Journal of Performance in Management and Accounting

E-ISSN 3123-2442

Vol. 2, No. 2, Februari 2026

Available online at: https://jpma.jagatra.co.id/index.php/jpma

MAPPING THE EVOLUTION OF QUANTUM LEADERSHIP IN ORGANIZATIONAL STRATEGY AND BEHAVIOR FOR RESILIENT INSTITUTIONS: A BIBLIOMETRIC ANALYSIS

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Abstract

This research aims to map the development of Quantum Leadership in the field of Strategy and Organizational Behavior, identify intellectual structures, collaboration networks, thematic evolution, as well as research gaps and future research agendas. The research uses a descriptive quantitative approach with a bibliometric analysis method. Data was obtained from the Dimensions database which produced 2,293 publications, then analyzed using VOSviewer through co-authorship, co-occurrence, citation, bibliographic coupling, overlay visualization, density visualization analysis, as well as an analysis of annual publication trends. The results of the study show that publications on Quantum Leadership have increased significantly, especially since 2022 until reaching its peak in 2025. The intellectual structure of this field is still built through linkages with positive leadership, ethical leadership, digital leadership, and distributed leadership. Network analysis shows that there is collaboration between authors, organizations, and countries dominated by several specific institutions and countries. The thematic evolution shows a shift in research focus towards organizational resilience, strategic agility, AI implementation, technological advancement, and sustainable business practice. This research also identifies that Quantum Leadership still requires strengthening conceptual definitions, developing operational indicators, and empirical validation in various organizational contexts. The research findings contribute to clarifying the map of the development of Quantum Leadership while providing future research directions for the development of Strategy and Organizational Behavior science.

Keywords: Quantum Leadership; Strategy; Organizational Behaviour; Bibliometric Analysis; VOSviewer; Dimensions Database.

1. INTRODUCTION

Changes in the increasingly complex organizational environment have encouraged the need for a leadership paradigm that is able to respond to uncertainty, technological dynamics, and changes in organizational behavior in a more adaptive way than conventional leadership approaches (Zohar, 2021). This complexity is characterized by increasing inter-stakeholder interdependence, accelerating digital transformation, and the need for organizations to maintain competitiveness through innovation, continuous learning, and adaptability to changes that take place in a nonlinear manner (Pallathadka & Roy, 2025). In this context, Quantum Leadership is beginning to gain attention as a leadership paradigm that offers a different perspective than traditional leadership models because it places uncertainty, system connectedness, cross-border collaboration, and organizational learning as the main foundation of the leadership process (Hataminasab, 2025).

Quantum Leadership is understood as a leadership framework that integrates nonlinear principles, probabilistic principles, as well as dynamic relationships between individuals, teams, and organizations in the face of an increasingly complex environment (Akyürek, 2024). Although the term Quantum Leadership still has a relatively limited number of publications

compared to other leadership paradigms, the development of the literature shows that this concept has a strong relationship with positive leadership, ethical leadership, digital leadership or e-leadership, as well as distributed leadership that has grown rapidly in the last two decades (Hsieh et al., 2023). The relationship shows that Quantum Leadership does not emerge as a stand-alone concept, but rather develops through a synthesis of various contemporary leadership paradigms that equally emphasize organizational adaptation, collaboration, and learning (Porter-O'Grady et al., 2026). Therefore, understanding the conceptual development of Quantum Leadership is important to clarify the position of this concept in the modern leadership literature as well as identify the space for theoretical development that is still open. This condition makes bibliometric research a relevant approach to systematically map the development of science so that the direction of the development of Quantum Leadership can be understood more comprehensively (Zhou & Chen, 2025).

The urgency of this research is increasing in line with the acceleration of organizational transformation influenced by digitalization, artificial intelligence, changes in work models, and the increasing need for organizational leadership that is able to build resilience and innovation in a sustainable manner. The literature shows that modern organizations can no longer rely on a linear hierarchical structure because decision-making processes are increasingly influenced by collaborative networks, real-time information exchange, and organizational ability to perform sensemaking to various environmental changes (Delgarm et al., 2022). In this perspective, Quantum Leadership offers an approach that places organizational learning, cross-functional collaboration, strategic adaptation, and digital technology integration as important elements in building a resilient organization (Krauter, 2025).

The development of digital leadership and distributed leadership shows that information technology not only functions as an operational tool, but also as a social infrastructure that enables cross-location coordination, knowledge network formation, and acceleration of organizational innovation ((Alawamleh et al., 2024). On the other hand, positive leadership and ethical leadership show that trust, employee well-being, empathy, and ethical values remain the main foundation of an organization's success in the face of an uncertain environment (Hsieh et al., 2023). Thus, Quantum Leadership can be seen as a paradigm that integrates technological dimensions, organizational behavior, ethical values, and adaptive capabilities into one more comprehensive leadership framework. However, although the development of these themes is quite rapid, the intellectual structure that specifically discusses Quantum Leadership is still not systematically mapped, so a bibliometric study is needed that is able to show the direction of the evolution of concepts, the relationship between themes, and opportunities for future research development (Dorri & Farahani, 2025).

The results of bibliometric mapping obtained in this study show that the development of publications on themes related to Quantum Leadership has increased significantly, especially from 2022 to 2025 (Bilgen & Elçi, 2022). The publication development graph shows a growth trend consistent with the peak of publication in 2025 before experiencing a temporary decline in 2026 which is very likely influenced by the publication year that has not yet ended (Dorri & Farahani, 2025; Stewart et al., 2025). The findings show that academic attention to modern leadership related to innovation, strategy, organizational behavior, governance, digital transformation, and organizational resilience is increasing. Analysis keyword co-occurrence shows that terms such as innovation, leadership, challenge, theory, manager, market, corporate governance, and organizational resilience is the center of the research network, thus illustrating that the development of Quantum Leadership is still largely built through its relationship with contemporary leadership themes (Cai et al., 2024; Pallathadka & Roy, 2025). Visualization overlay It shows that the focus of the latest research is shifting towards the issues of digital

leadership, artificial intelligence implementation, organizational resilience, agility, technological advancement, and sustainable business practices which reflect the shift of academic attention towards leadership that is more adaptive to technological changes and organizational complexity (Bozorgi et al., 2020; Hataminasab, 2025; Zhang et al., 2024). In addition, the analysis density visualization shows that innovation, leadership, theory, and challenges are areas with the highest research density so that they become the center of intellectual development in this field. The findings reinforce the argument that Quantum Leadership has a great chance of developing as a future leadership paradigm, but still requires more systematic conceptual mapping to make its theoretical limits clearer (Cai et al., 2024; Pallathadka & Roy, 2025; Zhou & Chen, 2025).

In addition to showing the development of the research theme, bibliometric analysis also shows an interesting pattern of scientific collaboration at the author, institutional, and state levels. Network co-authorship shows several groups of authors who are actively building international collaborations, although the network is still fragmented, showing that the research community on Quantum Leadership is not yet fully integrated globally (Watson et al., 2018). At the organizational level, several universities such as the University of Johannesburg, the University of Warwick, the University of Oxford, UNSW Sydney, the Indian Institute of Technology, and Copenhagen Business School play an important role as nodes in the network of research collaborations. Meanwhile, the analysis of country collaboration shows the dominance of the United States, India, China, Australia, Germany, Italy, and Spain as centers of knowledge production as well as a liaison of international research networks (Chinchilla-Rodríguez et al., 2019; Doyle et al., 2026; Hudson et al., 2020).

This pattern shows that research development is still concentrated in certain countries so that opportunities for collaboration across regions, including developing countries, are still very wide. These findings are also in line with the argument that the development of modern leadership theory is heavily influenced by the formation of knowledge networks, distributed leadership, and international collaboration that accelerate the exchange of ideas and the development of new theories (Adams et al., 2025). Therefore, bibliometric mapping not only provides an overview of the development of publications, but is also able to explain intellectual structures, collaboration networks, evolution of research themes, and opportunities for the development of Quantum Leadership in the future.

