



# Mapping the Structure of E-Leadership Research: A Co-keyword Analysis

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**Abstract.** This paper aims to identify the main concepts of e-Leadership study by network analysis of the co-occurrence of keywords, through knowledge domain mapping, a method used in bibliometrics analysis. We analyzed 148 documents from the Web of Science database on e-Leadership with the help of VOSviewer software tools. Keyword co-occurrence analysis is adopted to visually explore the knowledge base, topic distribution, and research fields in the field of e-Leadership research. Fifteen representative areas were found to be concentrated in the main keywords, namely e-leadership, leadership, performance, management, virtual teams, impact, model, transformational leadership, teams, communication, technology, trust, work, information, and behavior.

**Keywords:** E-Leadership · Virtual Leadership · Leadership · Co-Occurrence Analysis · Bibliometrics Analysis

## 1 Introduction

Along with the rapid development of technology, the use of information technology in various sectors has also experienced a significant increase. The use of information technology as a medium of interaction and communication is a necessity for all organizations in various sectors [1, 2]. This should be the subject of study, especially how a leader in an organization to influence its members. Therefore, the concept of e-Leadership (electronic leadership) has now received attention from scholars. e-Leadership is defined as a social process in an organization mediated by technology to generate changes in behavior, thinking, attitudes, and performance, both individually, in groups, and organizations to direct all members of the organization towards achieving organizational goals effectively [3, 4]. Avolio and Kahai [3] emphasize that e-Leadership allows for an increase in relationships between members of organizations mediated by information technology. The collection and dissemination of information and also communication of members of the organization occurs through the mediation of information technology.

Organizational leadership in the traditional context occurs when there is a face-to-face interaction between the leader and members of the organization [5–8]. Recently, organizational leaders can lead organizational work remotely by utilizing information technology as a mediator in interacting with organizational members [9–12]. Recently, organizations are able to combine information technologies to communicate work issues, and creating the need for e-Leadership. e-Leadership mode involves many forms and types of information technology, such as wifi, email, mobile phones, or video conferencing. This results in organizations having to struggle to integrate information technology, while members of the organization face the learning pressure of using information technology which at any time there can be changes [4] and this could have an impact on the level of technostress. However, the understanding of how information technology changes human dynamics and behavior has lagged behind the use and rapid development of information technology itself. Therefore, it requires understanding and knowledge of the impact of information technology on human dynamics and behavior in organizations [3, 13–15].

But it should be noted, leaders in the context of a virtual environment (e-Leadership) have the same responsibilities as traditional leaders (face-to-face leaders), such as developing team members, monitoring organization's progress, organizing the organization, and motivating the organization's team. The difference is that e-Leadership faces additional challenges that traditional leaders do not have [16], such as how to develop technical skills using technology to facilitate leadership in order to effectively monitor the organization remotely, respond to questions, motivate organizational members, build teams from different cultures, and also increase organizational flexibility in the face of rapid changes in information technology. Leader communication skills are necessary to build the closeness and trust of the members of the organization [17–19] and ensure the leader's message is not misinterpreted by the members of the organization [20–22], hence, more frequent communication and extra work between the dreamer and the follower.

Leaders must realize it is difficult to build close bonds when organizational communication is separated by time and space [20, 23, 24], so e-Leadership has a crucial and important role in the development of virtual relationships within the organization. This research conducted a systematic review of e-Leadership research from the Web of Science (WoS) database. The results provide scholars with insights into key themes of e-Leadership research that can be used in future research.

## 2 Methods

This article presents the results of bibliometric analysis from studies on e-Leadership. We identified by applying the keyword “e-Leadership”, from the Web of Science (WoS) database, the time span of 1997–2020, a search was conducted in May 2021, and obtained 148 documents. Furthermore, the data were further analyzed with keyword co-occurrence analysis, focusing on understanding the knowledge component and knowledge structure of the scientific field by examining the relationship between keywords in the literature [25]. We used VOSviewer software in this study to map knowledge structures and clustering in the field of e-Leadership.

