

Opportunities and Challenges in the Integration of the Virtual and Music Industries: The Case of Aespa

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Abstract: The integration of virtual technologies into the music industry has opened up new creative and commercial possibilities, particularly within K-pop. This paper explores the opportunities and challenges of merging the virtual and music industries using the South Korean girl group Aespa as a case study. Aespa, launched by SM Entertainment, is the first K-pop group to incorporate a metaverse concept through the creation of virtual avatars, which are embedded in their music, performances and brand identity. This study adopts a dual analytical approach using the PESTEL model to examine Aespa's external environment and the SWOT framework to evaluate its internal factors. The findings reveal that Aespa benefits from strong policy support, market demand for virtual content and technological innovation. However, challenges such as high operational costs, limited audience diversity and sustainability concerns remain. In response, strategies are proposed to diversify music styles, strengthen partnerships with technology firms and expand low-carbon digital interaction platforms. This case offers insight into how virtual technologies can be more effectively integrated into mainstream music production and branding while balancing innovation with cultural and environmental demands.

Keywords: Virtual Technology, Metaverse, Aespa, K-pop, Sustainability.

1. Introduction

As the virtual reality ecosystem continues to grow, the music industry is being influenced by this field. This influence is seen in how music products are produced, and concerts are presented, and it also drives the creation of virtual concepts combined with music products. Against this backdrop, the Korean music industry has been in the spotlight with the launch of SM Entertainment's girl group Aespa, the first idol group to combine the concept of the metaverse with music in the Korean music industry, which has created a new form of idol expression through the use of virtual technology. This paper takes Aespa as a case study object to explore the opportunities and challenges faced in the music industry after the fusion of music and the virtual industry. The group's external environment is analysed through the PESTEL model, revealing the key factors and potential constraints driving its development. Its internal strengths and limitations are analysed in depth using the SWOT model. Finally, based on these analyses, the main challenges of integrating the music and virtual industries are explored, and optimisation strategies are proposed to provide references and lessons for applying virtual concepts in music products.

2. Case Background: South Korean Girl Group Aespa

Aespa is a South Korean girl group launched in 2020 by SM Entertainment, consisting of four members - Karina, Winter, Ningning, and Giselle - who have built a metaverse worldview centred on the coexistence of the real and the virtual and created virtual characters for the members 'æ' (Jeong & Kim, 2023). To reinforce this core concept, the virtual characters often appear in music videos alongside the actual members, and Aespa's debut song 'Black Mamba' features virtual characters and real members fighting against a virtual enemy through AR and VR technologies

(Sriwahyuni et al., 2023). The group communicates their constructed metaverse worldview to the audience visually through music videos, which are usually created to deepen this worldview in subsequent works. Their music piece 'Next Level' continues the episodic content of their debut track. This narrative is an innovative fusion of music and visual media that pushes the traditional boundaries of K-pop performance (Weng, 2024). Aespa also focuses on conceptual output in their stage performances, an act that is designed to give the audience a more intuitive sense of their group identity. Virtual characters in their stage participate in the stage design and demonstrate the fusion of technology and performance by interacting with real characters (Li, 2023). Aespa not only opens up the expression of K-pop idols but also explores more possibilities for combining music and virtual industries.

3. PESTEL Analysis of Aespa's External

This part uses the PESTEL model to analyze Aespa's external environment, explore the key drivers supporting the development of their virtual concept, and reveal the potential obstacles limiting its development.

3.1. Political

On August 19, 2024, the South Korean Cabinet passed the "Enforcement Decree of the Virtual Convergence Industry Promotion Act" (Ministry of Science and ICT, 2025). The introduction of this policy signifies that the South Korean government will provide strong support and protection for the virtual convergence industry. Therefore, Aespa can achieve steady development under this policy as a representative group of the virtual concept.

3.2. Economic

In recent years, the South Korean music industry has shown significant growth. From 2014 to 2022, the sales revenue of

the South Korean music industry increased from 4.61 trillion KRW to 11.01 trillion KRW, approximately tripling in revenue (MCST & Korea Creative Content Agency, 2025). This sustained growth indicates that the music industry has become an important economic pillar of South Korea's cultural and creative industries, providing a market foundation for Aespa's development.

3.3. Social

Both Generation Z and Hallyu influence South Korea's social culture. Since the late 1990s, Hallyu, in the form of K-pop, has become an important part of global popular culture (Choi & Maliangkay, 2015). Generation Z, the leading consumer group in South Korea today, shows a very high acceptance of virtual content (Dombrosky et al., 2018). This trend allows Aespa to gain significant recognition in the current music industry and brings particular possibilities for their global expansion.

