International Journal of Informatics, Information System and Computer Engineering

A Computational Bibliometric Analysis of Esport Management using VOSviewer

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ABSTRACTS

The project aims to combine visualization study with VOSviewer and Publish or Perish software to conduct a computerized bibliometric analysis of the phrase "Esports Management." The method used descriptive-quantitative approach in conjunction with bibliometric analysis. The data was obtained from the Google Scholar search results for "Esports Management." There were 999 articles published between 2017 and 2021, with an increase each year except for 2021 to 2022. This may be demonstrated in 2017 with 58 articles, in 2018 with 92 pieces, in 2019 with 160 articles, in 2020 with 242 articles, and in 2021 with a huge rise to 335 articles. In 2022, however, the number of articles had significantly decreased to 64. Based on further findings of this research, it can be concluded that there are several understudied sectors in Esports Management that may be examined further to increase the efficacy of Management in Esports. It is anticipated that this research will also serve as an example for further studies in defining and evaluating the research subject, as well as for the Esports participants' management team.

ARTICLE INFO

Article History:
Submitted/Received 25 Dec 2022
First Revised 27 Jan 2023
Accepted 01 Apr 2023
First Available Online 12 Apr 2023
Publication Date 01 Jun 2023

Keywords:
Bibliometrics,
Esports Management,
Data Analysis,
VOSviewer.

1. INTRODUCTION

ESports is one of the first industries to confront the challenge of transitioning from global to local and online to offline as a whole ecosystem (Scholz, 2019; Taylor, 2012; Scholz, 2020). Even though there are still disputes about the nature of esport as a "sport" (Franke, 2015; Hutchins, 2008; Jenny et al., 2017; Jonasson & Thiborg, 2010; Witkowski,

DOI: https://doi.org/10.34010/injiiscom.v4i1.9570
p-ISSN 2810-0670 e-ISSN 2775-5584

2010), the stronger opinion stated that it does can be considered as a sport based on factors such as the presence of enemy, rules and ethics, strategy, as well as winning and defeat (Kenzhekanova, 2015). Due to the fact that esports is a relatively new industry, it is still evolving as there has been several ground-breaking changes in the recent decades on this industry. Since the financial model of the esports industry is unstable, esports organizations prioritize risk management related to future developments such as new markets, franchising, new titles, and the extant fragmentation of the esports industry (Kenzhekanova, 2015). This makes it important to properly govern Esports as a growing industry (Scholz, 2019). However, the research concerning esports is in a fragmented state as there are multiple understudied fields, making it quite hard to research the topic in a thorough manner. Conducting a bibliometric study of esports, particularly on the subject of esports management, is one technique to discover such understudied subjects.

Numerous studies on bibliometric analysis in different domains have been conducted. For instance, digital learning (Husaeni & Nandiyanto, 2022), computer science (Husaeni & Nandiyanto, 2023), vocational school (Husaeni & Nandiyanto, 2023), high school (Husaeni & Nandiyanto, 2023), Covid-19 (Hamidah et al., 2020), scientific publications (Husaeni et al., 2022; Soegoto et al., 2022). Additionally, there have been studies on esports, such as those by Sousa et al. that addressed the physiological and cognitive functions in competitive esports matches (Sousa et al., 2020). Chiu et al. undertook a bibliometric study of esports generally as part of their research on bibliometric analysis of esports (Chiu et al., 2021). Yamanaka et al., BÜYÜKBAYKAL and Burak, Arwendria, and Kurnia all did separate studies on the same subject as Chiu et al. (Yamanaka et al., 2021; Büyükbaykal & Burak, 2020; Arwendria, 2021; Kurnia, 2021). However, no bibliometric examination of esports management has been conducted.

Based on the issue, this research aims to conduct a bibliometric analysis research regarding esports management. Qualitative-descriptive approach was used with literature review as the data collection method. To analyse the data, VOSviewer was used to illustrate the connection between the terms as well as to discover the term and publication trend between the year 2017 to 2022.

2. METHOD

This study employed quantitative, descriptive, and bibliometric techniques. For this study, we compiled information from a number of Google Scholar-listed, previously published journals. This is because Google Scholar is one of the sources of easily accessible journals. Using the program publish or perish, we also conducted a literature review on "Esports Management". It was decided to use Publish or Perish to extract bibliometric data from study subjects (Jenny et al., 2017). Moreover, once the data has been saved from the Publish or Perish utility as a *Ris. file, it can be viewed with the VOSviewer application. This research uses VOSviewer 1.6.17 and Publish or Perish 8 as its data collection program.

In this research, we combed through data and utilized pertinent data to support our claims on esports management. In

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p-ISSN 2810-0670 e-ISSN 2775-5584

alignment with the title, keyword, and abstract requirements of the Publish or Perish program, we retrieve data from Google Scholar using the term "Esports Management" 999 data on the study of esports management were acquired. The research papers that were considered were published between 2017 and 2022.

The compiled articles are then saved in *.ris format. After that, we create visualizations with the help of the VOSviewer program and utilize bibliometric maps to assess trends. From the prepared database source, we map the article data.

Three categories of mapping information are used by the VOSviewer software: network visualization, visualization overlay, and visualization density. Additionally, we apply filters to the phrases shown in the mapping representation of VOSviewer. (Jonasson & Thiborg, 2010).

3. RESULTS AND DISCUSSION

3.1. Research developments in the field of Esports Management

Esports management research into the changing climate, explains how research on the topic of managing esports has evolved between 2017 and 2022 in Fig. 1. Research on Esports Management increases every year, starting from 2017 to 2022 except in 2022. This can be proven in 2017 with the number of articles 58, in 2018 increased to 92 articles, in 2019 increased back to 160 articles, in 2020 increased to 242 articles, pada in 2021 experienced a significant increase to 335 articles, and by 2022 research on Esports Management decreased drastically, the number of publications to 64. We find 999 publications that match the study subject in the Publish or Perish software's search results. We selected 20 papers from 20 different journals and books with the most citations from this data (Table 1).

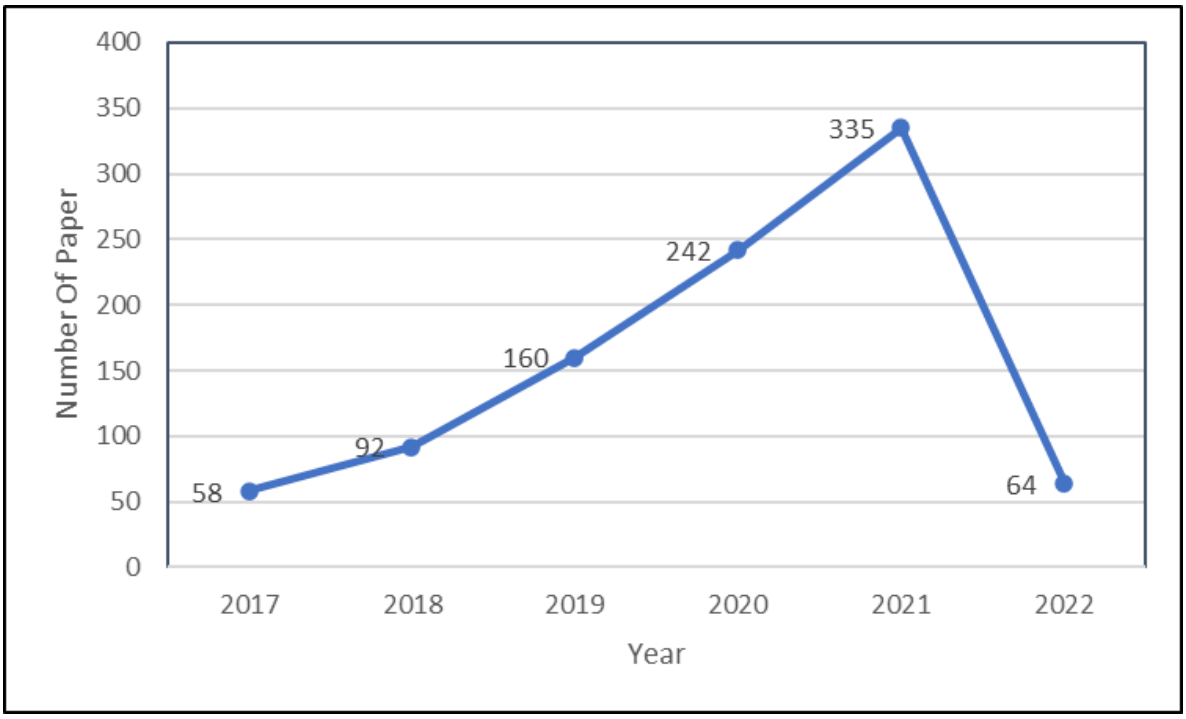

Fig. 1. Level of research development on Esports Management

DOI: https://doi.org/10.34010/injiiscom.v4i1.9570
p-ISSN 2810-0670 e-ISSN 2775-5584