Based on these conditions, this study aims to map the conceptual development of Quantum Leadership in organizational strategies and behaviors through a bibliometric approach so that it can explain the intellectual structure, theme evolution, scientific collaboration network, and the direction of future research development. This research also aims to identify the dominant themes, authors, institutions, countries, and relationships between concepts that form the theoretical foundation of Quantum Leadership. By using bibliometric analysis through science mapping, co-authorship, co-citation, bibliographic coupling, keyword co-occurrence, as well as thematic evolutionary analysis as recommended in the bibliometric literature (Lim & Kumar, 2023), this research is expected to be able to provide a more complete picture of the position of Quantum Leadership in the development of contemporary leadership science.

In addition, this research is expected to be able to identify research gaps that still exist in the development of the operational definition of Quantum Leadership, empirical testing of nonlinear dimensions and inter-level interconnectedness, integration of digital technology in leadership practices, and validation of concepts in various industrial and cultural contexts (Barik & Nayak, 2023). Based on these objectives, the formulation of this research problem is: (1) how the development of scientific publications on Quantum Leadership in organizational strategy and behavior; (2) how the intellectual structure, collaborative networks, and thematic

evolution of Quantum Leadership research are; and (3) how the research gap and future research agenda can support the development of Quantum Leadership as a relevant organizational leadership paradigm in a complex and dynamic environment. Thus, this research is expected to make a theoretical contribution through mapping scientific developments while providing a conceptual foundation for future empirical research on Quantum Leadership (Bilgen & Elçi, 2022; Cai et al., 2024; Dorri & Farahani, 2025).

2. RESEARCH METHODS

This study uses the Qualitative by the Bibliometrik Analysis (bibliometric analysis) to map the conceptual development of Quantum Leadership in organizational strategies and behaviors (Saran, 2026; Wandrial, 2026). The bibliometric approach was chosen because it is able to describe the intellectual structure of a field of science through the analysis of the relationship between documents, authors, institutions, countries, and the development of research themes systematically (Cai et al., 2024; Dorri & Farahani, 2025; Krauter, 2025). In addition, this method allows the identification of patterns of scientific collaboration, the evolution of research topics, and research gaps that are still open so that they can be the basis for the preparation of future research agendas (Lim & Kumar, 2023). The research design is exploratory by utilizing secondary data in the form of metadata of scientific publications obtained from the database Dimensions (Herzog et al., 2020; Suharso et al., 2021).

The literature search process was carried out using keywords that have been determined according to the scope of Quantum Leadership, Strategy, Management and Organisational Behaviour, as well as the relevant Sustainable Development Goals theme (Cai et al., 2024; Krauter, 2025; Mafu & Senekane, 2023). Search results result in 2,293 documents that meet the search criteria and is subsequently exported in a format compatible with the software VOSviewer for the bibliometric analysis process. This approach was chosen because it is able to produce a comprehensive scientific visualization of the structure of knowledge, the relationship between research elements, and the dynamics of the development of the field of science under study (Alawamleh et al., 2024). The main instrument in this study is in the form of publication metadata which includes author information, article title, abstract, keywords, year of publication, organization affiliation, author's country of origin, publication source, and citation data obtained from Dimensions.

All of this metadata is processed using VOSviewer to generate various forms of visualization and bibliometric analysis. The analysis carried out includes co-authorship analysis to map collaboration networks between authors, organizations, and countries; co-occurrence analysis 1 identifies the relationship between keywords and the development of the research theme; citation analysis to see the influence of publications based on the number of citations; bibliographic coupling to identify similarities in references between articles; and co-citation analysis to map the intellectual structure of the research field. In addition, this study also produces network visualization to describe the relationship between nodes, overlay visualization to show the temporal development of the research topic, and density visualization to identify the research areas that have the highest study density.

Furthermore, an analysis of the development of the number of publications by year was carried out to determine the dynamics of the growth of Quantum Leadership research during the observation period. Interpretation of results is carried out through the sensemaking so that the pattern of relationships, knowledge structures, and evolution of themes can be explained systematically and result in identification of research gap and future research agendas as recommended in bibliometric studies (Adams et al., 2025). With this procedure, all stages of research, from metadata collection, data processing using VOSviewer, to interpretation of

visualization results and bibliometric analysis, can be replicated by other researchers using the same keywords, data sources, and analysis parameters to ensure transparency, consistency, and reproducibility of research (Beck et al., 2024; Dorri & Farahani, 2025; Doyle et al., 2026).

3. RESEARCH RESULTS

3.1. Development of Quantum Leadership Publications

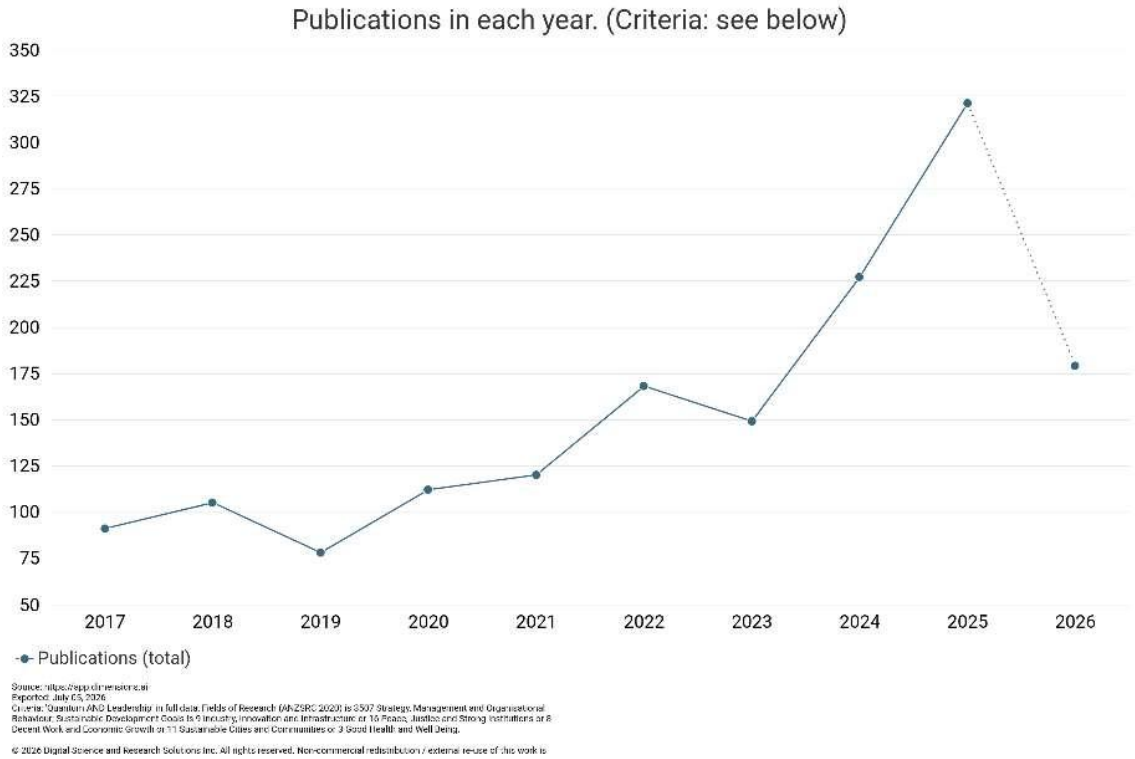


Figure 1. Visualization Mapping with VOSviewer Research Model

Source: Researcher's data, 2026

Literature search results in the database Dimensions Produce 2,293 documents that meet the search criteria and are further analyzed using the VOSviewer software. Publication data shows that research related to Quantum Leadership, Strategy, Management and Organisational Behaviour, as well as the theme of Sustainable Development Goals has experienced fairly consistent development throughout the observation period from 2017 to 2026. The number of publications fluctuated at the beginning of the research period, then showed a more significant increase starting in 2022. 2025 will be the period with the highest number of publications, while data for 2026 shows a lower number of publications compared to the previous year. The decline is still provisional data because the publication year has not ended at the time the data collection process is carried out. In general, the trend of publications shows an increasing trend which shows the increasing attention of academics to modern leadership themes related to innovation, organizational strategy, organizational behavior, governance, and organizational transformation (Lord et al., 2015). Annual development data only shows changes in the number of publications without providing an explanation of the factors causing the change.