The procedure in e-Leadership research using VOSviewer software is as follows: Identification of publications in the database of selected scientific publications (in this case, WoS) based on the adopted criteria (in our case, “e-Leadership”, the time span of 1997–2020, which resulted in 148 publications). Create and download bibliographic data from selected publications from the WoS database in plain.text format. Choosing a VOSviewer that allows the creation of maps based on bibliographic data follows the recommendations of the software. Verify the terms chosen by the software, i.e. filter out distractions such as common nouns (e.g. “implication”, “introduction”), and words related to publishing (e.g. “copyright”, “Palgrave”). The creation of a map of the relationship of keywords and their analysis using the “item” and “analysis” options.

The resulting network of connections is very compact, characterized by many connections in the selected part of the map (occurrence ratio and total link strength). The occurrence ratio is the number of shared events of two keywords that measures the number of publications in which both keywords appear together in the title, abstract, and keyword list [26]. The construction of a keyword co-occurrence analysis matrix is the basis of performing cluster analysis, calculating the number of times each two keywords appear in the same document [27].

### 3 Results and Discussion

Figure 1 and Fig. 2 present the result of the keyword co-occurrence analysis. There are 810 keywords appear in all the articles collected about e-Leadership. Nevertheless, this article selects keywords in the VOSviewer view. Keywords that have a frequency of more than 5 occurrences are analyzed by VOSviewer, thus getting 28 keywords. The results of the analysis get four clusters. Based on Fig. 1, each keyword is represented by a node, the size of the node indicates the number of keywords appearing, and the link shows the relationship between the two keyword nodes. The color in Fig. 2 indicates the time when the article appears, which means that the keywords that are closer to yellow, the more recent the keyword appears. The following describes each cluster.

Cluster 1 Red, ten keywords make up this cluster (Table 1). The keyword “e-Leadership” has the highest occurrences (53). In addition, other keywords that are dominant in this cluster are virtual teams (17) and communication (11). The two keywords are closely related to the effectiveness of e-Leadership, without a solid team and good communication between the leader and the leader, e-Leadership will not run well. Moreover, there are non-dominant keywords in this cluster related to behavior, computer-mediated communication, education, organizations, personality, creativity, and style. Keywords in this cluster are closely related to organizational behavior.

Cluster 2 Green, this cluster is organized by nine keywords (Table 2). The keyword “leadership” has the highest occurrences (28). The keywords “performance” and “management” rank 2nd and 3rd, having occurrences (26) and (22), respectively. Cluster 2 seems closely related to organizational performance management (a set of keywords work, innovation, challenges, and framework).

Cluster 3 Blue, this cluster is organized by six keywords (Table 3). The keyword “model” has the highest occurrences (13). The keywords “teams” and “technology” ranked 2nd and 3rd, having occurrences (12) and (11), respectively. Cluster 3 seems

**Table 1.** The Keywords for Cluster 1 Red

Number	Keyword	Occurrences	Total link strength
1	e-leadership	53	159
2	Virtual teams	17	77
3	Communication	11	59
4	Behavior	9	44
5	Computer-mediated communication	8	34
6	Education	7	5
7	Organizations	6	21
8	Personality	6	22
9	Creativity	5	31
10	Style	5	26

**Table 2.** The Keywords for Cluster 2 Green

Number	Keyword	Occurrences	Total link strength
1	Leadership	28	88
2	Performance	26	98
3	Management	22	66
4	Impact	15	57
5	Work	11	45
6	Innovation	8	22
7	Challenges	6	17
8	Framework	6	16
9	Knowledge	6	23

closely related to teamwork in organizations that need information system support (a set of trust, information, and e-government keywords).

Cluster 4 Yellow, this cluster is organized by only three keywords (Table 4). The keyword “transformational leadership” has the highest occurrences (13). The keywords “transactional leadership” and “commitment” ranked 2nd and 3rd, having occurrences (7) and (5), respectively. Cluster 4 seems closely related to the commitment of organizational leaders.

Furthermore, based on Fig. 2, we can discover the study timeline. The study of e-Leadership ranges from the study of performance, leadership, transformational leadership, management, technology, work, teams, information, and computer-mediated communication. The results of this study show that if you look at the future, then the study of





to provide immediate feedback, language variations, and the availability of existing personalization in the organization [4, 44]. Therefore, a leader for this purpose needs to study the interactivity and clarity of the media he uses to make their presence feel positive among his followers. Successful e-Leadership will bring some advantages, such as the balance between traditional and new (virtual) leadership models properly and precisely, the use of information technology media that reaches all members of the organization massively and responsively, avoiding misunderstandings by communicating intentions clearly and carefully to all members of the organization, and use information technology to face the diversity of human resources owned by the organization.