Table 1. Article Data in the Field of Esports Management

No	Authors	Title	Year	Cites	Refs
1.	Hamari and Sjöblom.	What is eSports and why do people watch it?	2017	900	(Hamari, 2017)
2.	Jenny et al.	Virtual (ly) athletes: where eSports fit within the definition of "Sport"	2017	455	(Jenny, 2017)
3.	Hallmann & Giel.	eSports–Competitive sports or recreational activity?	2018	332	(Hallmann, 2018)
4.	Bányai et al.	The psychology of esports: A systematic literature review	2019	211	(Banyai et al., 2019)
5.	Reitman et al.	Esports research: A literature review	2020	193	(Reitman et al., 2020)
6.	Pizzo et al.	eSport vs sport: a comparison of spectator motives	2018	175	(Pizzo, 2018)
7.	DiFrancisco et al.	Managing the health of the eSport athlete: an integrated health management model	2019	126	(DiFrancisco et al., 2019)
8.	D Himmelstein et al.	An exploration of mental skills among competitive league of legend players	2021	119	(Himmelstein et al., 2021)
9.	R Li.	Good luck has fun: The rise of eSports	2017	117	(Li, 2017)
10.	Holden et al.	The future is now: Esports policy considerations and potential litigation	2017	108	(Holden et al., 2017)
11.	Kane & Spradley.	Recognizing ESports as a sport	2017	97	(Kane & Spradley, 2017)
12.	Ye et al.	Mastering complex control in moba games with deep reinforcement learning	2020	94	(Ye et al., 2020)
13.	Jenny et al.	eSports venues: A new sport business opportunity	2018	91	(Jenny, 2018)
14.	Griffiths.	The psychosocial impact of professional gambling, professional video gaming & eSports	2017	71	(Griffiths, 2017)

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Table 1 (Continue). Article Data in the Field of Esports Management

No	Authors	Title	Year	Cites	Refs
15.	Freeman & Wohn.	eSports as an emerging research context at CHI: Diverse perspectives on definitions	2017	70	(Freeman & Wohn, 2017)
16.	Ströh.	The eSports market and eSports sponsoring	2017	60	(Stroh, 2017)
17.	Schaeperko et al.	The "new" student-athlete: An exploratory examination of scholarship eSports players	2017	53	(Schaeperko etter, 2017)
18.	Chung et al.	Will esports result in a higher prevalence of problematic gaming? A review of the global situation	2019	49	(Chung, 2019)
19.	Ye et al.	Towards playing full moba games with deep reinforcement learning	2020	44	(Ye, 2020)
20.	Nagorsky & Wiemeyer.	The structure of performance and training in esports	2020	43	(Nagorsky, 2020)

Twenty papers that meet the requirements for research are listed in Table 1. Out of the 20 publications that were chosen, the study on Esports Management has a greatest citation of 900 and a lowest citation of 43. According to Table 1, the articles with the most quotations will be published in 2017 and 2022, respectively. The most papers cited between 2017 and 2022 total 900 articles. That there would be 193 articles mentioned in total by 2020. The year with the most quotes includes up to 900 articles.

3.2. Visualization Esports Management topic area using VOSviewer

Visualization Al Husaeni and Nandiyanto claim that the VOSviewer software is used in the Esports Management field since it has a limited amount of relationships (BÜYÜKBAYKAL & Burak, 2020). However, in this investigation, VOSviewer requires a minimum of three connections.

Thus, 26 elements in a total of 10 clusters constitute the end result. Using analytical mapping and visualization, a study of the atmosphere of the esports industry was conducted:

(i) Cluster 1 (5 items)

Esport, Esports consumer, Esports game, esports research, gaming (See Fig. 2).

(ii) Cluster 2 (4 items)

Esports competition, esports event, esports tournament, sport management (See Fig. 3).

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(iii) Cluster 3 (4 items)

Audience, Esports community, esports fan, esports sponsorship (See Fig. 4).

(iv) Cluster 4 (3 items)

Digitalization, sport, strategic management (See Fig. 5).

(v) Cluster 5 (3 items)
Participant, professional esports player, video game (See Fig. 6).

(vi) Cluster 6 (3 items)

Athlete, esports athlete, esports organization (See Fig. 7).

(vii) Cluster 7 (1 item)

Competitive gaming (See Fig. 8).

(viii) Cluster 8 (1 item)

Development (See Fig. 9).

(ix) Cluster 9 (1 item)

Gambling (See Fig. 10).

(x) Cluster 10 (1 item)

los esport (See Fig. 11).

Cluster 1 is represented with the color red, Cluster 2 with the color green, Cluster 3 with the color blue-old, Cluster 4 with the color yellow.

Cluster 5 with the color purple, Cluster 6 with the color cyan, Cluster 7 with the color orange, Cluster 8 with the color brown, Cluster 9 with the color pink, and Cluster 10 with the color draco turquoise.

