

CHALLENGES OF E-SPORTS BASED ON BIG DATA AND QUALITATIVE ANALYSES: HOW SHOULD E-SPORTS DEVELOP IN THE FUTURE?

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ABSTRACT

e-Sports has become one of the fastest-growing segments of the sports industry. However, the research trends in e-sports rely heavily on traditional research trends in sport management. Therefore, the purpose of this study was to generate a strategic development plan for e-sports based on an in-depth analysis of the current status of the e-sports industry. The two studies conducted used big data analysis and qualitative research methods. For Phase 1, the overall schema of e-sports was established through the analysis of big data on the internet. In Phase 2, three Delphi surveys were conducted and analytic hierarchy process (AHP) analysis was used, involving 13 experts in the field of e-sports in South Korea. Study 1 produced 15 keywords related to the development of e-sports, while 12 subcategories required for the development of e-sports were generated through Study 2. The detailed guidelines for each subcategory were based on the results of this study.

Keywords: Analytic hierarchy process; Big data analysis; Delphi; e-Sports; Online game

INTRODUCTION

According to Newzoo (2019), global e-sports generated more than 865 million US dollars in revenue in 2018, an increase of more than 32% compared with 2017. The popularity of global e-sports keeps growing in terms of the audience, awareness and fans. For example, the “League of Legends” World Finals drew 12 million more fans than the National Basketball Association (NBA) finals held at the same time (Clavio, 2017), and its popularity has become a global phenomenon. The e-sports industry has become the fourth largest source of online streaming, after Netflix, Google and Apple (Billings & Hou, 2019).

Systematic development of e-sports began in South Korea, which is considered to be the epicentre of modern professional e-sports. A unique internet café called “PC Bang (room)” in Korea, where individuals play computer games and use high-speed web-surfing while enjoying foods and drinks at a reasonable price, became the hub of gaming culture and e-sports (Park & Kim, 2020). It played a similar role in taking e-sports to the “back alley”, where some X-games, such as skateboards, were initiated. This initiation in South Korea quickly turned the gaming culture into e-sports and generated the organised structure of e-sports in collaboration with media companies and the biggest corporations in Korea (Yoon, 2020). This was possible because the Korean government strategically encouraged the development of information technology (IT), which could be the future national driving force for many industries. The

installation of a high-speed internet infrastructure throughout the country for all citizens to enjoy was an essential part of the strategy (Park & Kim, 2020). To support and manage the development of e-sports, the Korean government created the Korea e-sports Association (KeSPA) and the International e-sports Federation (IeSF), while KeSPA is now an official member of the Korean Sports and Olympic Committee (KOC) (Yoon, 2020). Additionally, South Korea has been one of the countries that has implemented e-sports-related laws. A special law for the e-sports industry was established in 2016, and the Korea National Assembly recently approved a standard contract law for e-sports players. These laws are crucial as they provide a legal framework to protect the rights of e-sports players, ensure fair play, and promote the sustainable growth of the e-sports industry.

The global e-sports market has grown steadily since the 2000s, expanding from Asia and North America to include new markets in Europe and South America (Expert Market Research, 2023). The global e-sports market has been able to grow so rapidly owing to the rapid increase in the number of e-sports viewers (Newzoo, 2019). As the number of viewers who are enthusiastic about e-sports increases, e-sports broadcasting and media appeal increase accordingly; a virtuous cycle in which companies and investors continue to invest in e-sports is being built (Expert Market Research, 2023). However, despite its growth, e-sports has been criticised by a number of scholars. For example, some have argued e-sports is a simple game activity rather than a sport, as active physical activity is not involved (Witkowski, 2012; Heere, 2018). This lack of physical activity is a characteristic that divides e-sports from the general definition of sport itself, since sports are closely related to the development of the body (Park & Kim, 2020). Further, Inoue *et al.* (2018) noted critical differences between e-sports and traditional sports in terms of facilities, governing organisations, and the nature of the events.

Despite these criticisms, it is essential to recognise the unique benefits and potential of e-sports, which encourage sports researchers to focus on developing this activity. First, the criticism that the content of e-sports is an extension of a simple game can be diluted when we consider that the content of e-sports has infinite expandability because it uses electronically mediated content, not just “gaming content” (Park, Lee & Yung, 2019). In other words, if sports content is developed through electronically mediated content, we can consider it e-sports. Additionally, e-sports offers inclusivity and accessibility, allowing individuals from various demographics and physical abilities to participate and compete at high levels. This inclusivity can lead to increased global engagement and community building. Furthermore, e-sports can generate substantial economic benefits, including job creation and revenue generation from events, sponsorships and media rights. The digital platform also allows for innovative interactions and real-time data analytics, enhancing both player performance and viewer experience (Heere, 2018). These factors illustrate that e-sports is not only a legitimate form of competition but also a burgeoning field with considerable opportunities for growth and development (Witkowski, 2012). Second, regarding physical activity, although e-sports involves a limited range of physical activity, it does involve some degree of movement that directly affects the outcome of the game, which can have significant implications for cerebral intellectual activation (Kim *et al.*, 2015). One could argue that auto racing, widely accepted as a sport and its participants as athletes, is similar to e-sports in this way. Finally, e-sports have become a substantial cultural and economic phenomenon, indicative of broader trends in digital innovation and social interaction. This growth is evidenced by a significant increase in global viewership and sponsorship, drawing parallels to traditional sports (Taylor, 2012; Hamari & Sjöblom, 2017).

The recognition of e-sports was further solidified when it was included as a pilot event at the 2018 Jakarta-Palembang Asian Games, and later as an official event in the 2022 Hangzhou Asian Games. Despite these advancements, there remains a scarcity of objective research within sport management that examines e-sports' role within the broader sports world and its potential future impact. This gap underscores the need for more rigorous, scientific research methods to foster the sustainable growth of the global e-sports industry. Such studies could enhance our understanding and acceptance of e-sports, paving the way for its integration into the mainstream sports arena.