3.4. Technological

The rapid development of virtual technologies has opened up new directions for the music industry. For instance, the advancement of Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI) has not only diversified the ways music is delivered but also enhanced the audience's experience of music products (Turchet, 2023). Developing VR and AR technologies further provides the technical foundation for creating virtual worlds. AR technology enables real people and virtual characters to interact within the same scene, while VR technology offers immersive experiences (Petrović, 2020). These technological advancements allow Aespa to strengthen their core concept further.

3.5. Environmental

Global climate change and sustainable development are highly relevant topics today. While the rapid development of digital technologies drives innovation, it also inevitably increases the carbon footprint. Servers and data centres required to maintain virtual technologies consume significant energy, leading to adverse environmental impacts (Turchet, 2023). Although Generation Z is highly interested in virtual content, they are equally concerned about sustainability issues and support brands that demonstrate positive social responsibility and environmental performance (Shorey et al., 2021). This presents a challenge for Aespa, which is characterized by its virtual world. They must not only maintain their leadership in virtual technology innovation but also find a balance between sustainable development and energy consumption.

3.6. Legal

South Korean law provides important support for developing the music and virtual industries. The Copyright Act of Korea automatically protects original music works (Generis Online, 2023). As a signatory to the Berne Convention, South Korea's copyright protection aligns with international standards, providing legal support for the global distribution and rights protection of Aespa's music. Additionally, as part of digital content, virtual characters are protected under the Korean Copyright Act. The copyrights for virtual characters belong to their creators or companies, and unauthorized use may constitute infringement (Korea Copyright Commission, 2024). This legal framework allows Aespa to protect their intellectual property during virtual

integration, reducing the risk of infringement.

3.7. Summary

Through the PESTEL model analysis of Aespa's external environment, it can be concluded that the external environment supports the combination in five aspects. The South Korean government actively promotes the development of virtual industry integration and provides policy guarantees for Aespa. As an important part of South Korea's current economic income, the music industry has laid a stable market foundation for Aespa. At the socio-cultural level, the Korean Wave culture dominates the global export of Korean culture. Generation Z has become the main consumer, providing broad audience support for the virtual concept of Aespa. The diversified development of virtual technology provides a technical guarantee for Aespa in building virtual concepts. The copyright protection of virtual images and music works in relevant laws also provides institutional support for its creation and development. However, environmental aspects pose challenges to Aespa. Despite the innovation and convenience of virtual technology, Aespa still needs to find a balance between environmental protection and technology's energy consumption.

4. SWOT Analysis of Aespa's Internal Environment

This part uses the SWOT model to discuss the advantages, disadvantages, opportunities and threats of Aespa's internal environment.

4.1. Strengths

4.1.1. Unique Brand Characteristics

Aespa creates a recognisable group identity through the concept of the virtual. The group incorporates the metaverse concept into their music production, distinguishing them from other current K-POP groups (Amaliyah et al., 2023). In order to make the virtual concept a substantial output, the group creates its avatars to construct the metaverse worldview. These avatars were created to reinforce the virtual concept and shape the complete brand identity by creating metaverse stories (Weng, 2024). The virtual concept is the core of Aespa's most distinctive brand identity in the K-POP industry.

4.1.2. Music Products to Satisfy Generation Z

Aespa's music product pinpoints the demand for music products from Generation Z. Generation Z, a generation that focuses on narrative experiences, is more easily attracted to this virtual worldview (Dombrosky et al., 2018). Aespa's music videos usually contain a complete narrative of the metaverse concept, presented dramatically. Aespa attracts Generation Z with its music content and arouses Generation Z's interest in a music style that fits the virtual world. The group's arrangements feature intense electronic sounds and futuristic rhythms, presenting a technological atmosphere (Sriwahyuni et al., 2023). Therefore, Aespa's music products have the characteristics of appealing to Generation Z, satisfying the aesthetic preferences of this audience.

4.1.3. SM Entertainment's Powerful Support

SM Entertainment can provide Aespa with high-quality music resources and global promotion opportunities. As a leading entertainment company in Korea, SM has a sound content production system and brand management strategy to ensure the high-quality output of Aespa's music products (Choi & Maliangkay, 2015). Furthermore, SM's successful

expansion into North America, Europe, and Southeast Asia markets lays a solid foundation for Aespa's global promotion. With its support, Aespa can consistently produce high-quality music products and receive strong backing for their global development efforts.

4.2. Weaknesses

4.2.1. High Cost of Operations

Building a virtual world requires expensive virtual technologies to sustain its operation. The high operational costs of maintaining virtual idols may limit their long-term sustainability (Han & Jeong, 2016). Constructing a metaverse narrative demands complex cross-media designs and technological collaborations, where any oversight could weaken the narrative's impact and damage the brand image. As a result, Aespa must invest significant financial resources in product development to ensure smooth operations.