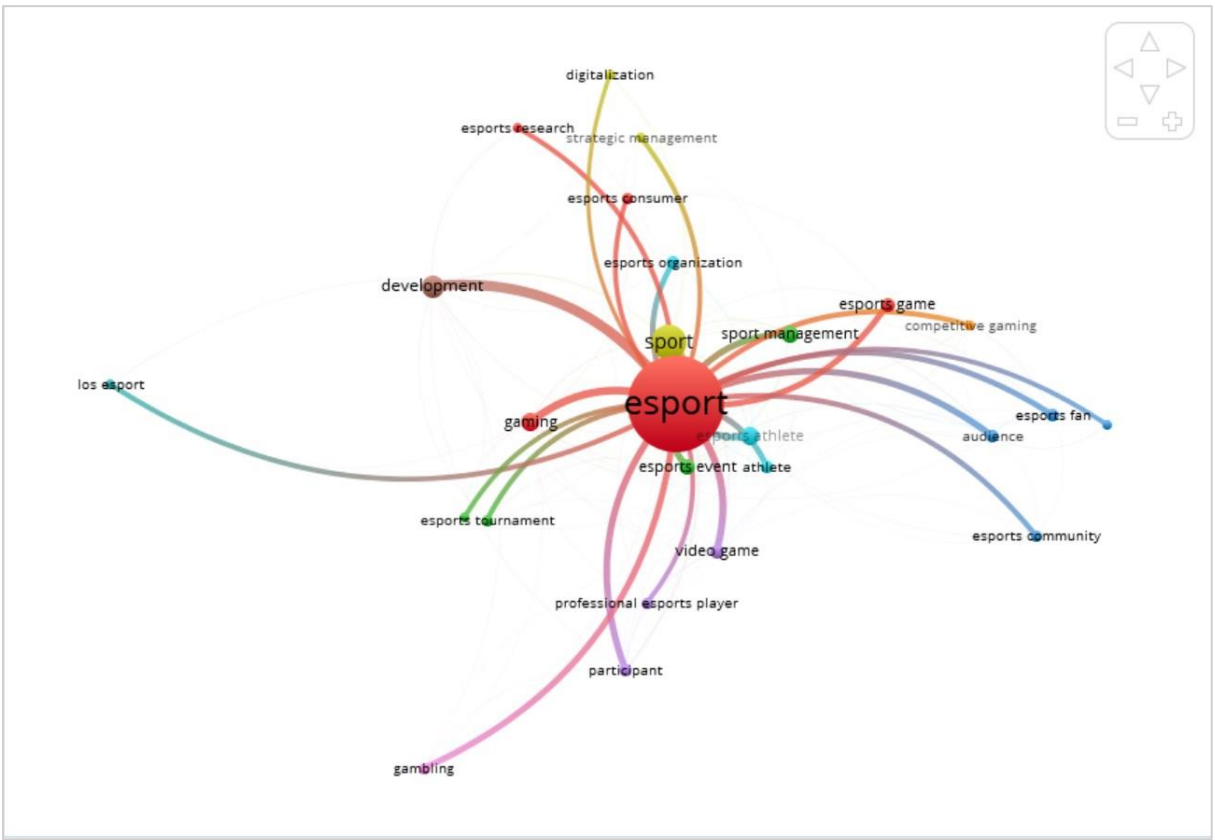

Fig. 2. Cluster 1 Visualization Esports Management Network

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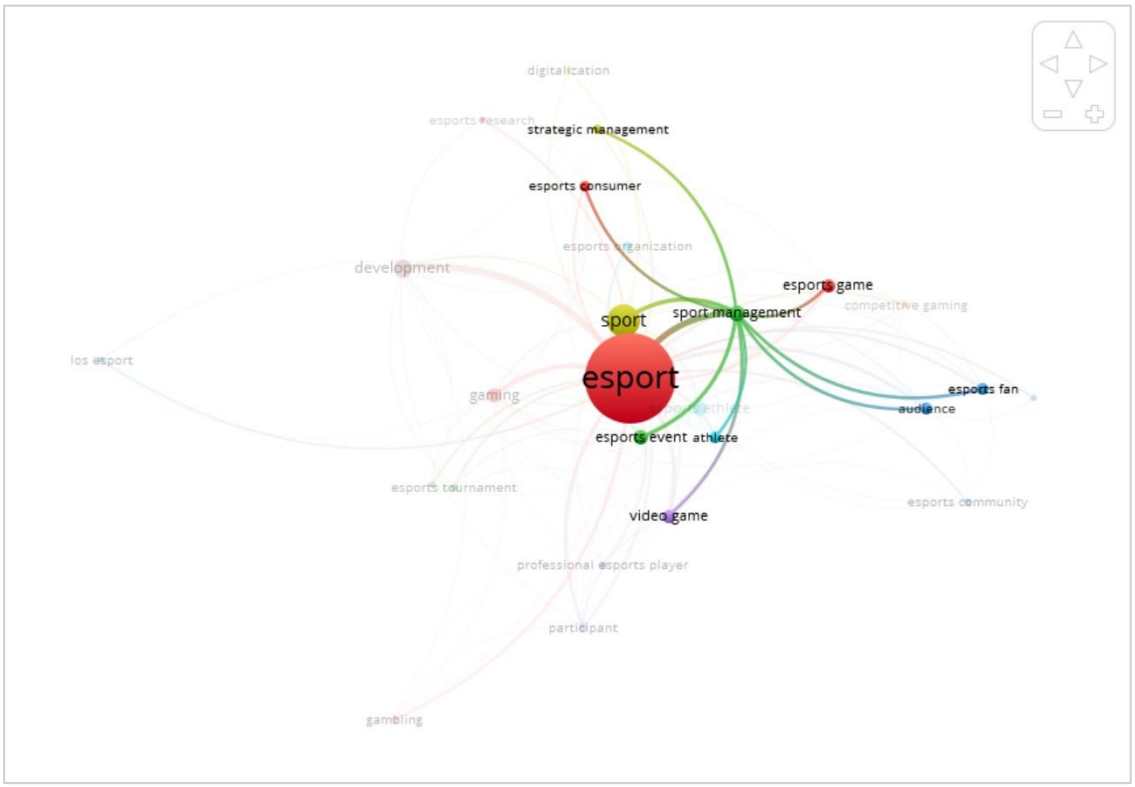

Fig. 3. Cluster 2 Visualization Esports Management network

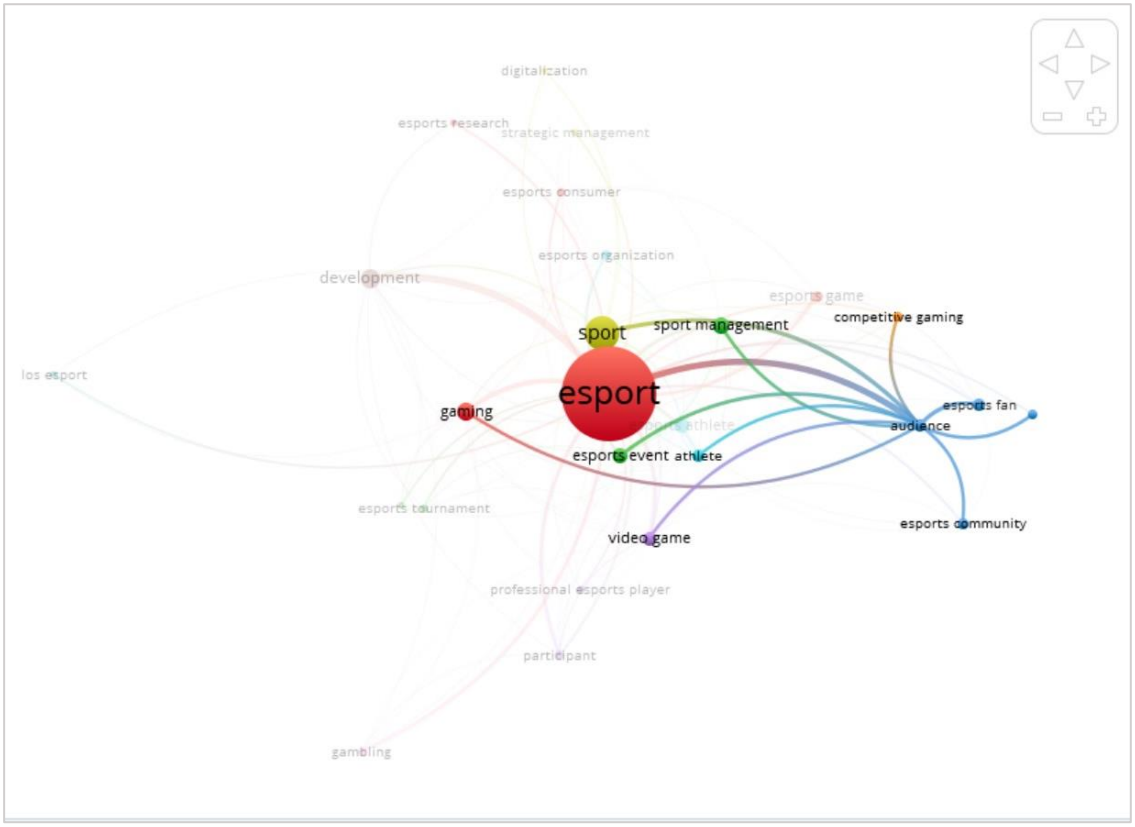

Fig. 4. Cluster 3 Visualization Esports Management network

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p-ISSN 2810-0670 e-ISSN 2775-5584