Table 1. Number of Publications

Years	Number of Publications
2017	91
2018	105
2019	78
2020	112
2021	120
2022	169
2023	149
2024	227
2025	321
2026*	179

The data for 2026 is provisional data at the time of data collection.

3.2. Co-authorship Analysis

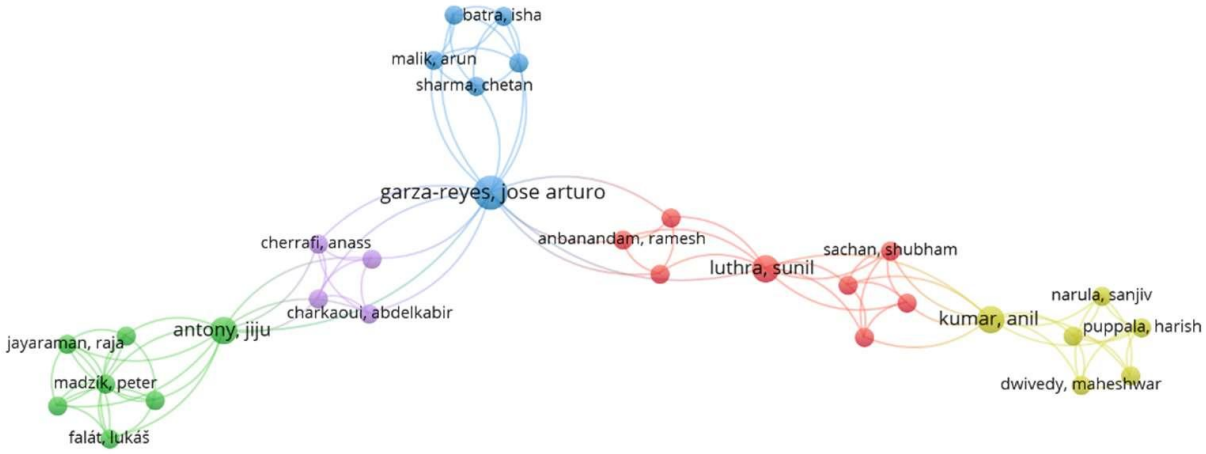


Figure 2. Co-authorship Visualization

Source: Researcher's data, 2026

Analysis co-authorship resulting in several groups of authors that are interconnected through scientific collaborative relationships. Network visualization shows that the authors form several clusters connected by connectivity lines with different levels of connectivity. Larger nodes show authors who have a higher level of collaboration than other authors (Du et al., 2024). Some of the author's names appear as a link between clusters so that they have a central position in the collaboration network. Among the authors, the names of the Jose Arturo Garza-Reyes, Sunil Luthra, Anil Kumar, Jiju Antony, as well as several other authors who formed different collaboration groups. The intercluster relationship shows the existence of cross-group research cooperation, although most of the collaboration still occurs in relatively small groups. The visualization also shows that not all authors are directly connected to each other, so the collaboration network is still spread across several research communities. These results only describe the structure of the author's collaborative network based on the analyzed bibliographic data.

3.3. Organizational Collaboration Network

The analysis of co-authorship organizations shows the collaborative relationships between organizations that contribute to publications in this field of research. The visualization shows that some universities have larger node sizes than others. The University of Johannesburg emerged as one of the most connected organizations in the collaborative network.

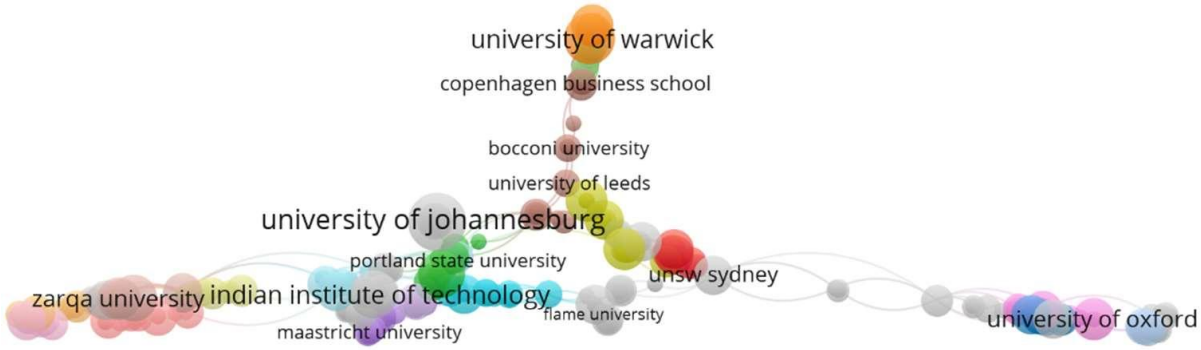


Figure 3. Visualization of Organizational Collaboration

Source: Researcher's data, 2026

In addition, the University of Warwick, the University of Oxford, UNSW Sydney, the Indian Institute of Technology, Copenhagen Business School, the University of Leeds, and Bocconi University are also seen to have links with other organizations in the research network. Some organizations form dense collaborative groups, while others have relationships with only a small number of institutions. The relationship between institutions is shown through a connecting line that represents the collaboration of scientific publications. The organizational distribution in the visualization shows that there are different collaboration centers according to the intensity of the publication relationship. These results describe the pattern of organizational relationships without providing an explanation of the quality or impact of the collaboration.

3.4. State Collaboration Network

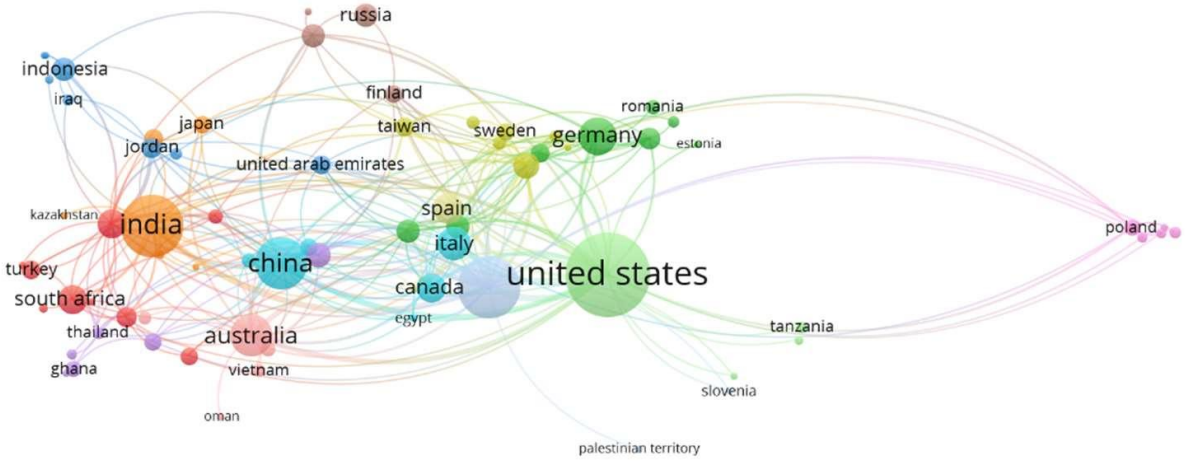


Figure 4. Visualization of State Collaboration

Source: Researcher's data, 2026

Country collaboration analysis shows that research in this field involves collaboration from different countries. The United States has the largest node in the network, making it the country with the highest level of collaboration based on the data analyzed. Other countries that also

have important positions include India, China, Australia, Germany, Italy, Spain, South Africa, Japan, and Canada. In addition to these countries, several other countries also appear in the network with smaller node sizes, such as Finland, Taiwan, Poland, Romania, Slovenia, Indonesia, Jordan, Iraq, Thailand, Ghana, Vietnam, Turkey, the United Arab Emirates, Kazakhstan, Oman, Tanzania, Palestine, Estonia, and Russia. Relations between countries are visualized through connectivity lines that show the existence of cross-border publication collaborations. Some countries act as the main liaison that connects various groups of other countries in the research network. Some countries form regional collaboration groups, while others deal with different regions at the same time. These results present an international collaboration network structure based on publication metadata.