History of the global e-sports industry

IeSF defines e-sports as a competitive sport created using IT and communication equipment (e.g., personal computers, broadcasting equipment and networks). Wagner (2006) defines it as an area of sport activities that improve mental and physical abilities using information and communication technology, while Xue *et al.* (2016) define e-sports as a multi-player video game competition played by individuals or teams within an event that is broadcasted, economically motivated and has a wide range of participants.

Network games between people started in the early 1990s, and game competitions in the same format as general sports were established. In particular, in the mid-90s, Doom Series and other first person shooting (FPS) game competitions were held in Las Vegas and Atlanta in the United States as event competitions to encourage gamers' participation at game shows (current E3 Show). In 1997, the ProGame League (PGL), the first professional game competition, was launched based on the proposal of Joe Perez, and the Cyberathlete Professional League (CPL) was launched based on the proposal of Angel Munoz. As the CPL grew into an international e-sports competition, e-sports culture spread across North America. However, it is difficult to say e-sports was commercially successful in North America because video game consoles were traditionally positioned as the main content rather than online games, and there was no ecosystem composed of major stakeholders, such as sponsors, traditional media (i.e., TV), online streaming, game companies and consumers. Thus, Korea took the lead in the development of e-sports, launched an e-sports-only cable channel, and opened an e-sports-only stadium for the first time. In addition, Korean lawmakers passed several e-sports laws to help develop the ecosystem of the industry. Since the launch of IeSF in 2008, the establishment of e-sports associations approved by governments around the world has continued and there are now 130 member countries registered. The 2014 World Championship hosted by IeSF was recognised as one of the first international e-sports competitions. Today, ESPN understands the popularity and impact of e-sports and has a separate e-sports tab like those of traditional sports, such as soccer and baseball, to provide news and analyse data by country (Graham, 2017).

Research in global e-sports

Various academic studies have been conducted on e-sports, including research on the history of e-sports (Schwartz, 2017), research on systems and laws related to e-sports (Hollist, 2016), comparative research between traditional sports fandoms and e-sports fandoms (Brown *et al.*, 2017; Pizzo *et al.*, 2018, e-sports and its role in sport (Park & Kim, 2020), and the influence of e-sports on sport for the disabled (Park, Jung *et al.*, 2019). Academic research has generally sought to determine whether e-sports meets the criteria of existing traditional sports (Jenny *et al.*, 2017).

In the field of sport management, there is growing interest in the governance, marketing, gambling and management of e-sports (Cunningham *et al.*, 2018; Sweeney *et al.*, 2021); Funk *et al.* (2018) discussed the five governance challenges inherent in e-sports, including scholarship opportunities for collegiate e-sports participants, legal and labour issues, diversity and culture of game contexts, and ownership of e-sports. From the sports marketing perspective, Pizzo and colleagues (2018) found participants of traditional sports (e.g., soccer) and e-sports (e.g., FIFA Online 3 and StarCraft II) showed similar patterns for 11 out of 15 spectator motives (interest, vicarious achievement, excitement, interest in player, aesthetics, social opportunities, drama, role model, entertainment value, wholesome environment, family bonding, knowledge, skills, physical attractiveness, aggression), with significant differences only in vicarious achievement, excitement, physical attractiveness and family bonding. They also found various motivators influencing e-sports attendance, such as vicarious achievement, entertainment value, family bonding and athletes' skill. In addition, research on the effect of e-sports activities on the participant's physical and mental well-being was partially attempted (Pizzo *et al.*, 2018)

Although research on e-sports is becoming more active, it is still in its early stage and heavily focused on peripheral topics of e-sports. For example, the major topics of current research on e-sports are similar to traditional research in other sports. This means scholars still approach the topics in e-sports using their current and traditional general sport perspectives. Research into e-sports is burgeoning yet remains nascent, with a pronounced focus on topics that are peripheral to the core of e-sports. Presently, the dominant themes within e-sports research mirror those traditionally explored in other sports studies. This alignment suggests that scholars continue to apply established sports research perspectives to e-sports, potentially overlooking unique aspects specific to the digital realm. Although there are parallels in the evolution of traditional sports, as outlined by Adelman (1986), and e-sports, it is crucial to acknowledge and explore the inherent differences. Understanding these distinctions will enhance our comprehension of the unique developmental trajectory of e-sports and its impact on both participants and spectators. Therefore, because few attempts have been made to objectively analyse the current e-sports industry and holistically provide suggestions for its future development, this study had two primary purposes. First, we sought to objectively explore the current status of e-sports. Second, we sought to identify factors that will impact the future development strategy of e-sports.

METHODS

For this study, the researchers utilised two research designs divided into two parts (Phase 1 and Phase 2). In the first phase, through a scientific and objective method utilising big data sets on the internet, it attempted to establish the overall schema of e-sports and the justification for a second phase. During the second phase, based on the findings from Phase 1, three Delphi surveys and interviews were conducted involving 13 experts in the field of e-sports. By utilising these two research methods, the future development direction of e-sports was identified.

Phase 1

Identification of e-sports-related words

For this study, 328 million web pages on Naver (www.naver.com), one of Asia's largest internet portal sites, were analysed. Over the past 3 years, the authors utilised RCrawler, a web-crawling function of the R program, for this analysis. RCrawler is particularly effective for domain-

based web crawling and content scraping (Khalil & Fakir, 2017). The focus on South Korean domestic portals and blogs on Naver was due to South Korea's status as the world's largest producer of e-sports-related information, with much of this content being redistributed in blog-like articles. The authors extracted 842 web pages containing one or more of five e-sports-related keywords (e.g., 'e-sports', 'esports' – both in Korean and English, and 'e sports') from over 300 million web pages. After identifying the main keywords present in these 842 web pages, they were sorted in descending order by frequency. Subsequently, the 15 most significant words related to e-sports – “sports”, “game”, “star”, “match”, “professional”, “league”, “competition”, “function”, “craft”, “science”, “technology”, “virtual reality”, “augmented reality”, “facility”, and “internet” – were extracted from these documents based on frequency, meaningfulness and implication. Content validity was established with the assistance of seven experts, including professors, practitioners and journalists in the field of e-sports. The authors then reanalysed all the web pages using the same RCrawler, identifying 2167 web pages that contained at least one of the 15 main keywords.

