment structures that are not observable through traditional demographic variables alone. The analytical framework consists of four reproducible stages: (1) data collection and integration, (2) feature construction, (3) clustering model training and validation, and (4) segment interpretation and strategy mapping. First, heterogeneous data sources are integrated, including in-game behavioural logs (e.g., playtime, ranked participation, KDA patterns), monetization records and player-generated text (e.g., Steam reviews, forum discussions). Second, features are standardized and transformed into a unified vector representation. Numerical indicators are normalized categorical variables are encoded, and text data are embedded using TF-IDF or transformer-based sentence embeddings. Third, clustering algorithms such as K-means, Gaussian Mixture Models (GMM), and hierarchical clustering are tested. The optimal number of clusters is determined using elbow method and silhouette score to ensure stability and separability. Finally, each cluster is interpreted through dominant feature patterns and labeled into economically meaningful segments, enabling downstream

applications such as target market selection, CLV optimization [8], and differentiated marketing strategies.

4 Case Analysis

4.1 Market Positioning of VALORANT

VALORANT also includes a skills-driven agent system and stylized visual communication where the dominance of pure gunplay in determining match outcomes is reduced. So, new players can be connected along with accomplishment and teamwork. Additionally, the cosmetic skin system reinforces identity expression and social display functions and drives consumption behavior emotionally and symbolically. With its free-to-play model and cosmetic-based monetization, it aligns perfectly with a younger and more diverse target group of players, reinforcing how consistent the business strategy is with the market positioning. As shown in Figure 1, VALORANT's esports audience is dominated by younger players.

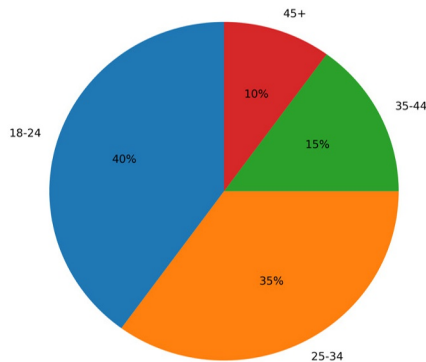


Fig. 1. VALORANT esports audience age distribution. Data from: <https://abiosgaming.com/press/press-kit/>

4.1.1 Design Mechanisms and Player Motivation: A Social-Entertainment Orientation.

From a player motivation viewpoint, VALORANT enhances social and emotional experiences aside from pure competitiveness. Studies conducted by esports engagement researchers indicate that player engagement is fueled not only by competitive success and achievement, but it is also mediated by social motivations, identity recognition, and emotional gratification. Due to its agent-based skill system, players can create their own sense of belonging through cooperation and coordination in VALORANT. The player's aiming skills can be relatively poor and effective in reducing the barriers to entry of new and casual players. Content marketing research

shows that VALORANT has a strong relationship between esports communication and community operations, and that the content communication of the brand focuses primarily on character stories, trend-based symbols, and youth-oriented subcultural language, leading to greater community bonding [9-10]. This means VALORANT can leverage as a social and cultural digital product for Gen Z users, when they don't use it as just a competitive shooting device.

4.1.2 Market Positioning of CS2.

In contrast to VALORANT, CS2 remains in the context of a traditional tactical FPS experience with a high competitive skill threshold. Traditional FPS titles are generally associated in the public's perception with hardcore competition, masculine identity, and rigorous technical demands, based on research on genre differences in esports games[11-12]. This genre image functions as a segmentation filter, naturally: it attracts core players, who focus on technical enhancement and competitive fairness, then it dissuades casual players from coming and staying on board. As shown in Figure 2, VALORANT has a relatively higher proportion of female players than CS2.

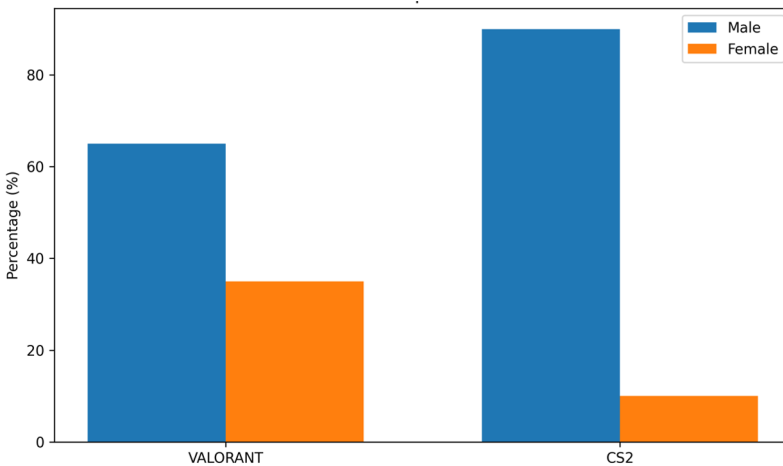


Fig. 2. Gender distribution comparison between VALORANT and CS2 players. Data from: <https://abiosgaming.com/press/press-kit/>; <https://profilerr.net/cs2-player-statistics/>

4.2 Market Positioning of CS2

In contrast, CS2 maintains realistic shooting mechanics and a high competitive threshold as its core design philosophy, emphasizing technical growth and competitive fairness. Its cosmetic system is built upon Steam's ecosystem, forming a consumption logic oriented toward collection and trading value. This mechanism attracts core players willing to invest substantial time and effort, thereby enhancing ecosystem stickiness and consolidating CS2's stable position among traditional FPS players.