## 4 Conclusion

Our main finding is the identification of four large thematic clusters, which represent the direction of research in the e-Leadership field. Based on the calculated network of shared events, we find the main topics related to each of the four topics. Cluster 1 Red is the most numerous among the classified. This cluster is a group of problems related to e-leadership, virtual teams, and communication. Cluster 2 Green is a group of problems related to leadership, performance, and management. Cluster 3 Blue is a group of issues related to models, teams, and technology. Cluster 4 Yellow is a group of issues related to transformational leadership, transactional leadership, and commitment. Key trends in e-Leadership research were identified, such as e-Leadership, leadership, performance, management, and virtual teams. The research carried out makes it possible to show the direction of further development of e-Leadership research, both by method and from the results obtained in the clustering technique. Undoubtedly, e-Leadership research is still a big challenge for researchers and scholars. The complexity and multidimensionality of the variables that define the construction of e-Leadership require organizational leaders to be able to make decisions by looking at the management role and leadership processes of the organization at large. The results presented in this study can provide a basis for further research in the field of e-Leadership.

## References

1. A. Nurabadi, I. Bafadal, I. Gunawan, A. S. I. Burham, and E. J. Bengen, "Website development for principals induction program," in *Proceedings - 2020 6th International Conference on Education and Technology, ICET 2020*, Oct. 2020, pp. 205–208.
2. I. Gunawan et al., "Evaluation of online teaching with the SIPEJAR platform during the COVID-19 pandemic," in *2022 2nd International Conference on Information Technology and Education (ICIT&E)*, Jan. 2022, pp. 374–377.
3. B. J. Avolio and S. S. Kahai, "Adding the 'E' to E-Leadership: How it may impact your leadership," *Organ. Dyn.*, vol. 31, no. 4, pp. 325–338, 2003.
4. K. J. Crawford-Mathis, "Concepts and challenges of e-leadership," in *Electronic business: Concepts, methodologies, tools, and applications*, I. Lee, Ed. Hershey, PA: IGI Global, 2008, pp. 1748–1753.
5. I. Gunawan, "Instructional leadership profile of junior high school's principal (A case study of Junior High School in Malang)," *Int. Res. Educ. J.*, vol. 1, no. 1, pp. 64–68, 2017.