Data analysis

We conducted the association analysis using R. For the analysis, the Apriori algorithm was used; the Apriori algorithm is one of the most widely used data mining algorithms (Hassan *et al.*, 2023; Singh *et al.*, 2018). Three methods, including “support”, “reliability”, and “improvement”, were used for the association analysis. “Support” is the probability of simultaneously performing several specific actions of interest in all cases (N). For example, it is a method used to estimate the percentage of the total when consumers purchase a laptop computer (A) and a game console PS2 (B) together. Therefore, the ratio of cases that correspond to A (laptop purchase) and B (PS2 purchase) out of all N cases is calculated by the formula $(A*B)/N$ (see Hassan *et al.*, 2023). Similarly, “reliability” is the probability that a person who has carried out a particular action will perform a particular action in another area of interest. For example, it estimates the percentage of all consumers who bought a laptop (A) who would also buy a PS2 (B) game console. Therefore, the ratio of cases corresponding to B (PS2 purchase) among cases A (laptop purchase) is obtained by the formula $(A*B)/A$. Finally, “improvement” contrasts the probability of a selective action in a specific situation. For example, the comparison between the probability that a consumer who has not purchased a notebook (A) will purchase PS2 (B) and the probability that a consumer who has purchased a notebook (A) will purchase PS2 (B). Therefore, the comparison between the probability that a consumer who does not fall under A (laptop purchase) will purchase B (purchase PS2) and the probability that a consumer who falls under A (laptop purchase) will purchase B (PS2 purchase) is given by the expression $\{(A*B)/A\}/\{B/(NA)\}$. Therefore, if the “improvement” is 5.0 in this case, and the probability the person who did not purchase the notebook (A) will purchase the PS2 (B) is 10%, then the probability the person who purchased the notebook (A) will purchase the PS2 (B) would be five times higher at 50% (see Hassan *et al.*, 2023).

RESULTS AND DISCUSSION

As previously stated, the 15 main keywords in e-sports extracted using big data analysis were sports, game, star, match, professional, league, competitions, function, craft, science, technology, virtual reality, augmented reality, facility, and internet. The authors first performed a word cloud analysis of all keywords except “e-sports”. A word cloud provides an overview of words based on frequency and uses visualisation methods to make the words clear (Heimerl

et al., 2014). Using the word cloud analysis, we found that words such as sports, games, players, Korea and StarCraft were most commonly mentioned on 2167 web pages.

Results of the association analysis method using R

As stated above, the *a priori* algorithm was used for the association analysis of R. For the association analysis, support, reliability and improvement were obtained. First, using the Apriori algorithm, the authors found 146,366 rules with support and reliability of 0.01 or higher for “e-sports” and 15 keywords appearing on 2167 web pages. The result of sorting these in order of reliability is shown in Table 1.

Table 1. ANALYSIS OF WORDS RELATED TO E-SPORTS SORTED IN ORDER OF RELIABILITY

Common keywords	Main keywords	Support	Confidence	Lift
S+E+F+SC+M+L	e-Sports	0.1305	0.9826	1.5890
S+G+E+F+SC+M+L	e-Sports	0.1305	0.9826	1.5890
S+P+E+F+SC+M+L	e-Sports	0.1301	0.9825	1.5889
S+G+P+E+F+SC+M+L	e-Sports	0.1301	0.9825	1.5889
S+E+SC+M+L	e-Sports	0.1550	0.9824	1.5887
G+S+E+SC+G+L	e-Sports	0.1550	0.9824	1.5887
S+SN+E+SC+M+L	e-Sports	0.1550	0.9824	1.5887
S+G+SN+E+SC+G+L	e-Sports	0.1550	0.9824	1.5887
SN+E+SC+G+L	e-Sports	0.1545	0.9824	1.5887
S+G+SN+E+SC+M+L	e-Sports	0.1545	0.9824	1.5887

E=e-Sports S=Sports G=Game SC=StarCraft M=Match P=Professional L=League SN=Science
F=Facility

The results are interpreted based on the first result, S+C+F+SC+M+L, and are presented in Table 1. LHS means left hand side, and RHS stands for right hand side. Here, RHS stands for e-sports, and LHS is the rule of association between the major keywords found in this analysis. For example, the first result had an approval rating of 13%, which means there is a 13% possibility of existing together with the word “e-sports” (E) if keywords such as “sports” (S), “competition” (C), “facility” (F), “StarCraft” (SC), “match” (M) and “league” (L) are shown on the web pages. In a similar manner, a reliability of 98.26% means if words such as “sports”, “competition”, “facility”, “StarCraft”, “match” and “league” are included on the web pages together, the probability of finding the word “e-sports” is 98.26%. Likewise, a degree of improvement of 1.589 means if the words “sports”, “competition”, “facility”, “StarCraft”, “match” and “league” are included together on the web pages, the probability of having the word “e-sports” is 1.589 times higher than otherwise.

To summarise the results of big data analysis, the words that frequently appear with “e-sports” were “sports”, “game”, “star”, “match”, “professional”, “league”, “competition”, “function”, “craft”, “science”, “technology”, “virtual reality”, “augmented reality”, “facility” and “internet”. Therefore, even though e-sports is recognised as a game, it is clearly classified by many as a sport because it has the highest correlation with sports.

Phase 2

Participants

After conducting a big data analysis, a Delphi survey was carried out three times over four weeks to develop a specific plan for e-sports. Thirteen experts participated, including two academics (one in sport management and one in e-sports), three e-sports administrators, two journalists, three field managers and three retired athletes. Following these surveys, an analytic hierarchy process (AHP) was used to refine the results further.

Procedures

The researchers in this phase compressed 15 keywords derived through big data analysis from the first phase into 10 keywords that were judged to be closely related to this study, while reducing the potential for duplication. The 10 keywords were “sports”, “games”, “professional athletes and teams”, “leagues and competitions”, “StarCraft”, “internet”, “science”, “facilities”, “virtual reality” (VR), and “augmented reality” (AR). The first Delphi survey was conducted based on these 10 keywords. In the first survey, a brief explanation of each keyword was presented, followed by two or three questions for each keyword. For example, images and feelings that come to mind (i.e., top of the mind) when thinking of keywords were selected as common items, and afterwards, in-depth opinions of the study participants on related keywords were collected through free expression of opinions. Subsequently, the researchers summarised the answers of each respondent and used this as the basis for the next survey.