3.5. Keyword Co-occurrence Analysis

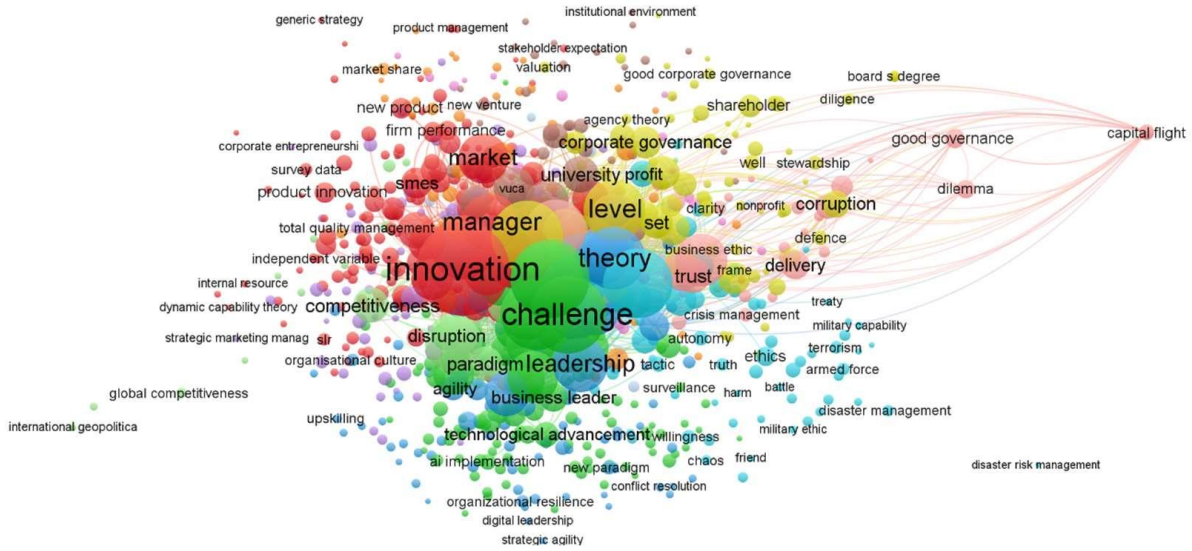


Figure 5. Visualization of Keyword Co-occurrence

Source: Researcher's data, 2026

Analysis keyword co-occurrence generate a keyword network consisting of several research clusters. Visualization shows that the keyword innovation, challenge, theory, manager, leadership, market, level, corporate governance, set, and delivery has a relatively larger node size than other keywords. In addition to these main keywords, keywords such as organizational resilience, digital leadership, strategic agility, AI implementation, quantum leadership, technological advancement, business leader, agility, ethics, trust, autonomy, corruption, terrorism, disaster management, corporate governance practice, shareholder, SMEs, product innovation, and firm performance. Each keyword group forms a cluster that is connected by a relationship line based on the frequency of co-occurrence in the same document. The size of the node indicates the level of frequency with which the keyword appears, while the position between words indicates the degree of interconnectedness in the research network (Ozek et al., 2022). Some keywords are in the central position of the network, while others are in the edge areas with lower connectivity levels. These results show the distribution of research themes based on the relationships between keywords.

3.6. Overlay Visualization

Visualization overlay Shows the distribution of keyword appearance time based on the average year of publication. The colors on each node represent a different time period, ranging from blue for earlier publications to yellow for newer publications (Xu, 2025). Keywords that

are on the older color spectrum indicate that the theme has appeared first in the literature, while keywords with lighter colors indicate a newer theme. In this visualization, it can be seen that several keywords such as business leader, AI implementation, organizational resilience, strategic agility, technological advancement, and sustainable business practice are in a newer color group than a number of other themes. On the other hand, keywords such as corporate governance, good governance, market, theory, and manager more are in the range of colors that indicate an earlier appearance.

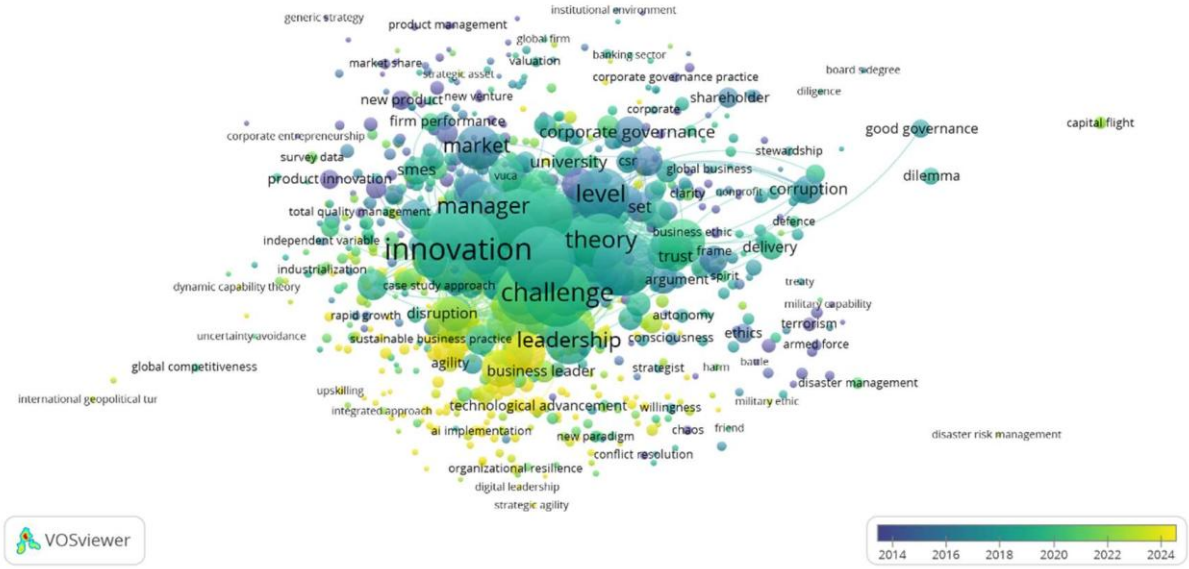


Figure 6. Overlay Visualization

Source: Researcher's data, 2026

The color distribution does not change the position of the relationship between keywords, but only shows the temporal dimension based on the average year of publication. The results of the overlay only present a chronological distribution of the research theme without interpreting the direction of its development.

3.7. Density Visualization



Figure 7. Density Visualization

Source: Researcher's data, 2026

Analysis density visualization shows the level of research density based on the frequency of occurrence of keywords in the bibliometric network. Areas with yellow color indicate the highest density, while green depicts moderate density and blue indicates lower density (Afraz et al., 2022). Based on these visualizations, the keywords innovation, challenge, theory, manager, and level be in the area with the highest density. Around the central area also appeared the keyword leadership, market, corporate governance, and delivery which has a relatively high density level compared to other themes. Keywords that are on the edge of the network such as capital flight, disaster risk management, global competitiveness, international geopolitical turbulence, and good governance has a lower density rate. The density distribution suggests that research is not evenly distributed across all themes that emerge in the network. Density visualization only describes the concentration of keyword occurrence based on bibliographic data without explaining the causal relationship between the research variables.