4.3 Big Data–Driven Player Demand Mining and Market Segmentation Using Clustering Algorithms

(1) Data source: The big data pipeline can be used to collect player log data (such as game duration, kill/death/assist count, in-game economy and purchase behavior, ranking dynamics, team formation situation, and chat frequency), transaction and payment data (such as skin purchases, transaction frequency and amount), and community text data (such as Steam comments, Reddit/Microblog posts, customer service tickets and community chats). These heterogeneous, multi-source datasets collectively reflect players' behaviors, emotions and value-related needs.

(2) Feature engineering: Player behaviors are transformed into clusterable feature vectors, such as competitive intensity (ranking/score/performance density), social tendency (team formation ratio, voice/text interaction), content preference (common weapons/characters/maps), consumption tendency (average revenue per paying user, number of collected decorations, transaction activities), and churn risk (activity in the last N days, retention cycle). Numerical features are standardized; categorical features are encoded using one-hot encoding; text features are represented by TF-IDF or BERT embeddings.

(3) Clustering modeling: Players can be segmented using K-means, Gaussian Mixture Model (GMM), or hierarchical clustering. The optimal number of clusters K is determined by evaluation metrics such as "elbow rule" and "silhouette coefficient", and then each cluster is named based on business interpretability (such as "hardcore competitive type", "social entertainment type", "collecting or trading type", and "light experience type" players).

(4) Output and application: The clustering results are mapped to segmented roles, and then the distribution differences of each cluster in "Valorant" and "Counter-Strike 2" are verified to explain the positioning differences in the design mechanisms and business models of these two products. This process directly supports economic management tasks such as target customer selection, pricing/promotion strategies, customer lifetime value (CLV) improvement, and marketing channel optimization.

4.4 Summary

Overall, VALORANT's segmentation strategy centers on entertainment experience, social interaction, and identity expression. Its target player group tends to be younger and more diverse, with a relatively higher representation of female players. Game design and monetization mechanisms largely serve this positioning, creating differentiated competitive space from traditional tactical FPS products

5 Discussion

5.1 Relationship Between Market Positioning and Player Structure

Based on the comparative analysis, differences in player structures between VALORANT and CS2 are not accidental but result from long-term positioning strate-

gies and design choices. Market segmentation theory emphasizes that products are not designed for “everyone” but rather attract specific user groups through conscious design decisions. From this perspective, VALORANT and CS2 represent two differentiated segmentation paths within the tactical FPS market.

VALORANT emphasizes entertainment value, visual aesthetics, and social experience. Its design reduces the decisive role of pure technical skill, enabling more new and casual players to participate and remain engaged. This approach aligns with the trend of younger and more diversified esports user structures, producing a Gen Z–dominated and relatively diverse player base. In contrast, CS2 focuses on realistic shooting experience and competitive difficulty, continuously serving traditional FPS players who seek technical depth and competitive fairness. Such positioning leads to a more concentrated player structure but ensures stability in community culture and competitive ecosystem.

Overall, market positioning and player structure demonstrate strong consistency. Tactical FPS titles are not necessarily competing for the exact same player base; rather, they occupy different roles and divisions within the genre.

5.2 Explainable Player Segmentation Using Text Mining and Clustering: From “Needs” to “Strategy”

(1) Theme extraction: Use LDA topic modeling or BERTopic technology to extract high-frequency themes, such as "competitive fairness", "social experience", "skin value or trading", "server or matching mechanism", and "anti-cheating".

(2) Vectorization and clustering: Represent each player's text as features through topic distribution or sentence embedding; then connect these features extracted from the text with behavioral data, such as game duration, retention rate, consumption, and skill metrics to perform clustering.

(3) Business interpretation and strategy planning: Interpret the core needs of each cluster by examining its main themes and behavioral indicators, and design differentiated strategies accordingly. For example, for the "fair competition" group, prioritize anti-cheating and matching mechanism optimization; for the "social participation" group, strengthen team/cooperative functions, social incentives, and community content; for the "collecting and trading" group, optimize item supply, scarcity design, and market mechanisms.

5.3 Synergistic Effects of Game Design, Business Model, and Consumption Behavior

Further analysis suggests that game design and monetization models interact synergistically to reinforce market positioning. In VALORANT, the agent system, skill mechanics, and stylized visual design not only shape gameplay experience but also influence consumption patterns centered on identity display and emotional satisfaction. Skin purchases therefore carry symbolic and social meaning, aligning with the value orientations of younger players and supporting long-term player lifetime value. As

illustrated in Figure 3, game design and monetization mechanisms jointly shape consumption behavior and reinforce market positioning.