6. A. Nurabadi, J. Irianto, I. Bafadal, I. Gunawan, and M. A. Adha, "Pengaruh kepemimpinan pembelajaran, perubahan, dan spiritual terhadap kinerja guru dan prestasi siswa sekolah dasar," *Cakrawala Pendidik.*, vol. 40, no. 1, pp. 17–31, 2021.
7. B. A. Pambudi and I. Gunawan, "Instructional leadership as an effort to increase teacher professionalism in the industrial revolution era 4.0," in *Proceedings of the 4th International Conference on Education and Management (COEMA 2019)*, Jan. 2019, pp. 216–220.
8. A. Y. Sobri, I. Bafadal, A. Nurabadi, and I. Gunawan, "Validity and reliability of questionnaire problematics leadership beginner school principals," in *Proceedings of the 4th International Conference on Education and Management (COEMA 2019)*, 2019, pp. 250–254.
9. I. Gunawan, L. K. Hui, M. A. Ma'sum, and N. N. Sukawati, "Enhancing learning effectiveness by using online learning management system," in *Proceedings - 2020 6th International Conference on Education and Technology, ICET 2020*, Oct. 2020, pp. 48–52.
10. D. Prestiadi, I. Gunawan, and R. B. Sumarsono, "Role of transformational leadership in education 4.0," in *Proceedings of the 6th International Conference on Education and Technology (ICET 2020)*, 2020, pp. 120–124.
11. A. N. Faizah, I. Gunawan, I. Bafadal, and A. Timan, "The relationship between learning leadership and teacher performance: A correlation analysis," in *Proceedings of the 1st International Conference on Information Technology and Education (ICITE 2020)*, 2020, pp. 599–602.
12. C. M. Shanti, I. Gunawan, and A. Y. Sobri, "Relationship of school visionary leadership and organizational climate with teacher performance," in *Proceedings of the 1st International Conference on Information Technology and Education (ICITE 2020)*, 2020, pp. 624–629.
13. D. D. N. Benty *et al.*, "Validitas dan reliabilitas angket gaya kepemimpinan mahasiswa," *JAMP J. Adminitrasi dan Manaj. Pendidik.*, vol. 3, no. 3, pp. 262–271, 2020.
14. B. B. Wiyono, D. E. Kusumaningrum, T. Triwiyanto, R. B. Sumarsono, A. V. Valdez, and I. Gunawan, "The comparative analysis of using communication technology and direct techniques in building school public relation," in *2019 5th International Conference on Education and Technology, ICET 2019*, Oct. 2019, pp. 81–86.
15. R. B. Sumarsono, I. Gunawan, D. E. Kusumaningrum, D. D. N. Benty, and A. N. Bhayangkara, "Influence of lecturer's pedagogic competency level, quality of administrative services, completeness of lecture supporting facilities, and student satisfaction on learning motivation," *J. Ilmu Pendidik.*, vol. 27, no. 1, pp. 23–33, 2021.
16. M. L. Pulley, V. Sessa, and M. Malloy, "E-leadership: A two-pronged idea at Xerox, leadership development is via the web and about the web," *T+D*, vol. 56, no. 3, pp. 35–47, 2002.
17. A. Prastiawan *et al.*, "Organizational climate in school organizations: A literature review," in *Proceedings of the 1st International Conference on Information Technology and Education (ICITE 2020)*, 2020, pp. 725–728.
18. E. Ubaidillah, I. Gunawan, M. A. Adha, N. S. Ariyanti, and Y. Erviana, "Students perception of technology-assisted services and readiness of employee digital competencies in covid-19 pandemic era," in *Proceedings of the 6th International Conference on Education and Technology (ICET 2020)*, 2020, pp. 151–156.
19. S. Taftania *et al.*, "Implementation of total quality management through the leadership of schools in efforts to improve teacher creativity: A conceptual paper," in *Proceedings of the 1st International Conference on Information Technology and Education (ICITE 2020)*, 2020, pp. 501–505.
20. I. Bafadal, Juharyanto, A. Nurabadi, and I. Gunawan, "Efforts to improve the integrity of the principal with the moral debate model," in *Proceedings of the 4th International Conference on Education and Management (COEMA 2019)*, Jan. 2020, pp. 1–4.
21. S. O. Ningsih, I. Gunawan, and Sultoni, "Relationship of self-efficiency and school climate with teacher work motivation," in *Proceedings of the 6th International Conference on Education and Technology (ICET 2020)*, 2020, pp. 342–345.