4.2.2. Limited Audience Reach

Aespa's music products face certain limitations in attracting a broad consumer base. Although the group appeals to Generation Z, its complex storylines and cross-dimensional virtual concepts may create barriers to understanding for some audiences, such as older Millennials or younger members of Generation Alpha (Li, 2023). Particularly in regions with more traditional cultural backgrounds or lower acceptance of advanced technologies, Aespa's virtual narratives may struggle to generate sufficient interest, limiting market penetration. For audiences unfamiliar with K-pop or the metaverse concept, Aespa's appeal may not resonate. While Generation Z is Aespa's primary audience, the group may lack appeal to other demographic groups.

4.2.3. Limited Diversity in Music Style

Aespa's current musical style is one-dimensional to reinforce the virtual concept. In addition to Black Mamba, which was used to export virtual concepts at the beginning, Next Level, which was used to strengthen the concept of metaverse, was biased towards electronic music style and futuristic music atmosphere (Li, 2023). As a result, Aespa does not currently involve other styles to expand the scope of music production, leading to a single music style.

4.3. Opportunities

4.3.1. Growing Demand for Virtual Content

The application of virtual content in music stage performances and the growing demand for virtual experiences have shown a significant upward trend. The rapid advancement of VR and AR technologies provides musicians with innovative, creative tools and meets audience expectations for immersive virtual experiences by generating engaging scenes (Petrović, 2020). With this trend, Aespa, with the concept of the virtual at its core, can open up a broader scope of development in creating music products with virtual technologies to satisfy the public's demand for virtual content.

4.3.2. Digital Technology Expanding Business Models

Diverse digital technologies can bring more possibilities of virtual integration to Aespa. For instance, NFT technology can expand music products into the digital asset field, such as exclusive music clips and virtual concert tickets. These products not only enhance fans' sense of collection value but also win market trust through a decentralized trading mechanism (Turchet, 2023). This expands the presentation form of music products for Aespa's development of virtual

concepts and further strengthens the brand's core concept.

4.3.3. Globalization of Hallyu Culture

Hallyu culture is a critical component of South Korea's cultural exports. Over the past decade, K-pop has steadily expanded its international market influence through meticulous production, unique presentation methods, and social media dissemination (Choi & Maliangkay, 2015). Hallyu has opened global markets for South Korean music groups and facilitated the spread of Korean culture to various countries. Consequently, this provides Aespa with a vital opportunity to access global markets.

4.4. Threats

4.4.1. Intense Market Competition

The competition within the K-pop industry is becoming increasingly fierce, placing significant pressure on Aespa. Many Korean groups now target Generation Z, tailoring their concepts to appeal to this demographic. For instance, NewJeans, under ADOR Entertainment, also focuses on Generation Z by creating a brand identity that aligns with their everyday lives, attracting a substantial fanbase (Chen, 2023). As a result, Aespa faces mounting challenges in maintaining their competitiveness in the market.

4.4.2. Potential for Lost Audiences

Virtual content may face challenges of cultural acceptance in some markets. Although virtual idols born in the virtual industry are popular in Asian markets, virtual content may be perceived as lacking authenticity or insufficient emotional expression, leading to musical works losing their appeal to audiences (Han et al., 2016). Virtual images serve as an important presence in narrating the worldview of the Aespa metaverse, some groups may feel alienated by something that is not real. Therefore, this may increase the risk of losing the audience.

4.4.3. Pressure for Sustainable Development

Sustainability policies seriously challenge Aespa's concept of combining virtual and real. Its highly dependent virtual technology requires much energy to support, and the high carbon emissions during operation may conflict with increasingly stringent environmental policies (Brennan et al., 2019). At the same time, Generation Z, the core consumer group of Aespa, has shown a strong concern for the environment and the brand's social responsibility (Shorey et al., 2021). If Aespa fails to achieve a decarbonised transformation of its virtual technology, its brand image may be tarnished by failing to meet social expectations.

4.5. Summary

Through SWOT analysis, it can be seen that Aespa has several significant advantages. Its unique virtual concept, catering to the aesthetic preferences of Generation Z, and the powerful resources of SM Entertainment are all advantages that enable Aespa to develop steadily in the Korean music industry. However, in terms of disadvantages, Aespa has relatively high capital costs, and its music style appears relatively monotonous to strengthen the concept, limiting its audience range. Regarding opportunities, the current market demand for virtual content is constantly increasing, and the rapid development of digital technology and the globalization of Korean culture provides a broad space for Aespa's future development path. However, Aespa also faces multiple threats. Firstly, fierce market competition and K-POP groups with the same target audience may weaken Aespa's market position. In

addition, when the use of virtual technology leads to an increase in carbon emissions, Aespa may face the risk of negative public opinion.