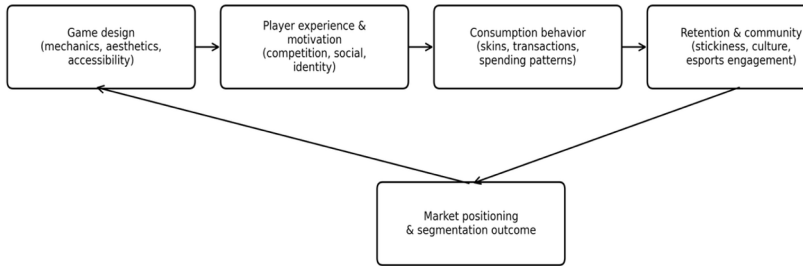


Fig. 3. Design–business model–consumption behavior framework in FPS games. Data from: Author’s synthesis based on market segmentation and esports motivation literature

By contrast, CS2’s skin economy—through Steam’s official marketplace and third-party trading platforms—constructs a virtual goods economic system characterized by liquidity and scarcity. In this context, skins are not merely decorative items but possess collectible and exchange value, and may even become speculative assets. This mechanism attracts core users who are sensitive to virtual asset value and willing to commit long-term time and resources, strengthening their stickiness to the ecosystem.

Thus, the difference between the two games’ monetization strategies is not simply about alternative revenue models; rather, it reflects deep coupling between design choices, business logic, and player motivations. Together these form a mutually reinforcing closed loop.

5.4 Player Evaluation: Perceived Differences in Gameplay and Design

To supplement the auxiliary data analysis, we conducted informal semi-structured interviews with two FPS players (Sophia and Trey), both of whom have played VALORANT and Counter-Strike 2 (CS2). Although the sample size is limited, these evaluations provide qualitative insights into how players view the differences between the two games in terms of gameplay, aesthetics, and competitive atmosphere.

Trey (male, a college student from Adelaide) emphasized that his main motivation for playing FPS games is "combat and competition", so he prefers CS2. In his view, "CS2" offers a more hardcore and realistic experience, with a clearer sense of competitive intensity. He indicated that his interest in "Brave Warrior" was limited, believing that the game lacked competitiveness and was more like a "cartoonized" game, featuring animations, sound effects and stylized visual effects, which reduced the sense of serious combat.

Sophia’s report is contrary to this. She said that VALORANT is more attractive because it has a stylized aesthetic, including "cartoon-like visual effects" and "pink-themed skins", which enhance the fun and identity expression. She also pointed out that compared with the realism and high-pressure atmosphere of CS2, VALORANT

feels less intimidating and places more emphasis on entertainment. Importantly, Sophia mentioned that in the highly competitive FPS environment, female players may be criticized when they perform poorly, while the community and game atmosphere of "VALORANT" are considered more casual and fun, which makes it easier for her to integrate and stay active.

Overall, these evaluations are consistent with the segmentation results: "CS2" is associated with hardcore competitive groups that value reality and fairness, while "VALORANT" is more attractive to players who pursue entertainment, aesthetic recognition, and lower psychological barriers to entry. This further supports the view that tactical FPS products can coexist by targeting different player groups rather than competing for a single homogeneous user base. As shown in **Figure 4**, VALORANT and CS2 follow differentiated market positioning paths within the tactical FPS genre.

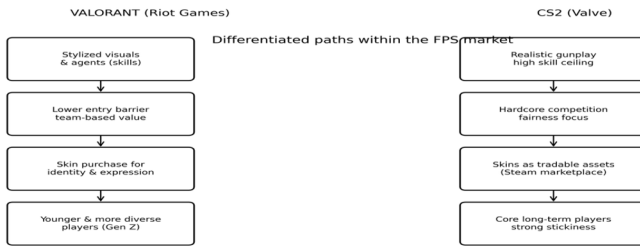


Fig. 4. Differentiated market positioning paths: VALORANT vs CS2. Data from Author’s synthesis based on case comparison.

6 Conclusion

6.1 Future Trends and Emerging Technologies

As players' motivations diversify, the FPS market may become more segmented. Emerging technologies such as AI-driven personalization, real-time analysis, and advanced anti-cheat systems will gradually shape player experience and ecosystem trust. Therefore, competitive advantages may rely less on the similarity of core gameplay and more on capabilities at the platform level, such as retention design, community governance, and the accuracy of segmentation.

6.2 Marketing Impact

Marketing strategies should shift from broad targets to life-cycle marketing for specific market segments. VALORANT should enhance its identity brand oriented towards Generation z and community-based growth, while CS2 should strengthen its value proposition of fair competition and technological mastery. Continuous cluster-based segmentation can help these two games track the evolving player structure, increase CLV, and reduce the churn rate in the stratified FPS market.

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