22. Sul-toni, I. Gunawan, and D. N. Sari, "Validity and reliability of character education internalization instruments," in *Proceedings of the 4th International Conference on Education and Management (COEMA 2019)*, 2019, pp. 245–249.
23. I. Gunawan et al., "Pengaruh gaya kepemimpinan, kemampuan manajerial, efikasi diri, dan prestasi belajar terhadap kesiapan kerja mahasiswa," *JMSP J. Manaj. dan Supervisi Pendidik.*, vol. 4, no. 1, pp. 126–150, 2019.
24. A. Prastiawan et al., "School leadership skills in educational institutions," in *Proceedings of the 6th International Conference on Education and Technology (ICET 2020)*, 2020, pp. 438–441.
25. S. Radhakrishnan, S. Erbis, J. A. Isaacs, and S. Kamarthi, "Novel keyword co-occurrence network-based methods to foster systematic reviews of scientific literature," *PLoS One*, vol. 12, no. 3, pp. 1–16, Mar. 2017.
26. N. J. van Eck and L. Waltman, "Software survey: VOSviewer, a computer program for bibliometric mapping," *Scientometrics*, vol. 84, no. 2, pp. 523–538, Dec. 2010.
27. N. J. van Eck and L. Waltman, *VOSviewer manual*. Leiden: Univeriteit Leiden, 2020.
28. N. W. N. Setya et al., "Development of student leadership variables instruments: Validity and reliability analysis," in *Proceedings of the 1st International Conference on Information Technology and Education (ICITE 2020)*, 2020, pp. 541–545.
29. I. Bafadal, Juharyanto, A. Nurabadi, and I. Gunawan, "Principal leadership and its relationship with student learning achievements: A regression analysis," in *Proceedings of the 3rd International Conference on Educational Management and Administration (CoEMA 2018)*, 2018, pp. 156–158.
30. A. N. Miroj, B. R. Saputra, and I. Gunawan, "Principal learning leadership tips managing learning in schools," in *Proceedings of the 6th International Conference on Education and Technology (ICET 2020)*, 2020, pp. 85–88.
31. V. A. Sudharta, M. Mujiati, A. Rosidah, and I. Gunawan, "Gaya kepemimpinan kepala sekolah dalam perspektif psikologi," *JMSP (Jurnal Manaj. dan Supervisi Pendidikan)*, vol. 1, no. 3, pp. 208–217, 2017.
32. A. K. Pertiwi, S. S. A. Cahyani, R. C. Diana, and I. Gunawan, "Analisis interaksi simbolik kyai dan santri dalam perspektif kepemimpinan berbasis nilai dan etika," *JMSP (Jurnal Manaj. dan Supervisi Pendidikan)*, vol. 2, no. 3, pp. 185–191, Jul. 2018.
33. D. E. Kusumaningrum, R. B. Sumarsono, and I. Gunawan, "Pengaruh kepemimpinan pembelajaran, kepemimpinan perubahan, kepemimpinan spiritual, budaya sekolah, dan etika profesi terhadap kinerja mengajar guru," *JMSP J. Manaj. dan Supervisi Pendidik.*, vol. 4, no. 3, pp. 198–219, 2020.
34. B. J. Avolio, S. Kahai, and G. E. Dodge, "E-leadership: Implications for theory, research, and practice," *Leadersh. Q.*, vol. 11, no. 4, pp. 615–668, Dec. 2000.
35. B. J. Avolio, J. J. Sosik, S. S. Kahai, and B. Baker, "E-leadership: Re-examining transformations in leadership source and transmission," *Leadersh. Q.*, vol. 25, no. 1, pp. 105–131, Feb. 2014.
36. D. E. Kusumaningrum, R. B. Sumarsono, and I. Gunawan, "Teachers empowerment of pesantren-based junior high school East Java Province Indonesia," *J. Soc. Sci. Humanit. Stud.*, vol. 4, no. 3, pp. 29–33, 2018.
37. D. E. Kusumaningrum, R. B. Sumarsono, and I. Gunawan, "Principal empowerment through soft system methodology approach," in *Proceeding International Conferences on Education and Training, 2nd ICET 2016*, 2016, pp. 205–211.
38. D. E. Kusumaningrum, R. B. Sumarsono, and I. Gunawan, "Professional ethics and teacher teaching performance: Measurement of teacher empowerment with a soft system methodology approach," *Int. J. Innov. Creat. Chang.*, vol. 5, no. 4, pp. 611–624, 2019.
39. Sul-toni, I. Gunawan, and T. N. Rosalinda, "Pengaruh pembentukan tim dan kepemimpinan spiritual terhadap motivasi diri mahasiswa," *JMSP J. Manaj. dan Supervisi Pendidik.*, vol. 2, no. 3, pp. 210–216, 2018.

40. N. N. Sukawati, I. Gunawan, A. G. Prayoga, and A. D. Wardani, "Teacher personality, interpersonal relationships, performance, and professionalism in the learning process: A qualitative study," in *Proceedings of the 6th International Conference on Education and Technology (ICET 2020)*, 2020, pp. 250–254.
41. I. Bafadal *et al.*, "Moral as the basis of leadership practices in excellent schools," in *Proceedings of the 7th International Conference on Education and Technology (ICET 2021)*, Nov. 2021, pp. 149–154.
42. A. K. Pertiwi, S. S. A. Cahyani, R. C. Diana, and I. Gunawan, "The leadership of Kyai: A descriptive study," in *Proceedings of the 3rd International Conference on Educational Management and Administration (CoEMA 2018)*, 2018, pp. 121–126.
43. E. M. Budiarti, I. Gunawan, and B. A. Pambudi, "The effect of spiritual leadership and academic supervision on teacher performance," in *Proceedings of the 6th International Conference on Education and Technology (ICET 2020)*, 2020, pp. 157–161.
44. I. Gunawan *et al.*, "Let me know about your leader! The framework of instructional leadership," in *Proceedings of the 7th International Conference on Education and Technology (ICET 2021)*, Nov. 2021, pp. 109–114.

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