5. Key Challenges and Response Strategies

This section combines the analyses from the PESTEL and SWOT models to explore Aespa's key challenges and propose corresponding strategies to address them.

5.1. Exploring Aespa's Key Challenges

5.1.1. Multicultural Adaptability Challenges

Currently, the cultural content that Aespa focuses on is mainly targeted at Generation Z, thus indicating that Aespa has not yet demonstrated characteristics of integrating other cultures. Although Aespa's brand concept is a representative presence in the Korean music industry, the virtual content part of the group is highly concentrated on the interests of Generation Z. Other generations or cultural groups that find virtual content hard to understand may feel alienated from Aespa's music content and style positioning, which leads to cultural challenges for Aespa.

5.1.2. Technical Costs and Market Challenges

Integrating virtual content and music products poses significant challenges for cost control. Aespa's metaverse concept requires substantial human resources, technology, and investment in funding. For instance, stages featuring virtual avatars collaborating with members rely heavily on advanced technology, and these high production costs require significant financial returns to break even. Moreover, as virtual technology develops and upgrades, its cost will also increase. Therefore, the imbalance between technology and cost affects Aespa's competitiveness and may also pose an obstacle to its long-term sustainable development. Additionally, if competitors are the first to introduce more immersive virtual concert technology, Aespa's current technological advantages may quickly lose appeal.

5.1.3. The Challenge of Protecting The Environment

Aespa is challenged by the concept of sustainability, and its use of virtual technology to create music products results in high energy consumption and increased carbon emissions. For example, when the group hosts a stage with avatars, it uses costly virtual technology that has high emissions. This would conflict with today's green philosophy and, to some extent, reduce the group's standing in the industry. If Aespa cannot balance technological innovation and sustainability, its long-term competitiveness could be affected.

5.2. Proposed Solutions

5.2.1. Diversify Musical Styles

Aespa can attract more diversified audiences and break through the existing market limitations by expanding the diversity of music styles. Firstly, it can integrate various music elements, for example, combining traditional instruments with electronic music and launching retro disco, jazz, R&B and other styles to attract listeners of different generations and cultural backgrounds. Aespa can also cooperate with globally renowned artists or music producers and leverage their influence to expand the audience, for example, by creating Latin styles or fusion works to cater to a broader range of music preferences. Preferences. This will not only attract a wider audience but also enhance its global brand image and competitiveness in the marketplace, setting

the stage for long-term growth.

5.2.2. Cooperation with Technology Companies

Aespa can achieve resource sharing and reduce input costs by establishing long-term partnerships with virtual technology companies. For example, Aespa can work with a leading virtual technology company to jointly develop AI interaction models for virtual members, use the technical results for Aespa's virtual world construction, and, at the same time, promote the application to other fields to dilute costs further. This optimises the investment in technology costs and enhances technological competitiveness by leveraging partners' resources to maintain an innovative edge in the market.

5.2.3. Expanding Online Interaction Channels

Aespa can reduce resource consumption by expanding online interactions. For example, creating a virtual fan community in the metaverse allows fans to interact without attending physical events. In this way, carbon emissions can be reduced, and connections with fans can be deepened. Additionally, Aespa could use AR or VR technology to provide immersive viewing experiences, allowing fans worldwide to enjoy high-quality music anytime. These strategies incorporate sustainability into Aespa's products.

6. Conclusion

This article takes the female group Aespa under South Korea's SM Entertainment as the research object, exploring its development opportunities and challenges under the metaverse concept. Through the external environment analysis of the PESTEL model, Aespa has significant advantages in policy support, market demand growth, technological innovation, and the globalization of Korean culture. However, the requirement for sustainable development is the current external environmental challenge it faces. Through the SWOT analysis, its internal advantages, such as brand characteristics, precise positioning of music style, and the company's high-quality resources, are further revealed while pointing out that high technological investment and audience limitations may restrict its future expansion. Based on the analysis of the two models, the main challenges Aespa currently faces are adaptability to multiculturalism, technological costs and market challenges, and compliance with green concepts. In response to these issues, this paper proposes strategies centred on optimising the diversity of music content, strengthening cooperation with technology companies and developing diverse online interactions. These strategies aim to help Aespa reduce technology costs and resource consumption, expand its audience, and enhance the brand's global competitiveness and sustainability. In the future, Aespa will need to balance technological innovation, environmental requirements, and market expansion to provide more possibilities for the innovative exploration of virtual and musical combinations.

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