For the Delphi survey, the authors contacted the experts with an invitation email and sent the actual questionnaire after their acceptance. The questionnaire contained various sections, including introduction, purpose, context of the study, explanation of the current status of e-sports in Korea, commitment required from participants in terms of time and feedback, and the expectation of researchers about the Delphi results. After receiving the first responses from the participants, the researchers examined and narrowed down the responses and developed the categories and subcategories in the development plan for e-sports.

Results

For the second Delphi survey, the authors developed and added two more keywords, “intellectual property” (IP) and “culture”, strictly based on the participants’ responses. All of the participants argued that e-sports is more than “gaming” and is becoming a culture. In addition, IP is one of the key elements of e-sports because e-sports require an IP (or game title) for any competition, and this is different from other sports (Park, Lee & Yung, 2019; Park, Jung *et al.*, 2019). Then, four major categories, 12 subcategories, and 40 detailed questions were developed by the researchers for the second Delphi survey, based on the first Delphi survey. There were two subcategories (rules and regulations, organisation) for “Sportification”, four subcategories (team; event and league; facility; internet and network) for “Infrastructure”, three subcategories (game, culture, IP) for “Contents”, and three subcategories (science applied to e-sports, VR, AR) for “Scientification”. For the second Delphi survey, the study participants read the development plans and answered “yes” if they were appropriate and “no” if they were not appropriate. They were asked to make instantaneous judgement rather than thinking deeply about the given development plan, to maintain their attention. Afterwards, the researchers of this study took note of the frequencies of “yes” and “no” of each participant by item and re-

arranged the primary importance in order of frequency. Among the three to four items, the items ranked first in each subcategory with the most “yes” responses were identified.

In the third Delphi survey, the AHP was utilised based on the concepts of the four major categories and 12 subcategories derived from the first and second surveys. The function of AHP in this study was to perform a pairwise comparison for each item. For example, it derives relative importance through pairwise comparisons of 1 to 2, 1 to 3, 1 to 4, 2 to 3, 2 to 4, and 3 to 4 from the four main categories. In this study, AHP analysis was used for the pairwise comparisons of the four major categories and 12 subcategories, respectively. We examined the relative importance to identify the priority among each major and subcategory by comparing each item on a nine-point scale. The results of the AHP are shown in Table 2. The relative importance of the four major categories is shown in Priority Weight A, and the relative importance of the 12 subcategories is shown in Priority Weight B. Therefore, the value multiplied by Priority Weight A and Priority Weight B provided the overall relative importance of the total 12 items

Table 2. RESULTS OF THE ANALYTIC HIERARCHY PROCESS ANALYSIS

Category	Priority Weight A	Subcategory	Priority Weight B	Overall priority (A*B)	Order by rank
Sportification	0.24	Rules and regulations	0.58	0.14	#1. IP
		Organisations	0.42	0.1	#2. Rules and regulations
Infrastructure	0.31	Athletes/team/HR	0.4	0.12	#3 Culture
		Event & league	0.28	0.09	#4 Athletes/team/HR
		Facility	0.23	0.07	#5 Organisations
		Internet/network	0.08	0.02	#6 Event & league
Contents	0.38	Game	0.2	0.08	#7 Games
		Culture	0.35	0.13	#8 Facility
		IP	0.45	0.17	#9 Science applied e-sports
Scientification	0.06	Science applied e-sports	0.45	0.03	#10 Internet/network
		VR	0.26	0.02	#11 VR
		AR	0.28	0.02	#11 AR
[Total]	1	–		1	
[Max Eigenvalue]	4.37	[Consistency index]	[Consistency ratio]		
		0.12	0.14		

HR=Human resources IP=Intellectual property VR=Virtual reality AR=Augmented reality

Confusion may occur as research participants conduct continuous comparisons. Therefore, in AHP analysis, the consistency of respondents is important. The consistency index (CI) and consistency ratio (CR) are critical when interpreting the research results. The closer the CI is to 0, the better the consistency. CR is also used to complement the consistency index, which is a value obtained by dividing the CI by a random index, and the smaller the CR value, the better the consistency. Saaty (2008) argued that $CR < 0.2$ is a satisfactory value in general and is also tolerable in the field of social science (Kulakowski, 2020). If the value of CR is 0.2, it means there is a 20% possibility the respondents answered the questions in a random manner (Kulakowski, 2020). Therefore, the CI (0.12) and CR (0.14) values in this study indicate consistency within this study. As a result of the AHP analysis, the most important factor for the development of e-sports was the resolution of IP disputes between stakeholders, followed by standardised rules and systems, culturalisation, team and athletes, organisation, events/leagues, games, facilities, science, internet and network, VR, and AR. As for the major category, Contents (0.38) is most important, followed by Infrastructure (0.31), Sportification (0.24), and Scientification (0.06).

DISCUSSION

This study is the first to identify factors in the development of e-sports based on big data analysis, Delphi surveys and AHP analysis. As mentioned earlier, two different studies were designed to accomplish this purpose. First, research was conducted utilising big data analysis and 15 main keywords were derived. Second, three Delphi surveys and AHP analysis were conducted. Through these, four major (Sportification, Infrastructure, Contents, Scientification) and 12 subcategories (IP, Rules and regulations, Culture, Athletes/team/HR, Organisations, Event & league, Games, Facility, Science applied e-sports, Internet/network, VR, AR) were identified. The description and the practical implications of the categories are shown and discussed below.