3.8. Bibliometric Results Summary

Overall, a bibliometric analysis of 2,293 publications yielded several key findings based on data processed using VOSviewer. Analysis of publication developments shows an increase in the number of articles from year to year with a peak of publication in 2025. Author network analysis resulted in several collaborative groups led by authors with a high level of connectivity. Organizational analysis shows that there are a number of universities that are centers for collaboration in research networks. The country analysis shows the involvement of various countries with the dominance of the United States, India, China, Australia, and several European countries. Keyword analysis produced a number of dominant themes related to innovation, leadership, theory, manager, challenge, corporate governance, organizational resilience, digital leadership, and technological advancement. Overlay analysis shows the temporal distribution of the emergence of the research theme, while the density analysis shows the density level of each theme in the bibliometric network. All of these results are the presentation of the main data obtained from the bibliometric analysis process without interpreting the relationship or implications of the research findings.

4. DISCUSSION

4.1 RQ1 Discussion: How is the Evolution of Quantum Leadership Publications in Strategy and Organizational Behaviour?

The results of bibliometric analysis show that the development of publications on Quantum Leadership in the context of Strategy and Organizational Behavior has experienced increasingly significant growth during the period 2017–2026. Based on data obtained from Dimensions as many as 2,293 publications, it can be seen that the number of publications fluctuated at the beginning of the observation period, then entered a more stable growth phase since 2020 and increased sharply from 2022 until reaching its peak in 2025. This pattern shows that the scientific community's attention to leadership paradigms oriented towards organizational complexity is growing.

Although the number of publications in 2026 is lower than the previous year, this condition cannot be considered a downward trend because the data was collected when the publication year was still ongoing so that it does not reflect the overall number of articles to be published. Therefore, the results of this study show that Quantum Leadership has developed from a relatively limited concept to one of the themes that is getting more and more attention in the study of organizational strategy and behavior (Aghababayi et al., 2013). These findings also show that the development of Quantum Leadership does not take place in isolation, but develops alongside a change in the paradigm of modern leadership that emphasizes adaptation, collaboration, innovation, and organizational learning. Thus, bibliometric results show an increase in research intensity which places Quantum Leadership as one of the developing fields in the contemporary leadership literature (Karakose et al., 2022; Krauter, 2025).

The increase in the number of publications is closely related to the change in the orientation of leadership research which has begun to shift from a hierarchical approach to a more adaptive, collaborative, and complexity-based paradigm. The literature on which this research is based shows that Quantum Leadership is understood as a leadership framework that integrates the principles of nonlinearity, uncertainty, interdependence, and relationship dynamics between individuals, teams, and organizations (Delgarm et al., 2022; Jie et al., 2021; Krauter, 2025; Watson et al., 2018). This shift can be seen from the increasingly dominant research that links Quantum Leadership with positive leadership, ethical leadership, digital leadership (digital leadership), as well as distributed leadership as the main conceptual foundation (Alawamleh et al., 2024; Hsieh et al., 2023). The bibliometric results in this study reinforce these findings because the visualization of the keyword network shows that the term leadership, innovation, challenge, theory, manager, and organizational resilience is at the center of the research network. The position of the keyword shows that the development of Quantum Leadership is more built through the integration of various contemporary leadership paradigms than through the formation of stand-alone theories. Thus, the development of publications found in this study shows that Quantum Leadership is developing as a paradigm that accommodates the needs of modern organizations for leadership that is able to face increasingly dynamic environmental changes (Leong, 2023; Orabi et al., 2024; Udin, 2025).

The development of publications also shows a change in the focus of research from conceptual discussions to strategic issues related to organizational transformation. The results of the overlay visualization show that the latest research is starting to lead to the themes of organizational resilience, strategic agility, technological advancement, AI implementation, digital leadership, and sustainable business practices. These findings show that Quantum Leadership is increasingly associated with the organization's ability to manage change, accelerate learning, increase innovation, and utilize digital technology in the decision-making

process. The shift in theme is in line with the development of the literature that places digital leadership as a social and technological infrastructure that enables cross-location coordination, global collaboration, and more adaptive organizational formation. In addition, the development of research on ethical leadership and positive leadership also shows that the dimensions of well-being, empathy, trust, and organizational values are increasingly integrated into modern leadership studies. Therefore, the results of this study show that the development of Quantum Leadership is not only marked by an increasing number of publications, but also by the increasing scope of research that links leadership to organizational strategy, innovation, technology, and organizational behavior.

Another finding that strengthens the development of Quantum Leadership can be seen from the results density visualization which shows that the center of research density is on the keyword innovation, challenge, theory, manager, and leadership. This condition shows that innovation is the most dominant theme in the development of literature related to Quantum Leadership. The findings are consistent with the argument that modern organizations need leadership that is able to create continuous learning, encourage experimentation, and improve an organization's ability to respond to uncertainty (Dong et al., 2026). In addition, the appearance of keywords such as organizational resilience, strategic agility, and AI implementation shows that research is starting to expand the scope of Quantum Leadership towards technology-based organizational transformation. Previous literature has also shown that organizational learning, adaptability, and cross-network collaboration are important characteristics in the Quantum Leadership paradigm that distinguish it from conventional leadership. Thus, bibliometric results not only show an increase in the number of studies, but also show a change in the substance of research towards issues that are increasingly relevant to contemporary organizational challenges.

From perspective Strategy, the development of the publication shows that Quantum Leadership is increasingly positioned as an approach that supports the process of formulation and implementation of organizational strategies in complex environments. The literature on which this research is based explains that organizational strategy is no longer seen as a linear process that is completely controlled by formal leaders, but rather as the result of the interaction of various actors in an ever-growing network of organizations (Adams et al., 2025). The results of this study support this view through the emergence of themes such as strategic agility, organizational resilience, technological advancement, and innovation as part of a rapidly growing research network. This shows that the development of Quantum Leadership is increasingly directed at the organization's ability to perform sensemaking, build cross-functional collaboration, and develop adaptive capabilities in dealing with environmental changes. Thus, the development of publications shows that Quantum Leadership is beginning to be positioned as a strategic paradigm that supports the development of organizations that are more flexible, innovative, and learning-oriented.

From the perspective of Organizational Behavior, the results of the study also show that Quantum Leadership is increasingly associated with human-oriented aspects of organizational behavior. The emergence of keywords such as trust, ethics, autonomy, business leader, organizational resilience, and digital leadership shows that the focus of research has shifted towards the formation of a work environment that supports collaboration, well-being, and continuous learning (Diniz et al., 2025; Saran, 2026). These findings are consistent with the literature that explains that positive leadership and ethical leadership are an important foundation in building healthy organizational behavior through increased trust, empathy, employee well-being, and commitment to shared goals. In addition, the development of digital leadership shows that modern organizational behavior is increasingly influenced by the ability

of leaders to leverage technology to build coordination and collaboration across organizational boundaries. Thus, the development of the publication Quantum Leadership shows that this paradigm is increasingly understood as an approach that integrates strategic dimensions, organizational behavior, technology, and ethical values into a more comprehensive leadership framework.

Overall, the answer to Research Question 1 shows that the development of Quantum Leadership publications in Strategy and Organizational Behavior has clearly increased both in terms of quantity and breadth of research themes. The increase in the number of publications since 2022, the development of international collaboration networks, the increase in organizations involved in research, and the emergence of new themes such as AI implementation, digital leadership, organizational resilience, and strategic agility shows that Quantum Leadership has developed into one of the increasingly relevant research areas in modern management studies. The results of this study also show that the development of Quantum Leadership is still largely built through integration with positive leadership, ethical leadership, digital leadership, and distributed leadership as described in the literature used in this study. Thus, these findings provide evidence that Quantum Leadership is no longer just a conceptual concept, but has developed into a research field that has an increasingly broad knowledge structure and becomes the basis for the development of organizational strategies and organizational behavior in complex and dynamic environments.