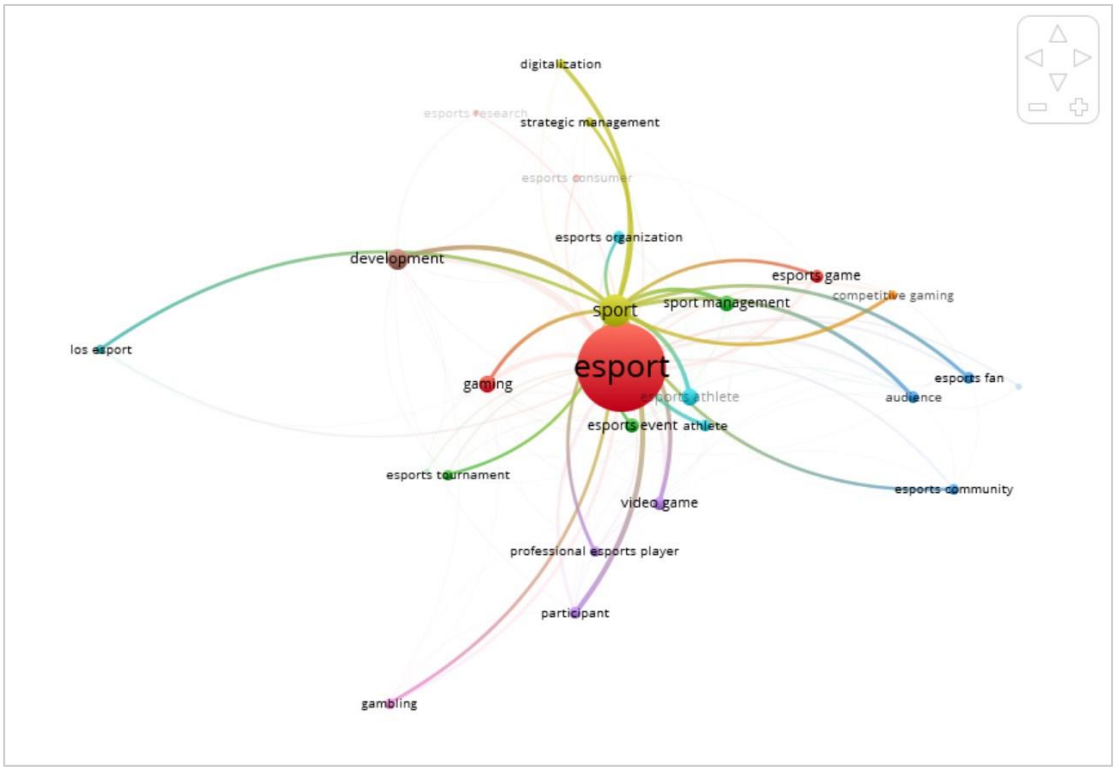

Fig. 5. Cluster 4 Visualization Esports Management network

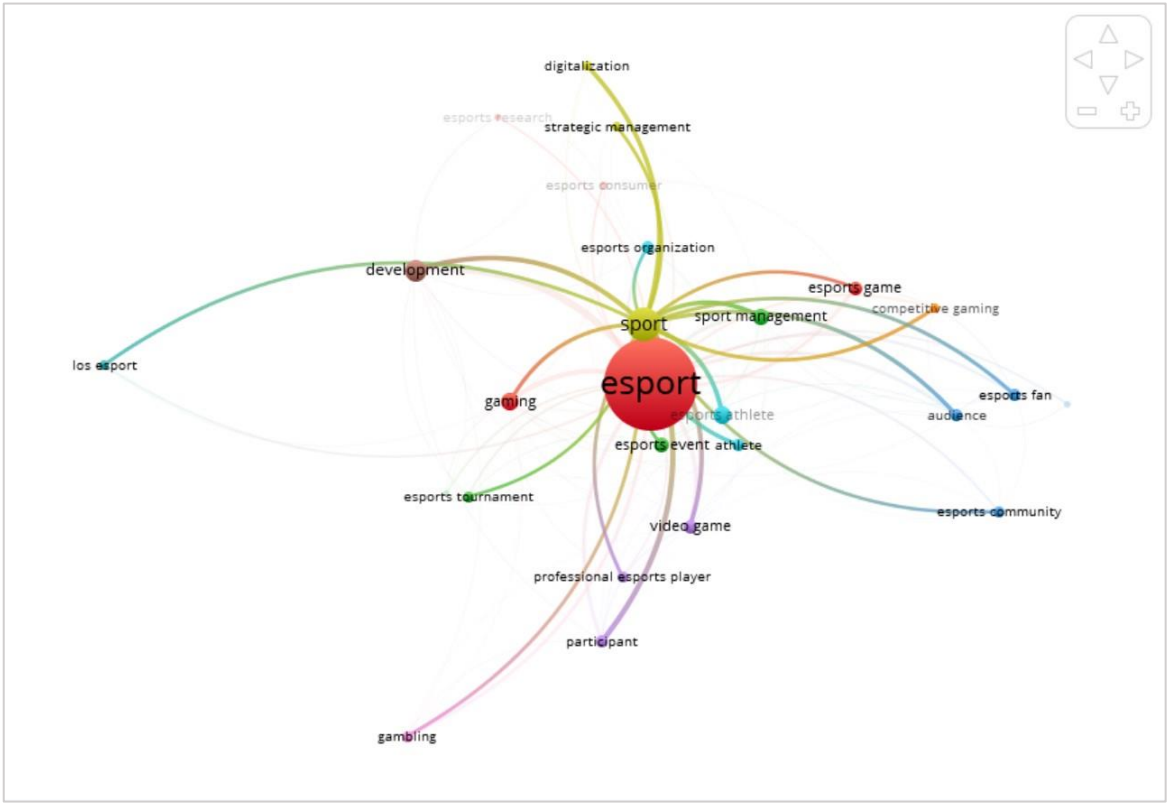

Fig. 6. Cluster 5 Visualization Esports Management network

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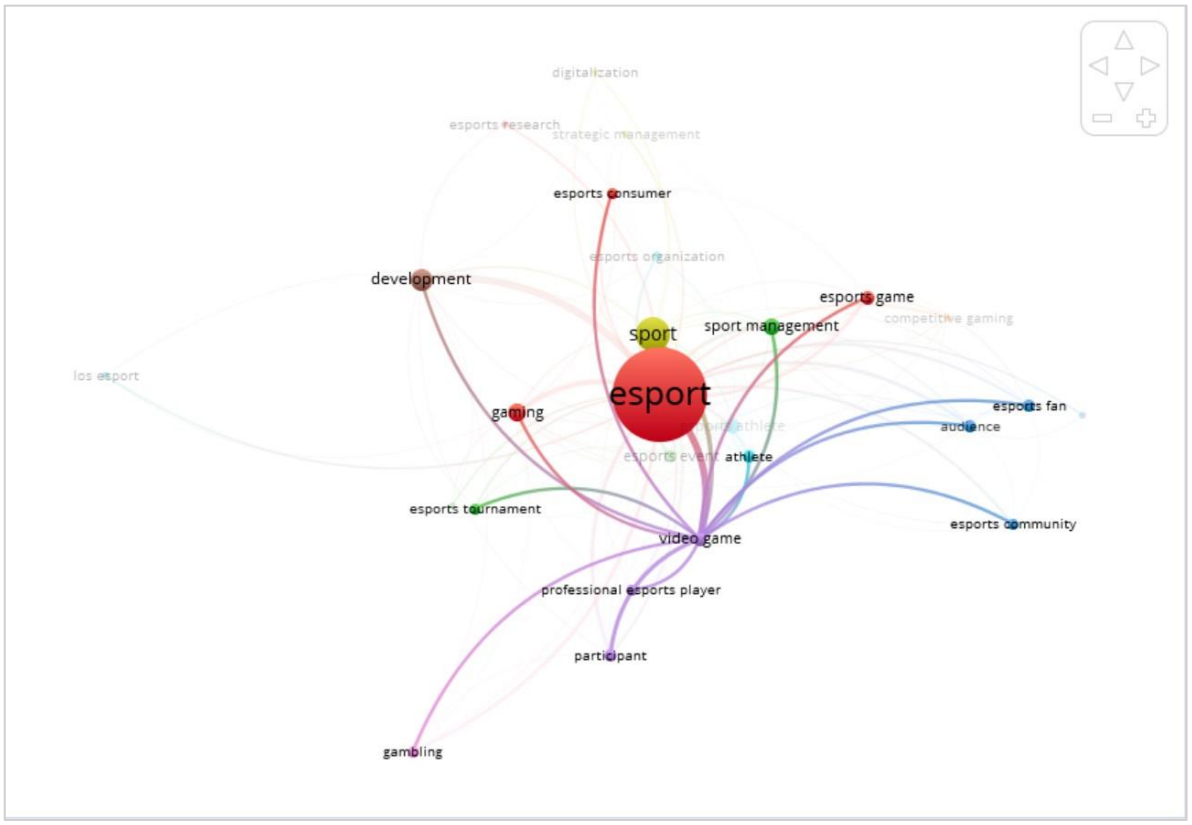