IP problem and solution

IP was considered the most important issue in the e-sports industry (overall priority = 0.17 out of 2). In particular, holders of game IPs recognise e-sports can have various positive impacts on their business. It also provides them with opportunities to work with the government and related organisations to maximise tangible and intangible benefits. Thus, when it comes to IP issues in e-sports, IP holders need to be more flexible because there have been many e-sports events that were not organised by IP holders but by KeSPA and even the Korean government. As previously discussed, the formation of e-sports was not driven by IP holders. Most of the e-sports events that consumers voluntarily created and participated in became the root of the development of e-sports, and later IP holders belatedly participated, which enabled them to obtain many benefits without much effort (Billings & Hou, 2019). Therefore, it is necessary to approach it from a more macro perspective. For example, it is possible to develop a self-sustaining business model with IP holders and other stakeholders (e.g., the government or business investors) working together. Multiple goals can be pursued simultaneously by providing consumers and markets with as many opportunities to participate in e-sports as possible. As IP holders are increasingly hosting e-sports events, the selective needs of IP holders, broadcasters and the national government should be considered. This is especially important regarding the hosting of mega sports events such as the Olympics. No other types of sport pay for IP usage just because the sport became an official Olympic sport, but if the game

company, (e.g., IP holder) seeks to maximise profitability through their IPs, can e-sports become an official sport of a mega sports event such as the Olympics? This does not seem easy. First, it would likely cause a controversy to make e-sports a formal event in a mega sports event such as the Olympics, since the IP of a game company is an area of private interest. In the case of the 2018 Asian Games in Jakarta, game companies allowed their IPs to be used for public events, but it is unclear whether they will continue to do so. Second, will organisations such as the International Olympic Committee (IOC) pay game companies for IP usage to make e-sports a formal Olympic sport? If e-sports become an official event of the Olympics, event holders, game companies and broadcasters could eventually work together to create new sports IP for the Olympic Games. The IOC is very interested in e-sports, to overcome the declining interest of young people in the Olympics and the smaller audience for Olympic broadcasts, which is the biggest source of revenue for the IOC, so the IOC would like to have their own exclusive IPs. The independent development of IP-driven competition by game companies is likely to negatively impact the IP development of currently popular game companies. However, the systematic planning and organisation of worldwide e-sports competitions could serve as a viable strategy to achieve a balance between the interests of IP holders and consumers.

Standardised rules and systems

Creating standardised rules and systems is ranked second for developing e-sports (overall priority=0.14 out of 1) (Table 2). Although IP is an area where e-sports face different challenges in its development when compared with traditional sport, the development of standardised rules is consistent with research on the development of traditional sports. Adelman (1986) identified six factors (urbanisation, industrialisation, technological advances, media coverage, social changes, institutional development) that were critical to the evolution of premodern to modern sport, and the development of consistent rules and regulations was one of those factors. A significant challenge in e-sports is the absence of uniform rules and regulations. Each game may have distinct rules, which can vary greatly from one tournament to another, confusing players and fans alike and complicating the integration of e-sports into mainstream sports events such as the Olympics. The creation of standardised rules through a transnational consultative body could help resolve these discrepancies. For example, there must be formalised and unified rules and systems for competition, athlete training and contracts, referee training, team management, facility management, sponsor management, broadcast (right) management, lighting and camera angles, and stage management. In particular, this can be considered from the perspective of various stakeholders, including the main governing body and team delivering the competition, the players participating in the competition, the direct consumers consuming the competition through the facility, and the indirect consumers consuming the competition through the media. Game companies and publishers now create competition rules for each game because they are trying to create, govern and operate their own e-sports events. To create a balanced e-sports ecosystem, universal rules and systems are necessary. For example, unfair contracts between teams and e-sports players and coaches were discovered and became an issue in Korea (Wolf & Kang, 2019) and demonstrate the need for clear and consistent rules.

Establishing and expanding unified rules and systems in almost all areas related to e-sports will be closely related to the satisfaction of fans consuming e-sports in the short term. In the mid-to long term, it will advance the quality of e-sports events, improve the players' careers and

consumer responses, and increase the profits of sponsors and broadcasting companies. Standardisation could be applied to almost all e-sports areas because it is still in the early stage of development and requires systematic development. In addition, drawing up globally accepted standardised rules, regulations and event protocols will enable e-sports to evolve from a passive tool of game developers (IP holders) for their new source of revenue generation to a future sport and pro-consumer industry.

Culturalisation of e-sports

Developing an e-sports culture is ranked third in the current study (overall priority=0.13 out of 1; Table 2). The biggest barrier to the culturalisation of e-sports is negative views and perceptions of e-sports. In particular, in Korea, games – which form the basis of e-sports – are often perceived as having a negative influence, especially on young people. This parallels the historical scepticism toward comics, which were not initially accepted as culture but have since evolved into significant cultural IPs, such as Webtoons (internet-based cartoon services) and cartoon-based films (Park, Seo & Ko, 2019). To properly communicate the correct definition of e-sports to the digital native generation who already accept it as culture, various strategies must be employed. Education plays a crucial role in this regard, helping to shift the perception of e-sports from a distraction to a legitimate cultural and social activity. Recognising that sports and games can foster students' social skills and serve as a platform for educational communication is vital. This perspective can unite people worldwide, contrary to the belief that games interfere with learning and education (Park, Seo & Ko, 2019). E-sports offer several positive effects that can be further developed, including the enhancement of cognitive skills such as problem solving, strategic thinking, and quick decision making (Griffiths, 2018). Participation in e-sports also fosters social skills, teamwork, communication, and leadership abilities (Taylor, 2012). Engaging in e-sports helps participants develop a strong familiarity with technology, which is valuable in the digital age (Seo, 2013). Furthermore, e-sports can be more inclusive and accessible than traditional sports, allowing people of all physical abilities to compete on an equal footing (Hamari & Sjöblom, 2017). The growing e-sports industry creates numerous job opportunities, from professional gamers to event organisers, coaches and content creators (Jenny *et al.*, 2017). e-Sports also brings together players from around the world, promoting cultural exchange and global connectivity (Scholz, 2019). To maximise these positive effects, it is necessary to establish structured training programmes, incorporate e-sports into educational curricula, conduct in-depth research on the benefits of e-sports, support local e-sports communities, promote a balanced approach to gaming that includes physical activity and mental health support, and develop industry standards and best practices. Active research supporting the development of the cultural values of e-sports is also essential, including analysing the economic effects of e-sports and consumer usage behaviours. The findings from such research can lay the groundwork for future studies and help in the cultural integration of e-sports (Witkowski, 2012). Moreover, it is important to address the current trends in e-sports, which are heavily focused on certain game titles reflecting the IP holders' interests. By broadening the focus and improving these trends, the e-sports and game industries can be recognised as specialised industrial areas with significant development potential (Taylor, 2012). The development of a sporting culture, whether in traditional sports or e-sports, involves several key factors. Changing negative perceptions is crucial, requiring a highlight of the positive aspects of e-sports, such as teamwork, strategy and skill development (Griffiths, 2018). Positive media coverage and representation play a significant role in shaping public opinion.