4.2 RQ2 Discussion: How is the Intellectual Structure, Collaborative Network, and Thematic Evolution of Quantum Leadership Research?

The results of the bibliometric analysis show that the intellectual structure of the research Quantum Leadership It is still in the development stage and is built through linkages with various contemporary leadership paradigms. In contrast to leadership theories that already have well-established conceptual and empirical constructions, Quantum Leadership has not yet formed a completely independent cluster of literature (Akyürek, 2024; Krauter, 2025). Instead, the structure of knowledge identified through analysis co-occurrence, co-authorship, as well as bibliometric networks show that Quantum Leadership develops through the integration of themes such as positive leadership, ethical leadership, digital leadership (digital leadership), and distributed leadership. These findings are in line with a conceptual study that explains that Quantum Leadership is a leadership framework that adopts the principles of non-linearity, uncertainty, intersystemality, and continuous learning in the face of organizational complexity (Alawamleh et al., 2024). Therefore, the results of this study show that the intellectual structure of Quantum Leadership is not built through one dominant school of theory, but through the synthesis of various modern leadership paradigms that have adaptive, collaborative, and value-based characteristics. This condition explains why the keyword network generated by VOSviewer shows a very strong relationship between leadership themes and innovation, strategy, organizational governance, digital transformation, and organizational behavior. Thus, the intellectual structure of Quantum Leadership can be understood as a multidisciplinary network that continues to evolve following the dynamics of modern organizations (Esenyel, 2024; Markham, 2024).

The analysis of keyword co-occurrence further clarifies how the intellectual structure is formed. Network visualization shows that the keywords innovation, leadership, challenge, theory, manager, market, corporate governance, and organizational resilience occupy a central position in the research network. This position shows that the development of Quantum Leadership is more centered on discussions about the organization's ability to face environmental challenges through innovation, adaptive leadership, and dynamic organizational management. In addition to these main themes, keywords such as AI implementation, strategic

agility, digital leadership, business leader, technological advancement, trust, ethics, autonomy, and sustainable business practices also emerged which forms relationships with various other research clusters. The structure of the relationship between these keywords shows that Quantum Leadership has a multidimensional character that connects aspects of strategy, organizational behavior, digital technology, governance, and organizational learning in one research ecosystem. These results support the literature explanation that Quantum Leadership develops through the integration of various leadership approaches that previously developed separately, especially positive leadership, ethical leadership, digital leadership, and distributed leadership (Harrington, 2022; Jame, 2022). Therefore, the intellectual structure found in this study shows that Quantum Leadership has developed into a conceptual space that connects various disciplines in management science and organizational behavior.

In addition to the conceptual structure, the results of the study also show that the development of Quantum Leadership is supported by an increasingly wide network of scientific collaborations. Analysis co-authorship shows that there are several groups of authors who are interconnected through collaborative relationships, although the network still consists of a number of relatively separate clusters. Some authors have a central position because they are the liaison between research groups so as to contribute to the dissemination of knowledge in this field. This condition shows that Quantum Leadership research has not been dominated by one particular scientific group, but is developing through the contributions of various academic communities that have different research focuses. The literature on distributed leadership explains that the formation of knowledge networks and scientific collaboration is one of the important mechanisms in accelerating organizational learning and generating conceptual innovation through the interaction of various research actors (Adams et al., 2025). The findings of this study show that this mechanism also occurs in the development of Quantum Leadership, where collaboration between authors forms a network of exchange of ideas that enriches conceptual perspectives on leadership in complex environments. Thus, the author's collaboration network is one of the important elements that make up the intellectual structure of Quantum Leadership.

At the organizational level, bibliometric analysis shows that research development is supported by a number of institutions that have a strategic position in international collaboration networks. The organisation's visualization shows that several universities such as the University of Johannesburg, University of Warwick, University of Oxford, UNSW Sydney, Indian Institute of Technology, University of Leeds, Copenhagen Business School, and Bocconi University become an important node in the research network. The interconnectedness between these institutions shows that the development of Quantum Leadership is mostly carried out through cross-university and cross-disciplinary cooperation. This pattern is in line with the characteristics of Quantum Leadership which emphasizes the importance of cross-border collaboration, collective learning, and knowledge exchange in dealing with organizational complexity. On the other hand, there are still a number of organizations that only have limited relationships with other institutions, thus showing that collaboration networks are not yet fully integrated globally. The findings indicate that there is still an opportunity to expand international collaboration so that the development of Quantum Leadership theory becomes more comprehensive and has wider validity. Thus, the network of organizations found in this study reflects the process of forming a scientific community that is still evolving.

Analysis results country collaboration shows that the development of Quantum Leadership is also supported by a fairly wide network of collaboration between countries. The United States emerged as the center of collaboration networks with the highest level of connectivity, followed by India, China, Australia, Germany, Italy, Spain, South Africa, Japan, and Canada. The

dominance of these countries shows that research development is still concentrated in countries that have strong research capacity and academic networks. However, the visualization also shows the involvement of various developing countries, including Indonesia, thus showing that research on Quantum Leadership is starting to spread to various regions. The literature on leadership knowledge networks explains that international collaboration has an important role in accelerating knowledge diffusion, broadening research perspectives, and improving the quality of theory development through the exchange of experiences across organizational contexts (Hussain et al., 2025). The results of this study show a similar pattern, namely the development of international networks as one of the factors that strengthen the intellectual structure of Quantum Leadership. Thus, collaboration between countries is an important part of the process of forming a global scientific community that supports the development of the concept of Quantum Leadership.

The thematic evolution of the research is also clearly seen through the results overlay visualization. The visualization shows that research in the early period focused more on themes such as corporate governance, market, manager, theory, and leadership. Over time, the focus of research shifted towards more contemporary themes such as AI implementation, digital leadership, organizational resilience, strategic agility, technological advancement, and sustainable business practice. This shift shows that academic attention is increasingly directed to leadership skills in managing digital transformation, increasing organizational resilience, and building adaptive strategies in the midst of rapid environmental changes. This evolution is in line with the literature that explains that modern leadership is no longer only oriented to organizational effectiveness, but also to the ability to build learning systems, digital collaboration, and sustainable adaptation to complex environments (Ekşili, 2023). In addition, the development of the theme towards AI implementation shows that Quantum Leadership research is beginning to interact with the development of intelligent technologies as part of the transformation of modern organizations. Thus, the thematic evolution found in this study shows a change in research orientation from traditional leadership issues to an increasingly adaptive, digital, and complexity-based leadership paradigm.

Overall, the answer to Research Question 2 shows that the intellectual structure, collaborative network, and thematic evolution of Quantum Leadership research develop simultaneously and reinforce each other. The intellectual structure is built through the integration of positive leadership, ethical leadership, digital leadership, and distributed leadership as the main conceptual foundations (Hsieh et al., 2023). The collaborative network demonstrates the involvement of authors, organizations, and countries that make up the international scientific community despite the fragmentation of several research clusters. Meanwhile, thematic evolution shows a shift in research focus from conceptual discussions to strategic issues related to digital transformation, artificial intelligence implementation, organizational resilience, strategic agility, and organizational sustainability. These three aspects show that Quantum Leadership is not only developing in terms of the number of publications, but also experiencing the maturation of knowledge structures, the expansion of collaboration networks, and the diversification of research themes. These findings strengthen the position of Quantum Leadership as an increasingly established field of study in the literature Strategy and Organizational Behaviour, while showing that the direction of its development is greatly influenced by technological dynamics, organizational complexity, and the need for a more adaptive leadership paradigm in dealing with environmental changes.