Fig. 7. Cluster 6 Visualization Esports Management network

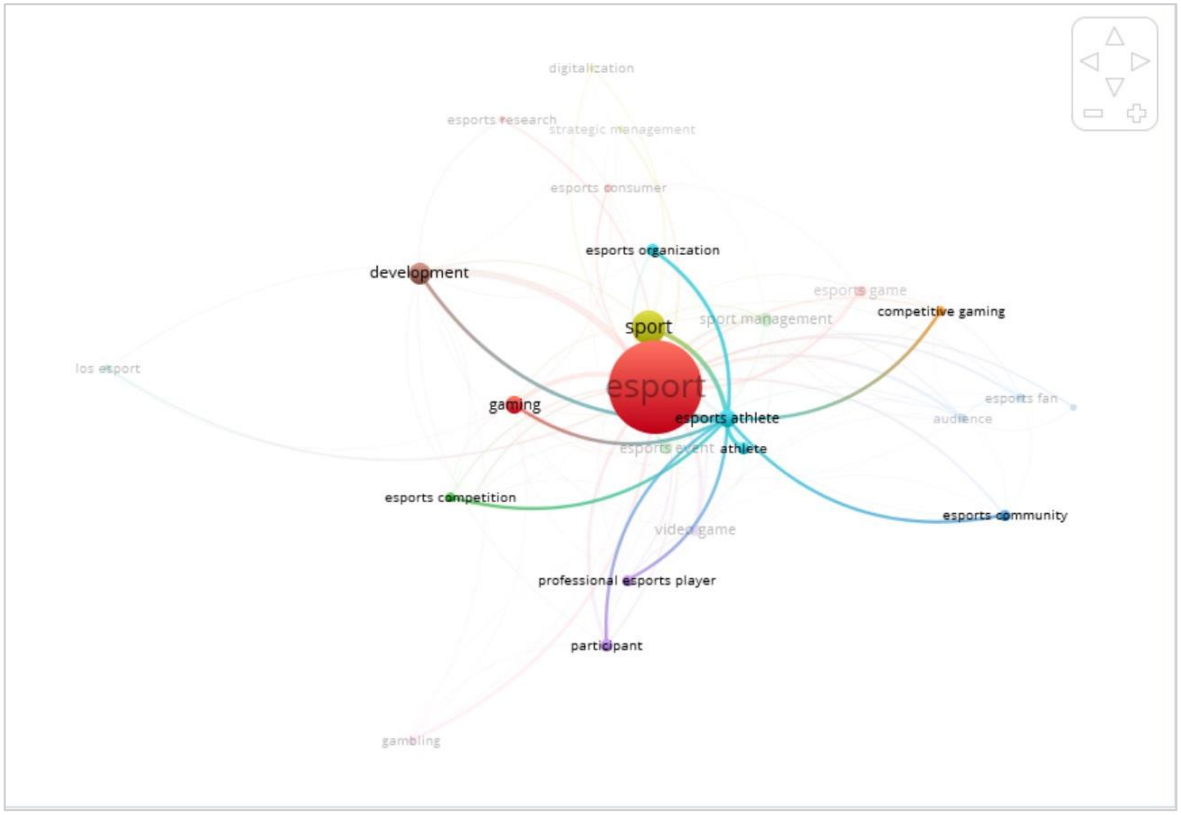

Fig. 8. Cluster 7 Visualization Esports Management network

DOI: https://doi.org/10.34010/injiiscom.v4i1.9570
p-ISSN 2810-0670 e-ISSN 2775-5584