Just as comics evolved into accepted cultural phenomena through various media, e-sports can gain legitimacy through broader and more positive media representation (Seo, 2013). Incorporating e-sports into educational systems can help validate it as a constructive activity, fostering both cognitive and social skills in students (Jenny *et al.*, 2017). Encouraging grassroots participation and building local e-sports communities can foster a more inclusive and widespread e-sports culture (Scholz, 2019). Conducting research on the benefits of e-sports, including its economic impact and social benefits, can provide evidence to support its cultural acceptance (Hamari & Sjöblom, 2017). Recognition and support from established sports institutions and governing bodies can further legitimise e-sports as a respected cultural and sporting activity (Witkowski, 2012). By addressing these factors, e-sports can continue to grow and be recognised as a significant cultural and sporting phenomenon.

e-Sports players, teams, and human resources

Taking care of human resources (e.g., players) within e-sports is ranked fourth in the development of e-sports in this study (overall priority=0.12 out of 1)(Table 2). In the e-sports industry, players and teams are among the most important stakeholders (Scholz, 2019). In particular, many e-sports experts and officials argue that guaranteeing e-sports players' rights and enhancing the treatment of players are critical issues in the e-sports industry. For example, given the relatively short careers of e-sports players compared with those in traditional sports, career planning for after retirement is required. Moreover, it is crucial to address the transition of players across different competitive levels. This aspect requires comprehensive planning by governing bodies and coaches to ensure it is effectively incorporated into player support programmes. In addition, there are many amateur players who want to become professional e-sports players. This means there is a very large supply of players, so teams sometimes regard them as disposable products to sell to the audience and discard them when this is done. This results in unfair contracts between teams and players and a lack of appropriate management behaviour towards players. For e-sports players to become experts in the industry, not just gamers, it is necessary to establish a systematic environment in which educational and vocational training opportunities are provided. Most e-sports players begin their professional career in their late teens or early 20s, thereby missing out on many good educational or vocational opportunities (Scholz, 2019). As a result, there is a pressing need for tailored programmes that integrate career development with competitive gaming, ensuring players have access to continuous learning and skill development that can benefit them both during and after their e-sports careers.

Sustained player production with fair treatment would be possible when a robust amateur-professional e-sports ecosystem is established. In particular, an e-sports association or other similar governing bodies can make a "PC room" or similar facility in their country, a hub that grants official certification and systematically fosters and educates amateur athletes on a regional basis. Teams would be able to invest this system or host amateur events in the certified PC room, to facilitate the grassroots development of the e-sports industry. Owing to the nature of e-sports, whose life cycle is critically short with a single e-sports game rarely lasting more than 10 years, it is challenging to create the appropriate ecosystem in the e-sports industry. Consequently, it is important to create a sustainable ecosystem in which various stakeholders and players can work together to lay a strong foundation for the development of e-sports.

Sports organisation for e-sports

The organisation of e-sports is ranked fifth for importance in this study (overall priority=0.10 out of 1; Table 2). This is another area in which the development of e-sports is similar to the development of other sports. Organisation was also identified as a key factor in the development of modern sports by Adelman (1986). Currently, some associations and organisations related to e-sports are working hard to promote e-sports by country and region, but the reality is that no clear results have been achieved. In the e-sports industry, a game developer is the original producer of the event and an IP holder. Accordingly, e-sports associations, organisations, and governing bodies would be greatly affected by whether game developers exist, the decision to suspend service, the changing environment of game services, and the popularity of games.

To reduce this uncertainty, it is crucial to define the rights and relationships between developers, broadcasters, associations and other stakeholders, to foster and strengthen cooperation. As previously noted, there is a pressing need to establish unified rules, policies, norms and standards in the e-sports market. This can be achieved by forming a transnational e-sports consultative governing body that includes various e-sports associations, global game developers, and sports-based organisations such as national Olympic committees in each country and the Global Association of International Sports Federations (GAISF), which governs nearly all international sports federations (IFs). This body aims to integrate e-sports into major sports events such as the Olympics. For instance, the IeSF is actively working to have e-sports recognised as an official sport in some major sporting events. Including e-sports in such prestigious events would not only enhance its perception but also position it as a specialised sports field, transcending its current image as merely video gaming. However, the IeSF has not yet achieved recognition as the sole IF by the IOC. Consequently, adopting a stakeholder-driven approach to establish a governing body in e-sports could cultivate a thriving environment and facilitate the industry's ongoing development (Scholz, 2019).

From an organisational standpoint, the development of e-sports involves several critical factors akin to those in traditional sports. E-sports necessitates structured governing bodies to standardise rules, oversee competitions and ensure fair play. The formation of entities such as IeSF exemplifies efforts to provide such governance structures. However, unlike established sports federations recognised globally by bodies such as the IOC, e-sports organisations often lack equivalent authority, resulting in a fragmented organisational landscape.

As e-sports continues to expand, there is an increasing need for comprehensive legal and commercial frameworks to address player contracts, sponsorship agreements and broadcasting rights. This also involves clarifying IP rights, which is pivotal due to the central role of game developers in the e-sports industry. As addressed, the push to include e-sports in mega sporting events such as the Olympics underscores the necessity for e-sports organisations to align with sports governance standards and strive for broader acceptance and recognition. This involves shifting the perception of e-sports from merely “video games” to a legitimate competitive sport.

Regional e-sports associations and bodies also play significant roles in promoting e-sports locally and globally. However, the effectiveness of these organisations varies, and clear results in promoting e-sports have often been hard to achieve. Strengthening these bodies through

enhanced funding, clear mandates and international cooperation could significantly improve their impact.