4.3 RQ3 Discussion: What is the Research Gap and Future Research Agenda of Quantum Leadership?

The results of the bibliometric analysis show that Quantum Leadership is a growing field of research, but it still has a number of conceptual, methodological, and empirical gaps that need attention in future research. Although the number of publications has increased significantly, the results network visualization, overlay visualization, and density visualization shows that Quantum Leadership has not yet formed a fully independent research cluster like the established leadership theory. On the contrary, the knowledge structure that has been formed is still dominated by the relationship with the themes of positive leadership, ethical leadership, digital leadership, distributed leadership, innovation, organizational governance, and organizational behavior. This condition shows that the development of Quantum Leadership is still at the conceptual consolidation stage, where researchers are using more existing leadership paradigms as a basis to explain the characteristics of Quantum Leadership (Ekşili, 2023). In other words, the concept of Quantum Leadership does not yet have conceptual boundaries that are really agreed upon so that interpretations of its dimensions, characteristics, and scope are still very diverse. The results of this study reinforce the findings because the keyword Quantum Leadership has not yet become the dominant center in the research network, while keywords such as innovation, leadership, challenge, theory, and organizational resilience It is precisely the core of the intellectual structure that develops. Therefore, research gap The first that has been successfully identified is the limited conceptual construction that explicitly defines Quantum Leadership as a leadership paradigm that is different from other leadership approaches.

The second gap has to do with the unavailability of operational definitions and indicators of Quantum Leadership measurement that can be used consistently in empirical research. The literature on which this research is based explains that Quantum Leadership has characteristics such as non-linearity, sensemaking, cross-organizational connectivity, continuous learning, systemic adaptation, digital collaboration, and integration of ethical values and organizational well-being (Dong et al., 2026). However, the bibliometric results show that existing research still discusses these characteristics more conceptually than testing them as an empirically measurable construct. This can be seen from the dominance of keywords related to theory, innovation, and leadership in general compared to terms that specifically describe the dimension of Quantum Leadership. Thus, the absence of standard measurement instruments makes research results difficult compared to studies and industries. This condition also limits the ability of researchers to test the relationship between Quantum Leadership and various organizational variables such as innovation, organizational resilience, strategic performance, and organizational behavior. Therefore, the development of valid and reliable operational indicators is one of the most important research agendas for the development of Quantum Leadership in the future (Bozorgi et al., 2020; Cai et al., 2024).

Research gap The next is related to the limited empirical evidence on the mechanisms by which Quantum Leadership influences organizational strategy and organizational behavior in complex environments. Results overlay visualization suggests that recent research is starting to point to the theme AI implementation, digital leadership, organizational resilience, strategic agility, and technological advancement. The findings suggest that academic attention is beginning to shift towards the relationship between leadership and digital transformation and the ability of organizations to cope with changing environments. However, most of the research still focuses on the mapping of concepts or relationships between variables in general, so there is not much explanation of the causal mechanisms that link the principles of Quantum Leadership to the achievement of organizational strategic outcomes. The literature used in this

study also emphasizes the need to test how the principles of non-linearity, uncertainty, and interconnectedness between leaders, teams, and organizations affect organizational innovation, adaptation, and transformation in real-world contexts (Lim & Kumar, 2023). Thus, the research gap lies not only in the definition of concepts, but also in the limited understanding of the process of how Quantum Leadership works in organizational practice. This condition shows that empirical research that links Quantum Leadership with organizational strategy, organizational behavior, and decision-making is still very much needed to strengthen the scientific basis of this paradigm.

The results of the study also show that there is a gap in the aspects of scientific collaboration and the dissemination of research globally. Analysis co-authorship, organizations, and countries show that research is still concentrated on a few specific groups of authors, institutions, and countries. The United States, India, China, Australia, Germany, Italy, and some European countries are the main centers of international collaboration networks, while the involvement of developing countries is still relatively limited. Although Indonesia has emerged in a collaborative network, the relatively small size of the node shows that the contribution of research is still not comparable to the countries that are the center of scientific development. The literature on scientific collaboration networks explains that the development of leadership theories will be stronger if supported by broader international collaborations so that it can produce diverse perspectives and strengthen the generalization of research findings (Hussain et al., 2025). Therefore, the results of this study indicate that the expansion of international collaboration networks is one of the important agendas in the development of Quantum Leadership. Collaboration across countries, across disciplines, and across organizational contexts is expected to enrich the development of theories while expanding the empirical validity of Quantum Leadership in various organizational environments.

Based on these gaps, the future research agenda can be directed to several key aspects. The first agenda is strengthening the conceptual foundation of Quantum Leadership through the preparation of a clearer, more consistent, and able to distinguish Quantum Leadership from other leadership paradigms. The results of this study show that intellectual structures are still built through the integration of positive leadership, ethical leadership, digital leadership, and distributed leadership (Adams et al., 2025). Therefore, further research needs to develop a conceptual model that integrates these various dimensions into one complete theoretical framework so that Quantum Leadership has a clearer academic identity. The second agenda is Development of measurement instruments which is able to operationalize the dimension of Quantum Leadership into an indicator that can be empirically tested in various types of organizations. The development of these instruments will strengthen the consistency of research results while allowing cross-sector and cross-cultural comparisons to be made.

The next agenda is related to empirical testing to the relationship of Quantum Leadership with various strategic variables of the organization. Based on bibliometric results, themes such as organizational resilience, innovation, strategic agility, AI implementation, and technological advancement shows increasingly rapid development. Therefore, future research needs to examine how Quantum Leadership affects organizational innovation, adaptability, digital transformation, decision-making quality, organizational resilience, and organizational learning in various industry contexts. In addition, the development of the theme AI implementation seen in overlay visualization shows that the integration between Quantum Leadership and artificial intelligence technology is one of the very potential research directions. The literature also confirms that digital leadership is an important infrastructure in supporting complex organizational coordination and cross-border learning (Alawamleh et al., 2024). Thus, future research can explore how Quantum Leadership interacts with artificial intelligence-based

systems, data analytics, and digital plaftorms in support of more adaptive leadership processes. Overall, the answer to Research Question 3 shows that the development of Quantum Leadership still leaves a very wide research space. The main gap lies in the lack of a conceptual definition, the lack of a standard measurement instrument, limited empirical evidence on the mechanism of influence of Quantum Leadership on organizational strategies and behaviors, and the uneven network of research collaborations at the global level. Based on these findings, the future research agenda needs to be directed at strengthening theoretical foundations, developing constructs that can be measured empirically, expanding testing in various organizational contexts, integrating Quantum Leadership with digital transformation and artificial intelligence, and strengthening international collaboration to expand conceptual and empirical validity. All of these agendas are consistent with the direction of the development of literature that places positive leadership, ethical leadership, digital leadership, distributed leadership, organizational learning, and sensemaking as the main foundation in building a more mature Quantum Leadership paradigm (Barik & Nayak, 2023). Thus, this research not only identifies the position of Quantum Leadership in the current scientific landscape, but also provides a clear direction for future research development.

4.4 Significance of Research Findings

The findings of this study are important because they provide a comprehensive overview of the development of science about Quantum Leadership in the field Strategy and Organizational Behaviour based on bibliometric analysis of 2,293 publications obtained from the database Dimensions. In contrast to conceptual studies that generally focus on the definition or characteristics of Quantum Leadership, this study is able to show how knowledge structures, patterns of scientific collaboration, development of research themes, and publication trends develop systematically over time. The results of the study show that Quantum Leadership has experienced a fairly rapid growth in publications, especially since 2022, which indicates increasing academic attention to leadership paradigms oriented towards organizational complexity, adaptation, and learning. In addition, the results network visualization, overlay visualization, and density visualization shows that the development of Quantum Leadership does not take place in isolation, but develops through integration with positive leadership, ethical leadership, digital leadership, and distributed leadership (Adams et al., 2025) . Thus, this study provides empirical evidence that Quantum Leadership has been part of the evolution of the contemporary leadership paradigm that continues to evolve following the changing organizational environment.