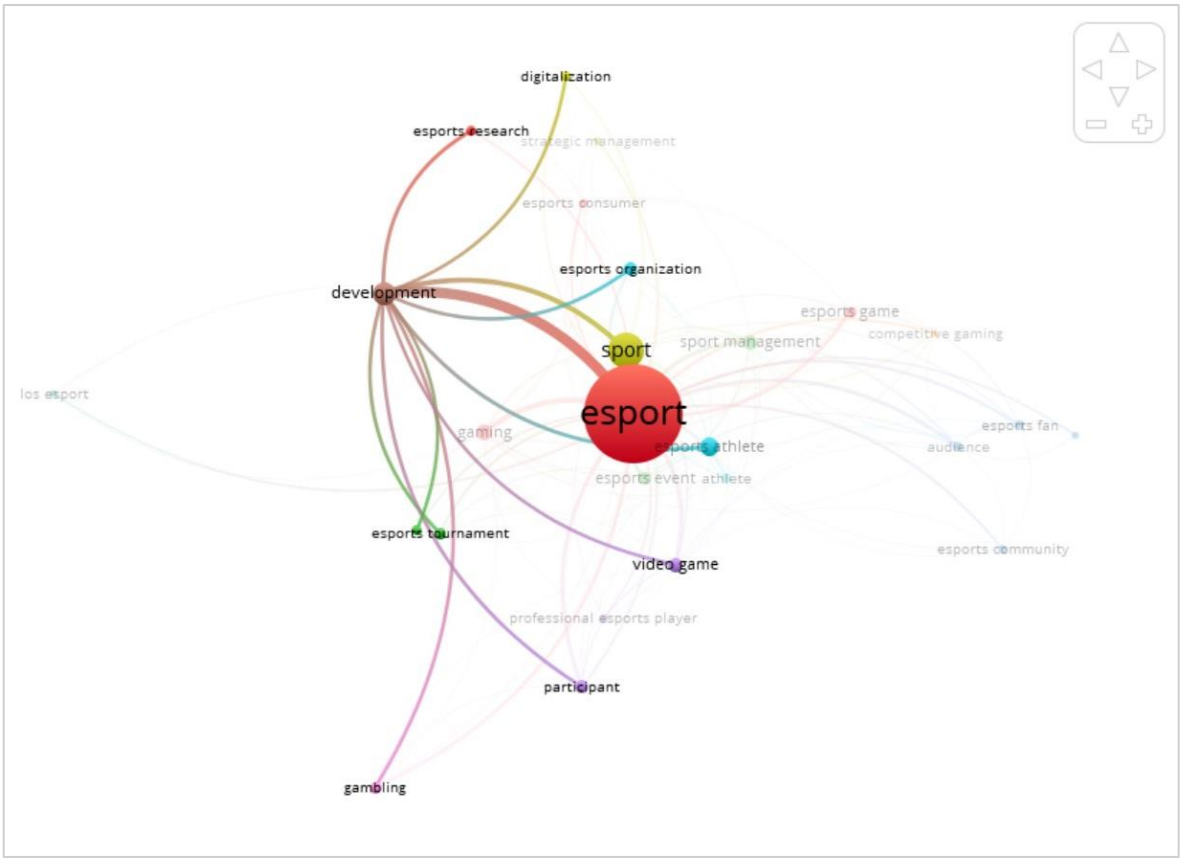

Fig. 9. Cluster 8 Visualization Esports Management network

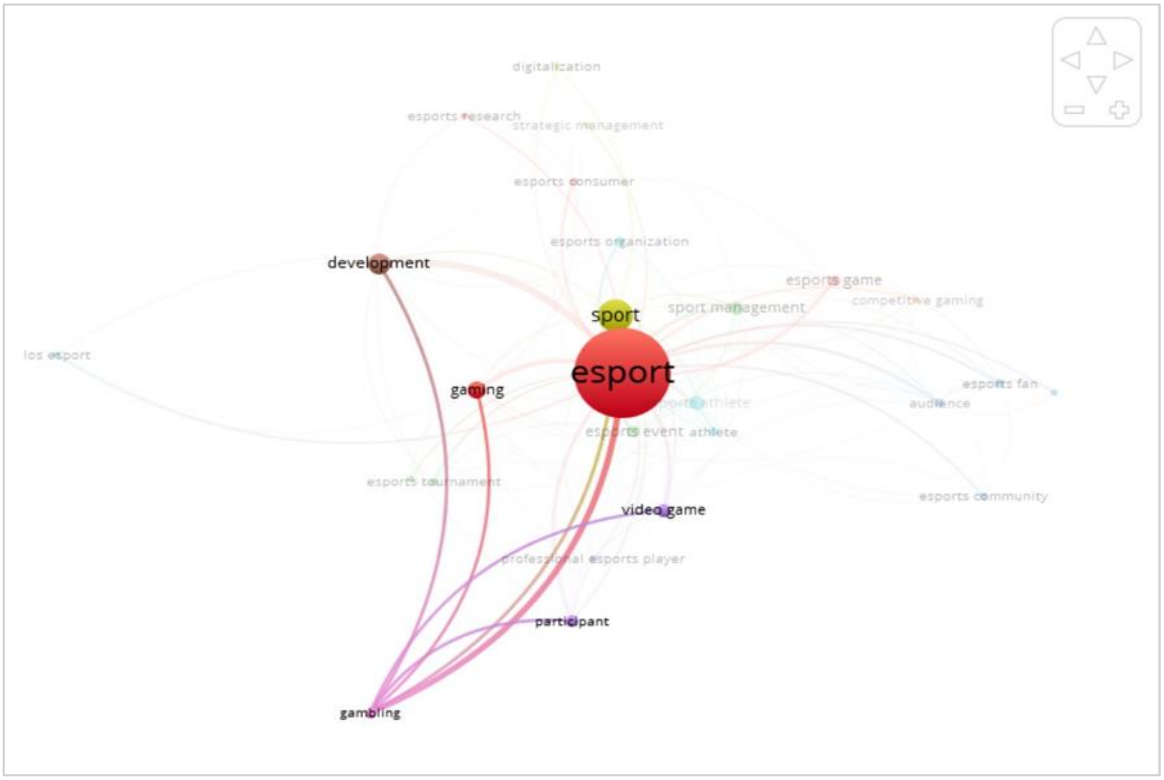

Fig. 10. Cluster 9 Visualization Esports Management network

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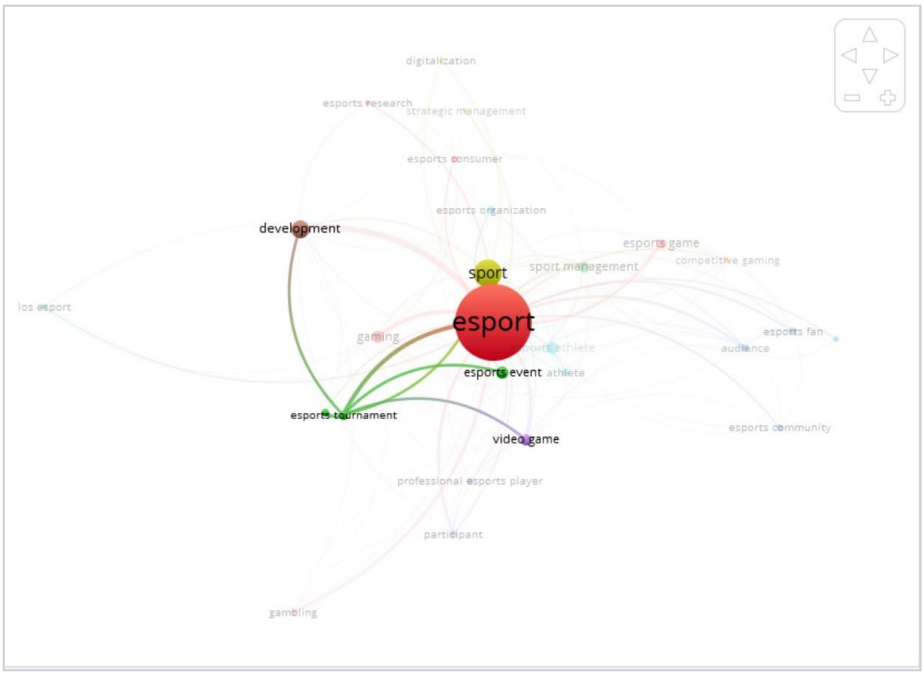

Fig. 11. Cluster 10 Visualization Esports Management network

3.3. Network visualization Esports Management topic area using VOSviewer

Each term's mapping in the VOSviewer program is segregated into the first of three categories, Visualization Network. The representation of a connected network One of the map's features. Existing relationship as represented in a network representation, or the line connecting two objects (See Fig. 12).

Visualization Network from the item "Esports Game" obtained using the VOSviewer program is shown in Fig. 12. Each cluster where in each individual area or investigated issue is depicted in Fig. 12. The esports Management climate, which includes cluster 10 and has a total strength of 40 and occurrence of 43, is seen in Fig. 12 above.

Esports climate connected to Cluster 1 (5 items) esport, esports consumer, esports game, esports research, gaming, Cluster 2 (4 items) esports competition, esports event, esports tournament, sport management, Cluster 3 (4 items) audience, esports community, esports fan, esports sponsorship.

Cluster 4 (3 items) digitalization, sport, strategic management, Cluster 5 (3 items) participant professional, esports play, video game.

Cluster 6 (3 items) athlete, esports athlete, esports organization Cluster 7 (1 item) competitive gaming, Cluster 8 (1 item) development, Cluster 9 (1 item) gambling, Cluster 10 (1 item) los esport.

3.4. Overlay visualization of Esports Management topic area using VOSviewer

The VOSviewer software's Second Visualization Network offers overlay-style visualization mapping. mapping properly Overlay visualization focuses on a fresh research phrase. Novelty term or Thing in research related to the climate of Esports Managements shown in Fig. 13

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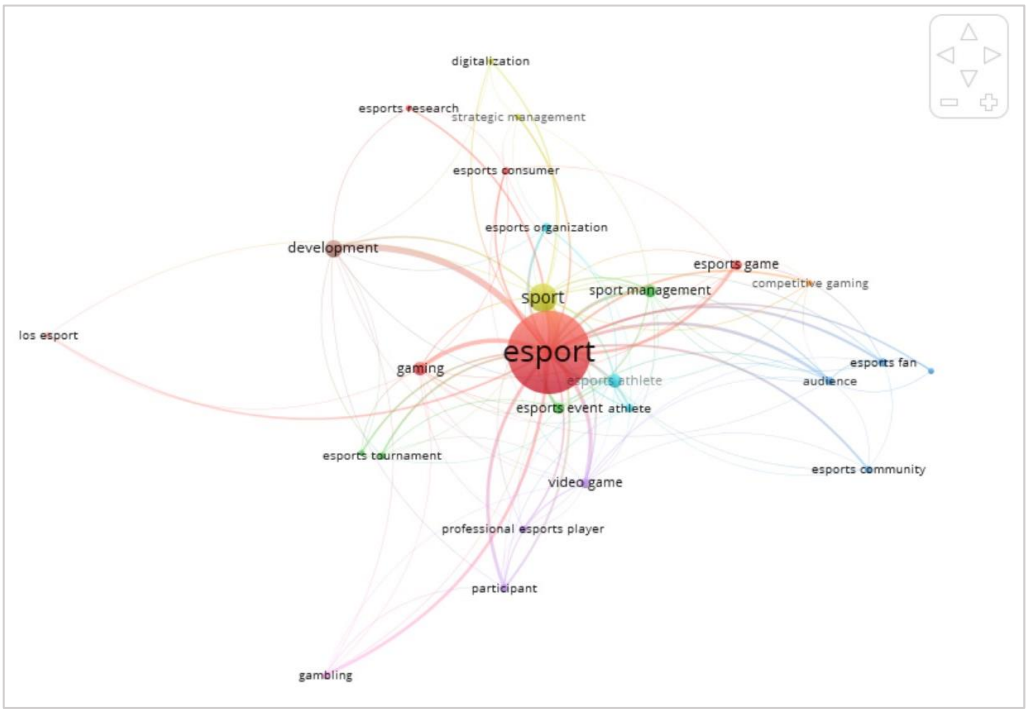

Fig. 12. Visualization Esports Management network

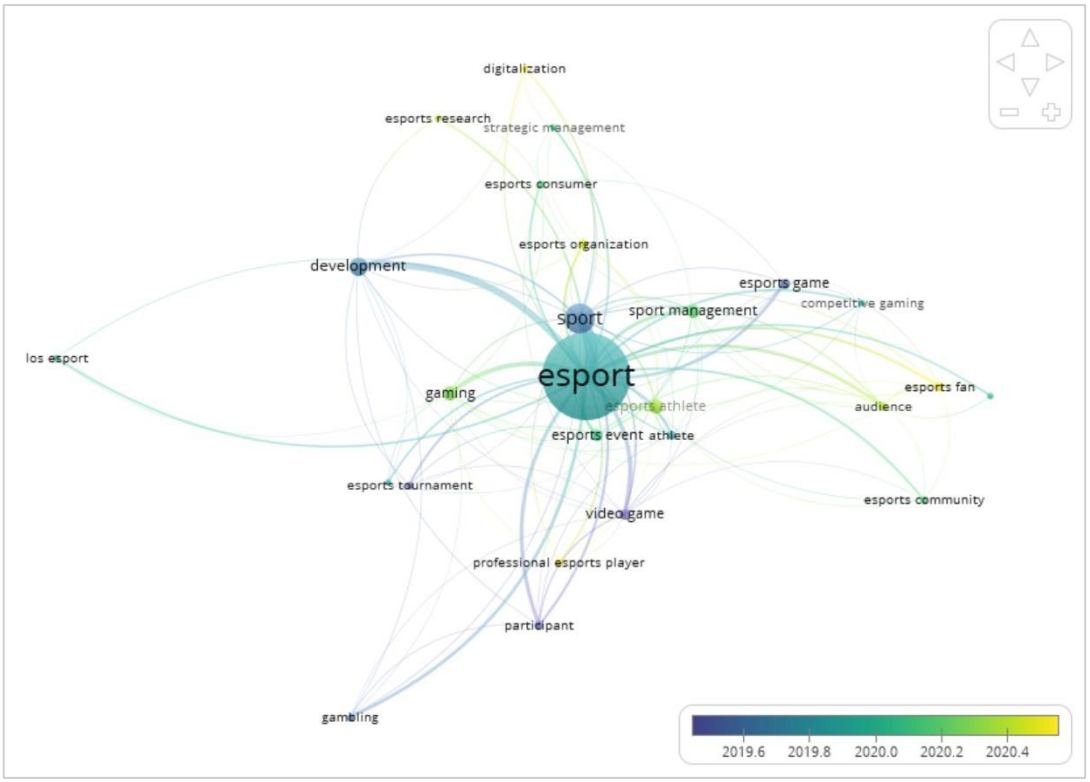

Fig. 13. Overlay Esports Management visualization

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p-ISSN 2810-0670 e-ISSN 2775-5584

In the depiction of Thing or term type Overlay, the popularity of each year can be seen. On Visualization Overlay, various hues indicate the duration of an extension in a specific period. In this research, the years 2017 to 2022 are considered. More dark colors approach purple, indicating that research on a particular Thing or term will be concluded by 2017. In the meantime, the hue is approaching yellow in a lighter fashion.