Events and professional league

The league and games were ranked sixth in terms of the most important factors for the development of e-sports (overall priority=0.09 out of 1; Table 2). Major e-sports leagues and events already have the prize money and numbers of spectators and viewers to compete favourably with traditional sports. However, only e-sports fans or game users with background knowledge of e-sports enjoy the league and events.

Continuous commercialisation of e-sports can be achieved by expanding its fan base. To achieve this, a variety of content and marketing plans that focus on attracting those unfamiliar with e-sports should be developed. In addition, the division of e-sports leagues and events is currently based on the country and event, but there is no clear difference between upper and lower divisions because of ambiguous standards based on the region and country. It is also possible to consider ways to increase the value of the upper league by organising multiple divisions within the league and clarifying the criteria between divisions, just like the traditional promotion system in many professional soccer leagues. Once again, role differentiation, which included providing different levels of competition based on skill level, was a critical factor that Adelman (1986) identified in the development of modern sports, such as baseball.

To develop a competitive and self-sustainable e-sports league, various marketing and branding activities at the player and team level, as well as the association level, must continue. The league needs not only to host and operate the e-sports events, but also must take full advantage of the brands of players and teams, which are the assets of the league. Therefore, it is essential to host competition-based professional events, new and recurrent e-sports events for amateur players, and technology and R&D exhibitions applicable to e-sports, to maximise the quality of consumers' direct (i.e., direct participation) and indirect (i.e., media consumption) experiences. These may help change the perception of e-sports from gaming activities to accepted sports. In addition, the professional e-sports league is now evolving into a franchise-based league in North America and South Korea (Scholz, 2019). However, this trend naturally requires and increases the need for a strong level of regulation and facilitation for the upper elite level driven by the game developer, which would reduce the grassroots operations at the amateur level.

Games

Games were ranked seventh among the most important factors for developing e-sports (overall priority=0.08 out of 1; Table 2); e-sports and game titles cannot be considered separately. In South Korea, there is a negative perception of electronic game activities owing to gambling and addiction elements, and this perception naturally spreads to e-sports. For example, in October 2002, a 24-year-old unemployed man died in a PC room while playing games for 86 consecutive hours. This is the world's first known fatality related to video gaming. In addition, a 28-year-old man in Daegu, South Korea suffered a heart attack and died in his seat after 50 hours of StarCraft games (Kim, 2019). The former government of South Korea regarded gambling, alcohol, drugs and video games as the four social evils (Choi, 2013), and this has adversely affected the development of e-sports in Korea because e-sports includes both video

games and illegal gambling.

As stated earlier, South Korea was the only country with legal regulations specifically for developing the e-sports industry. However, it only supports the promotion of games and e-sports from the perspective of game suppliers. From the perspective of consumers and users, there is a need for a policy to support e-sports with the concept of lifetime sports for a healthy and continuous game culture. Similarly, the prevention and treatment of the damage (i.e., game addiction) caused by immersive game activities should be continuously studied. Rather than utilising a punitive system, such as a system based on the “Shutdown law” under the Game Industry Promotion Act, which prohibited children under the age of 16 from playing computer games from midnight to 6 am (Yoon, 2017), positive intervention programmes that can reduce the negative effects of the games should be developed. For example, in the US, a nonprofit organisation called the International Center for Responsible Gaming (ICRG) supports various research grants and conferences, while actively conducting basic research to raise awareness of gambling and game addiction (ICRG, 2020). As previously discussed, negative perceptions about games are closely related to over-immersion and addiction to gaming. As professional players and game companies dominate e-sports, the majority of the public may think e-sports is just an extension of gaming activities that have a negative impact. This could adversely affect the expansion of e-sports. For the continuous expansion of e-sports, as previously mentioned regarding IP, it is necessary to actively utilise sports content. StarCraft-initiated e-sports needs to keep borrowing sports content (i.e., soccer and basketball) beyond simple game content. In the future, sports on the field will become a spectator sport and a major content for online-networked e-sports, simultaneously. When this happens, it would be possible to put the word “sports” on “e-sports” without hesitation.

Facility

The facility for e-sports needs to be understood as the network-based expansion of space (Park & Kim, 2020). In general, the e-sports facility reminds us of sport stadiums where e-sports are performed, such as an indoor arena. Still, considering that e-sports began with direct participation by fans rather than supplier-oriented systematic development, the stereotype of existing stadiums needs to be changed for e-sports. Through the development of the internet network, e-sports, enjoyed at home initially, were later played in a place where collective networking was possible (i.e., PC rooms). Also, e-sports could be enjoyed anytime and anywhere through 5G (fifth generation technology standard)-mediated networking in the future. The 5G-based high-speed internet and the internet of things (IoT) can make daily life more convenient, safe and efficient, enabling various ways of communicating through the coexistence of humans and technology (Osseiran *et al.*, 2014). Thus, advances in technology change the properties of the e-sports facility. For example, from the perspective of expanding the space of e-sports facilities, e-sports was first enjoyed at home, in PC rooms, and in large stadiums, but e-sports is now taking place in e-sports-only facilities, which inevitably requires a combination of layers of nonphysical data in physical facilities (i.e., AR). In other words, for future e-sports, which require physical activities away from past passive game participation, the e-sports stadium needs to be a space that is expanded based on human senses (Park, Seo & Ko, 2019). This space with expanded human senses primarily means expansion of the stadium, but it also means expansion of e-sports consumers; socially disadvantaged people, such as people with disabilities, would also enjoy e-sports without difficulty. This can be achieved

through e-sports' medium and networking capabilities. e-Sports helps expand the body and mind, which was restricted through a strong network orientation. In other words, the limited physical activity in e-sports has been recognised as a limitation in the past, but the expansion of space projected by technology can demonstrate that e-sports is fairer than any other sport and is an alternative to traditional sports, as it allows men and women of all ages and disabled/nondisabled people to compete without physical constraints (Park, Lee & Yung, 2019; Park & Kim, 2020). Thus, the e-sports stadium, where such technology is projected, could go beyond just game playing areas; they could further enhance the identity of e-sports as a new media sport. The genealogical new media characteristics of e-sports ultimately lead participants to experience body expansion, knowledge expansion, social expansion, humanity and the all-encompassing "human expansion" (see McLuhan, 2012; Bolter & Grusin, 1996).

