

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 of information technology.

Organizational leadership in the traditional context occurs when there is a face-toface 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 knowl-edge 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

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 1. The Keywords for Cluster 1 Red

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

Number	Keyword	Occurrences	Total link strength
1	Model	13	54
2	Teams	12	42
3	Technology	11	46
4	Trust	11	41
5	Information	10	27
6	e-government	5	16

Table 3. The Keywords for Cluster 3 Blue

Table 4. The Keywords for Cluster 4 Yellow

Number	Keyword	Occurrences	Total link strength
1	Transformational leadership	13	41
2	Transactional leadership	7	39
3	Commitment	5	14

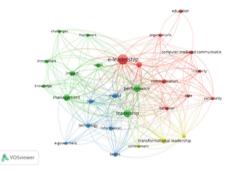


Fig. 1. The Keywords Co-Occurrence Network Visualization Of E-Leadership Studies

e-Leadership that predicts trust, knowledge, e-government, and education will become a hotspot in the e-Leadership field studies.

E-Leadership in organizational settings has been investigated by scholars. A field study of virtual teams by Avolio and Kahai [3] shows that initial interactions during team formation in an organization can predict the performance, satisfaction, and trust of subsequent members of the organization. Team members who attended the initial meeting to identify other team members and clarify their expectations had a high performance a few months later in the organization [28–30]. Therefore, the e-Leader must be able to promote the existence of interdependence with each other in all members of the organization, to give rational reasons for virtual team members to work together [4]. Culturally and geographically, virtual team members can be spread across different

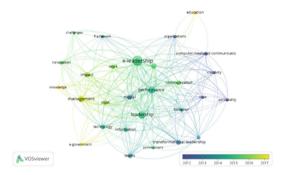


Fig. 2. The Keywords Co-Occurrence Overlay Visualization Of E-Leadership Studies

regions, therefore, a leader to carry out coaching on the close relationship of members in a geographically dispersed team [13, 31–33], needs to encourage the use of various communication media related to the completion of the tasks of each team member.

Scholars are also investigating e-Leadership in a more controlled setting. The results of the study of Avolio and Kahai [3] found controlled experiments on e-Leadership showed that participatory leadership models are more appropriate and suitable for generating solutions to organizational problems, both unstructured and semi-structured problems, while directive leadership is more appropriate and suitable for structured problems [34, 35]. The study of Avolio and Kahai [3] also noted that the features of groupware systems used as a medium in communication can replace organizational leadership. In addition, the study of Avolio and Kahai [3] also concluded that the motivation of the team can increase with anonymity. Therefore, e-Leadership should consider the use of polls and chat rooms to improve communication within the organization.

The use of information technology allows for more visual virtual interaction between leaders and followers. However, e-Leadership can involve content and leadership styles that are with traditional (face-to-face) leadership. Avolio and Kahai [3] report participatory leadership can increase opportunities for organizational members to be more involved in decision-making in organizations. The involvement of organizational members in the decision-making process is very important based on the perspective of human resource empowerment [36–38]. Therefore, participatory e-Leaders can utilize technologies such as chat rooms or electronic polls as a medium to convey information to their followers (members of the organization). As with traditional transformational leadership, e-Leadership can also inspire followers [39, 40]. Therefore, e-Leaders for this purpose can use media such as e-mails to communicate the organization's attractive vision and mission, a sense of excitement about new efforts and breakthroughs, or pride in achieving organizational performance targets [35].

A successful organizational leader in the view of e-Leadership has an additional challenge than traditional leaders which is to build trust and relationships faster [41–43]. The personal relationship between the leader and the close follower allows in a virtual setting and the leader of the organization can foster and assist the followers by paying attention to the information technology media owned by the organization. A leader in choosing a mode of communication should pay attention to his capacity

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.

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