3.5. Density visualization of Esports Management

Density Visualization is the third and final mapping depiction in the VOSviewer software. Fig. 14 depicts a visualization of Density Esports Management. The colors that appear in a term can be mapped using this method. If the color that appears becomes paler, then interest in the term is increasing. Conversely, if the color is becoming darker or more diminished, the frequency of research on the term is decreasing. Yellow color terms are depicted in Fig. 14 as having a diameter that is relatively large. These concepts are referred to as emission, Esports, Esports Management, Gaming, and Development.

Visualization density about climate Esports Management research is in the picture above, which means that on the map density showing results analysis use all article regarding Esports Management in 2017-2022.

In Fig. 14 is depicted a yellow pattern whose keyword density increases as the circle's diameter increases, indicating that they are more prevalent. If the color on the map fades or blends with the background color green, it indicates that the keyword appears less frequently.

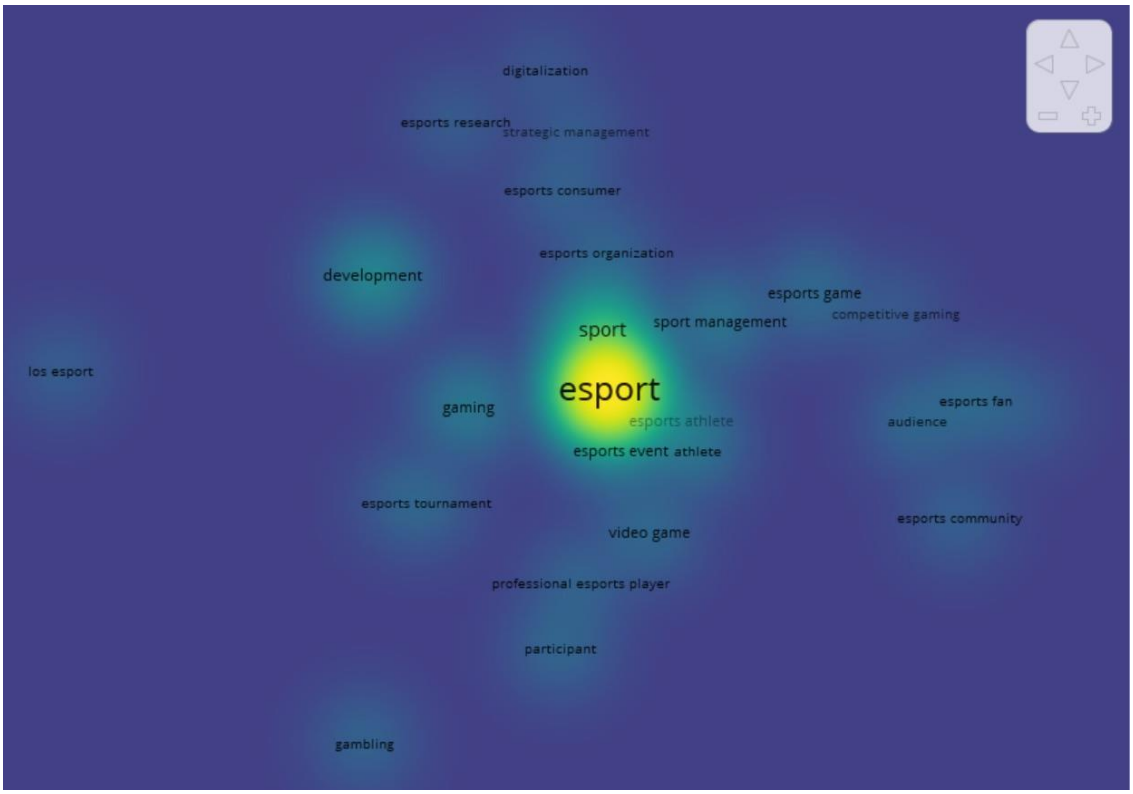

Fig. 14. Visualization Density Esports Management network

DOI: https://doi.org/10.34010/injiiscom.v4i1.9570
p-ISSN 2810-0670 e-ISSN 2775-5584

4. CONCLUSION

The purpose of this study is to evaluate and assess the bibliometric literature on Esports Management. The keyword "Esports Management" is used to retrieve data based on a subject area containing keywords, abstracts, and titles. After data processing and filtration, 999 relevant articles were obtained. To generate mapping data, a device soft VOS viewer is used. Using visualization grid, overlay, and density to map data. Based on results in mapping and analysis use VOS viewer, obtained that study regarding financial management with the term Esports Management in 2017-2022 decreased from every year to year. In research this, using method bibliometrics to identify theme main in every field studies before, because important to assess novelty in future research.

REFERENCES

Al Husaeni, D. F., & Nandiyanto, A. B. D. (2022). Bibliometric using Vosviewer with Publish or Perish (using google scholar data): From step-by-step processing for users to the practical examples in the analysis of digital learning articles in pre and post Covid-19 pandemic. *ASEAN Journal of Science and Engineering*, *2*(1), 19-46.

Al Husaeni, D. F., & Nandiyanto, A. B. D. (2022). Mapping visualization analysis of computer science research data in 2017-2021 on the google scholar database with vosviewer. *International Journal of Informatics, Information System and Computer Engineering (INJIISCOM)*, *3*(1), 1-18.

Al Husaeni, D. F., Nandiyanto, A. B. D., & Maryanti, R. (2023). Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research. *Indonesian Journal of Teaching in Science*, *3*(1), 1-8.

Al Husaeni, D. F., Nandiyanto, A. B. D., & Maryanti, R. (2023). Bibliometric analysis of educational research in 2017 to 2021 using VOSviewer: Google scholar indexed research. *Indonesian Journal of Teaching in Science*, *3*(1), 1-8.

Al Husaeni, D. N., & Nandiyanto, A. B. D. (2023). Bibliometric analysis of high school keyword using VOSviewer indexed by google scholar. *Indonesian Journal of Educational Research and Technology*, *3*(1), 1-12.

Al Husaeni, D. N., & Nandiyanto, A. B. D. (2023). Bibliometric analysis of high school keyword using VOSviewer indexed by google scholar. *Indonesian Journal of Educational Research and Technology*, *3*(1), 1-12.

Bányai, F., Griffiths, M. D., Király, O., & Demetrovics, Z. (2019). The psychology of esports: A systematic literature review. *Journal of gambling studies*, *35*, 351-365.

DOI: https://doi.org/10.34010/injiiscom.v4i1.9570
p-ISSN 2810-0670 e-ISSN 2775-5584

BÜYÜKBAYKAL, N. G., & Burak, İ. L. İ. (2020). E-Spor Kavramına Yönelik Araştırmaların Bibliyometrik Analizi Bibliometric Analysis of Researches for E-Sport. *Uluslararası Kültürel ve Sosyal Araştırmalar Dergisi*, *6*(2), 572-583.

Chiu, W., Fan, T. C. M., Nam, S. B., & Sun, P. H. (2021). Knowledge mapping and sustainable development of esports research: A bibliometric and visualized analysis. *Sustainability*, *13*(18), 10354.

Chung, T., Sum, S., Chan, M., Lai, E., & Cheng, N. (2019). Will esports result in a higher prevalence of problematic gaming? A review of the global situation. *Journal of behavioral addictions*, *8*(3), 384-394.