e-Sports with science, virtual reality and augmented reality

VR and AR were ranked joint 11th, and these two keywords are discussed here in association with e-sports with science (10th) because of their similar characteristics. e-Sports with science was also identified as an important element for developing e-sports in this study (overall priority=0.06 out of 1; Table 2). To further develop e-sports, continuing attempts to integrate advanced science, such as artificial intelligence (AI), into e-sports are essential. In particular, consumers' media usage and consumption behaviour are changed by the development of science and technology. Given the inherent characteristics of the e-sports created and developed based on online media, technology sensitivity is important (Park, Seo & Ko, 2019). With the development of new game platforms represented by AR and VR, specifically, game developers and practitioners in the e-sports industry need to admit that the areas of e-sports where science and technology could be applied are not only the equipment domain, such as mouse and keyboard. For example, an online e-sports platform based on the newest technologies such as VR and AR could be a platform for extended sport activities, although it requires limited physical activities in terms of body movement. Participating in a science-based platform helps people maximise their experience, stimulate brain development (i.e., Kim *et al.*, 2015) and reduce daily life stress. In addition, electronically and scientifically mediated e-sports contents, such as scientific learning programmes and athlete training programmes, would play important roles in developing the e-sports industry (Park, Seo & Ko, 2019).

This study identified VR as the 10th most important item (overall priority=0.02; Table 2). VR technology in e-sports is likely to be a key technology in eliminating the low physical activity that has been a limitation of e-sports. The combination of e-sports and traditional sports can also be developed through VR to create e-sports as a new genre and culture. Therefore, it is believed the introduction of VR technology will enable other innovations from existing e-sports to the scientification of e-sports, diversification of gaming platforms, or grafting with physical activities. In addition, it is possible to consider converting e-sports with traditional sports events actively. Developing training programmes such as baseball batting practice, basketball free throws and football quarterback training in networked e-sports games may develop into a new genre of e-sports that can combine traditional sports with existing e-sports. Again, applying these new technologies extends the limited body movements in e-sports into more sports-like activities. In addition, re-creating real sporting competitions (e.g., NBA or NFL finals) through VR in e-sports games and allowing a game user to directly experience the game or even control a particular player at a critical moment of the game would create a completely different

outcome and bring new excitement to traditional sports.

AR was identified as the 11th most important agenda item (overall priority=0.02); Table 2), the same as VR in terms of its overall priority. Games and e-sports using AR are already widely commercialised (e.g., Pokémon GO). There is no doubt AR will provide new experiences in the e-sports environment. It is expected that an environment containing a virtual stadium or virtual sport context can be presented directly to spectators using AR technology or device. Given that the Korean government specifically supports the e-sports and game industries, and special laws have been developed specifically for e-sports, it is necessary to establish policies to continuously develop e-sports using advanced technologies such as AR and VR and generate start-up funding for the industry. This can create an ecosystem that would develop e-sports from game-based activities to the future e-sport industry. As AR/VR is a field where innovators continue to serve as market leaders, a climate in which domestic game developers and e-sports practitioners can boldly challenge new technologies needs to be created. It is absolutely necessary to expand support for developers to boldly challenge the high-risk and high-return game industry.

Internet and network

Internet and network were also identified as the 10th most important agenda (overall priority=0.02; Table 2). The internet and networks can be viewed from two perspectives. First, as society enters the era of high-speed internet and the IoT, it inevitably helps to expand human senses through various technologies based on internet convergence. In this case, the core content of e-sports can escape from just game content and be enlarged into “extended e-sports” or various experiences in our everyday life. This change will be possible due to the networkability and scalability of e-sports based on the high-speed 5G internet. As mentioned earlier, the 5G-based high-speed internet will enable the coexistence of humans and technology, thereby allowing various ways of communication and making daily life more convenient, safe and efficient (Osseiran *et al.*, 2014; Park, Seo & Ko, 2019). Therefore, e-sports can also be greatly affected by these changes.

The second perspective comes from the network service related to the environment of e-sports. The network environment in which e-sports takes place plays an important role in overcoming time and space constraints and creating convenience that allows anyone to participate. From the perspective of creating a sustainable ecosystem for e-sports, it is necessary to develop a systematic online-based network of agreed policies on antidoping, standardisation of various rules, ranking system, and protection of e-sports athletes’ rights related to the prevention of cheats, hacks and cyber-attacks. Within the network, amateur users could enjoy e-sports safely, and professional athletes could play reliably, such that their rankings and points would be updated and compared in real-time domestically and globally.

CONCLUSION

Although this study is one of the first attempts to conduct a scientific and systematic analysis of the e-sports industry, it has limitations because it focused on experts, former athletes and industry practitioners. This study did not reflect the full characteristics of e-sports, which allows fair participation by both men and women of all ages and even people with disabilities. Therefore, there should be concrete efforts to conduct in-depth projects on the actual progress

of e-sports competition, organisational structure, coach–athlete relationships, promotion and cooperation, and scientific research on e-sports. This study can be a starting point for this development. In addition, it is necessary to conduct follow-up research so the abstract e-sports concept can develop into a subject of practical research by focusing on the current status of the e-sports context and the actual preferences towards specific game content. The biggest barrier limiting the activation of e-sports is the negative perceptions towards it (Cunningham *et al.*, 2018). In particular, it is not easy to receive social support from parents, schools and various organisations, owing to the negative perceptions of e-sports, even though this situation has changed to some extent because of the recent increase in the popularity of e-sports. Therefore, it is necessary to develop an educational programme to properly convey the valuable meanings and benefits of e-sports. In other words, it is important to show that e-sports and games do not always interfere with learning or cause harmful effects such as game addiction. However, e-sports can also be used as communication tools and educational opportunities that foster social skills and communication. It is necessary to continuously investigate ways to prevent problems caused by game addiction and prevent them in advance.

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Conflict of Interest

The authors report no conflict of interest

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