DiFrancisco-Donoghue, J., Balentine, J., Schmidt, G., & Zwibel, H. (2019). Managing the health of the eSport athlete: an integrated health management model. *BMJ open sport & exercise medicine*, *5*(1), e000467.

Franke, T. (2013). The perception of eSports-mainstream culture, real sport and marketisation. *eSports yearbook*, *14*, 111-144.

Freeman, G., & Wohn, D. Y. (2017, May). eSports as an emerging research context at CHI: Diverse perspectives on definitions. In *Proceedings of the 2017 CHI conference extended abstracts on human factors in computing systems* (pp. 1601-1608).

Griffiths, M. D. (2017). The psychosocial impact of professional gambling, professional video gaming & eSports. *Casino & Gaming International*, *28*, 59-63.

Hallmann, K., & Giel, T. (2018). eSports–Competitive sports or recreational activity?. *Sport management review*, *21*(1), 14-20.

Hamari, J., & Sjöblom, M. (2017). What is eSports and why do people watch it?. *Internet research*, *27*(2), 211-232.

Hamidah, I., Sriyono, S., & Hudha, M. N. (2020). A Bibliometric analysis of Covid-19 research using VOSviewer. *Indonesian Journal of Science and Technology*, 34-41.

Himmelstein, D., Liu, Y., & Shapiro, J. L. (2021). An exploration of mental skills among competitive league of legend players. In *Research anthology on rehabilitation practices and therapy* (1607-1629). IGI Global.

Holden, J. T., Kaburakis, A., & Rodenberg, R. (2017). The future is now: Esports policy considerations and potential litigation. *J. Legal Aspects Sport*, *27*, 46.

Hutchins, B. (2008). Signs of meta-change in second modernity: the growth of e-sport and the World Cyber Games. *New Media & Society*, *10*(6), 851-869.

Jenny, S. E., Keiper, M. C., Taylor, B. J., Williams, D. P., Gawrysiak, J., Manning, R. D., & Tutka, P. M. (2018). eSports venues: A new sport business opportunity. *Journal of Applied Sport Management*, *10*(1), 8.

DOI: https://doi.org/10.34010/injiiscom.v4i1.9570
p-ISSN 2810-0670 e-ISSN 2775-5584

Jenny, S. E., Manning, R. D., Keiper, M. C., & Olrich, T. W. (2017). Virtual (ly) athletes: where eSports fit within the definition of "Sport". *Quest*, *69*(1), 1-18.

Jenny, S. E., Manning, R. D., Keiper, M. C., & Olrich, T. W. (2017). Virtual (ly) athletes: where eSports fit within the definition of "Sport". *Quest*, *69*(1), 1-18.

Jonasson, K., & Thiborg, J. (2010). Electronic sport and its impact on future sport. *Sport in society*, *13*(2), 287-299.

Kane, D., & Spradley, B. D. (2017). Recognizing ESports as a sport. *The Sport Journal*, *19*(5).

Kenzhekanova, K. K. (2015). Linguistic features of political discourse. *Mediterranean Journal of Social Sciences*, *6*(6 S2), 192.

Kurnia, S. (2021). *Science, Technology, Engineering, Art And Mathematics (STEAM) di Pendidikan Sains: Analisis Bibliometrik dan Pemetaan Literatur Penelitian Menggunakan Perangkat Lunak Vosviewer* (Doctoral dissertation, UIN Raden Intan Lampung).

Li, R. (2017). *Good luck have fun: The rise of eSports*. Simon and Schuster.

Masruroh, B., Laksana, E. P., Rosyida, F., Harianti, L. R., & Maysa, F. (2022). Analisis sitasi Jurnal Pendidikan Geografi: Kajian, Teori, dan Praktik dalam Bidang Pendidikan dan Ilmu Geografi periode 2019-2021. *Jurnal Integrasi dan Harmoni Inovatif Ilmu-Ilmu Sosial (JIHI3S)*, *2*(3), 204-209.

Mulyawati, I. B., & Ramadhan, D. F. (2021). Bibliometric and visualized analysis of scientific publications on geotechnics fields. *ASEAN Journal of Science and Engineering Education*, *1*(1), 37-46.

Nagorsky, E., & Wiemeyer, J. (2020). The structure of performance and training in esports. *PloS one*, *15*(8), e0237584.

Nandiyanto, A. B. D., Al Husaeni, D. N., & Al Husaeni, D. F. (2021). A bibliometric analysis of chemical engineering research using vosviewer and its correlation with covid-19 pandemic condition. *Journal of Engineering Science and Technology*, *16*(6), 4414-4422.

Nandiyanto, A. B. D., Girsang, G. C. S., Maryanti, R., Ragadhita, R., Anggraeni, S., Fauzi, F. M., ... & Al-Obaidi, A. S. M. (2020). Isotherm adsorption characteristics of carbon microparticles prepared from pineapple peel waste. *Communications in Science and Technology*, *5*(1), 31-39.

Pizzo, A., Baker, B., Na, S., Lee, M., Kim, D., & Funk, D. (2018). eSport vs sport: a comparison of spectator motives. *Faculty/Researcher Works*.

DOI: https://doi.org/10.34010/injiiscom.v4i1.9570
p-ISSN 2810-0670 e-ISSN 2775-5584

Ragadhita, R., & Nandiyanto, A. B. D. (2022). Computational bibliometric analysis on publication of techno-economic education. *Indonesian Journal of Multidiciplinary Research*, *2*(1), 213-220.

Reitman, J. G., Anderson-Coto, M. J., Wu, M., Lee, J. S., & Steinkuehler, C. (2020). Esports research: A literature review. *Games and Culture*, *15*(1), 32-50.

Schaeperkoetter, C. C., Mays, J., Hyland, S. T., Wilkerson, Z., Oja, B., Krueger, K., ... & Bass, J. R. (2017). The "new" student-athlete: An exploratory examination of scholarship eSports players. *Journal of Intercollegiate Sport*, *10*(1), 1-21.

Scholz, T. M. (2020). Deciphering the World of eSports. *International Journal on Media Management*, *22*(1), 1-12.

Scholz, T. M., & Scholz, T. M. (2019). A short history of esports and management. *eSports is Business: Management in the World of Competitive Gaming*, 17-41.

Scholz, T. M., & Scholz, T. M. (2019). Introduction: The emergence of eSports. *ESports is business: Management in the world of competitive gaming*, 1-16.

Soegoto, H., Soegoto, E. S., Luckyardi, S., & Rafdhi, A. A. (2022). A bibliometric analysis of management bioenergy research using vosviewer application. *Indonesian Journal of Science and Technology*, *7*(1), 89-104.

Sousa, A., Ahmad, S. L., Hassan, T., Yuen, K., Douris, P., Zwibel, H., & DiFrancisco-Donoghue, J. (2020). Physiological and cognitive functions following a discrete session of competitive esports gaming. *Frontiers in psychology*, *11*, 1030.

Ströh, J. H. A. (2017). *The eSports market and eSports sponsoring*. Tectum Wissenschaftsverlag.

Taylor, T. L. (2012). *Raising the stakes: E-sports and the professionalization of computer gaming*. Mit Press.

Witkowski, E. (2009). Probing the sportiness of eSports. *eSports yearbook. Norderstedt: Books on Demand GmbH*, 53-56.

Yamanaka, G. K., Campos, M. V., Roble, O. J., & Mazzei, L. C. (2021). eSport: a state-of-the-art review based on bibliometric analysis. *Journal of Physical Education and Sport*, *21*(6), 3547-3555.

Ye, D., Chen, G., Zhang, W., Chen, S., Yuan, B., Liu, B., ... & Liu, W. (2020). Towards playing full moba games with deep reinforcement learning. *Advances in Neural Information Processing Systems*, *33*, 621-632.

DOI: https://doi.org/10.34010/injiiscom.v4i1.9570
p-ISSN 2810-0670 e-ISSN 2775-5584

Ye, D., Liu, Z., Sun, M., Shi, B., Zhao, P., Wu, H., ... & Huang, L. (2020, April). Mastering complex control in moba games with deep reinforcement learning. In *Proceedings of the AAAI Conference on Artificial Intelligence*, 34(04), 6672-6679.

DOI: https://doi.org/10.34010/injiiscom.v4i1.9570
p-ISSN 2810-0670 e-ISSN 2775-5584