Another significance of this study lies in its ability to identify the direction of development of research themes that have not been widely explained in previous studies. The results of the analysis show that the focus of the research has shifted from the discussion of leadership concepts in general to more strategic issues, such as organizational resilience, strategic agility, AI implementation, technological advancement, and sustainable business practice. These shifts show that Quantum Leadership is increasingly positioned as a relevant leadership approach to dealing with digital transformation, environmental uncertainty, as well as the complexity of modern organizations. These findings reinforce the argument in the literature that organizations need a leadership paradigm that is able to integrate continuous learning, cross-network collaboration, systemic adaptation, and the use of digital technologies as part of the strategic decision-making process (Dong et al., 2026; Lim & Kumar, 2023). In addition, this study also shows that these themes are starting to take center stage in the development of Quantum Leadership, thus providing a clearer picture of the direction of research evolution in the future.

This study also has methodological significance because it shows that the bibliometrik can be used as an instrument to map the development of Quantum Leadership in a more objective and systematic manner. Through analysis co-authorship, co-occurrence, country collaboration, organization collaboration, overlay visualization, and density visualization, this study succeeded in uncovering intellectual structures, collaborative networks, and concentrations of research themes that are not easily identified through a review of the narrative literature. This approach allows the identification of intertopic relationships, publication developments, and research gaps that are still open so that they can be the basis for the preparation of the next research agenda (Lim & Kumar, 2023). Therefore, the results of this study not only provide information about the current state of Quantum Leadership research, but also provide a scientific map that can be used by other researchers in determining the direction of future research development.

Overall, the significance of this research lies in its contribution in clarifying the position of Quantum Leadership in the scientific landscape of Strategy and Organizational Behavior through comprehensive bibliometric evidence. This research successfully shows that Quantum Leadership is a research field that develops dynamically with the support of international collaboration networks, an increasingly broad intellectual structure, and the evolution of themes that lead to digital transformation, organizational innovation, and organizational resilience. On the other hand, this study also identifies that Quantum Leadership still requires strengthening conceptual definitions, developing operational indicators, and empirical testing in various organizational contexts as indicated in the literature on which the research is based. Thus, the results of this research not only provide an understanding of the scientific developments that have occurred, but also become a scientific foothold for the development of Quantum Leadership theory and research in the future.

4.5 Theoretical contributions

This research makes an important theoretical contribution to the development of the study Quantum Leadership, especially in the field of Strategy and Organizational Behaviour, through the compilation of a knowledge map (knowledge mapping) which describes the intellectual structure, collaborative networks, and thematic evolution of research in a systematic manner. In contrast to previous research which generally focused on conceptual discussions or the development of certain leadership paradigms, this study shows how Quantum Leadership has developed as a scientific field through its relationship with various contemporary leadership paradigms. The results of the bibliometric analysis show that the intellectual structure of Quantum Leadership is built through the integration of the concepts of positive leadership, ethical leadership, digital leadership (digital leadership), and distributed leadership. The findings reinforce the view that Quantum Leadership is not a stand-alone concept, but rather the result of the evolution of various leadership approaches that equally emphasize adaptation, collaboration, organizational learning, and complexity management (Adams et al., 2025; Hsieh et al., 2023). Thus, this research contributes in the form of a more structured conceptual framework regarding the position of Quantum Leadership in the development of modern leadership theory.

The next theoretical contribution lies in the ability of this research to explain Evolution of Research Themes Quantum Leadership is based on bibliometric evidence. Results overlay visualization shows that the focus of research has shifted from conventional leadership themes to more complex issues, such as organizational resilience, strategic agility, AI implementation, technological advancement, and sustainable business practice. These shifts show that Quantum Leadership is evolving following changes in the organizational environment influenced by digital transformation, environmental uncertainty, and the increasing need for adaptive

organizations. These findings support the argument in the literature that modern leadership is no longer only oriented towards managerial effectiveness, but also on the ability to build organizational learning, cross-border collaboration, sensemaking, as well as sustainable adaptation to environmental change (Dong et al., 2026). Thus, this study expands the theoretical understanding of the direction of development of Quantum Leadership while showing how the paradigm continues to evolve following the dynamics of modern organizations.

In addition, this research contributes to the development of theories through Identification of conceptual gaps which is still found in the Quantum Leadership literature. The results of the analysis show that although the number of publications continues to increase, there is no widely agreed operational definition or indicator that can measure Quantum Leadership consistently in various organizational contexts. The structure of the keyword network also shows that Quantum Leadership is still explained more through supporting concepts than as a stand-alone construct. These findings strengthen the literature explanation that the development of Quantum Leadership still requires strengthening on conceptual aspects, dimensional development, and empirical validation in order to develop into a more established leadership paradigm (Ekşili, 2023). Therefore, this research contributes in the form of identifying theoretical development spaces that can be the basis for further research in formulating more comprehensive definitions, dimensions, and indicators of Quantum Leadership.

Another theoretical contribution is the provision of Scientific foundation for the integration of Quantum Leadership with the field of Strategy and Organizational Behavior. The results of the study show that the development of Quantum Leadership is increasingly closely related to organizational innovation, governance, organizational resilience, digital transformation, and organizational behavior. These findings show that Quantum Leadership has the potential to be developed as a leadership paradigm that is able to bridge strategic aspects and organizational behavioral aspects in one complete conceptual framework. The literature on which the research is based also explains that organizational learning, digital leadership, ethical leadership, and collaborative networks are important foundations in building organizations that are able to face complex environments (Adams et al., 2025). Thus, this study enriches the leadership literature by showing that Quantum Leadership has a position as an integrative paradigm that connects organizational strategy, organizational behavior, innovation, digital technology, and organizational resilience. This contribution is expected to be a foothold for the development of a more comprehensive theoretical model while strengthening the position of Quantum Leadership as one of the relevant leadership paradigms in dealing with organizational complexity in the future.

4.6 Practical Contribution

This research makes a practical contribution to the organization by providing a comprehensive overview of the direction of development Quantum Leadership based on scientific evidence obtained through bibliometric analysis. The results of the study show that Quantum Leadership is growing along with increasing attention to innovation, organizational resilience, digital transformation, organizational governance, and organizational behavior. The findings provide information that can be used by organizational leaders as a basis for designing a leadership system that is more adaptive to environmental changes. Organizations no longer rely enough on hierarchical and linear leadership patterns, but need to build leadership mechanisms that are able to encourage continuous learning, cross-functional collaboration, and responsive decision-making to environmental dynamics. The results of the study also show that themes such as organizational resilience, strategic agility, innovation, and digital leadership increasingly dominating the development of Quantum Leadership research so that it can be used

as a priority area in organizational capacity development. Thus, this research provides a scientific basis for organizations to align leadership practices with the demands of an increasingly complex business and organizational environment (Dong et al., 2026).

The next practical contribution is aimed at managers and organizational leaders in designing human resource development strategies. The results of the analysis show that the development of Quantum Leadership is not only related to the ability to strategize the organization, but also related to the formation of organizational behavior that emphasizes trust, ethics, learning, and collaboration. These findings suggest that leadership development needs to be geared towards improving capabilities sensemaking, adaptation to uncertainty, cross-functional communication, and continuous organizational learning. In addition, the increasing attention to digital leadership shows that leaders' competence in utilizing information technology is becoming an important part of modern leadership practices. Therefore, organizations can use the results of this research as a basis for developing leadership training programs that integrate aspects of digital technology, strengthening ethical values, innovation, and collaboration as a unit of competencies. This approach is in line with the development of the literature that places digital leadership, ethical leadership, and positive leadership as important foundations in the development of Quantum Leadership (Alawamleh et al., 2024). Thus, the results of this study provide practical direction for organizations in building leadership capacity that is more in line with the needs of future organizations.

This research also makes practical contributions to policymakers, educational institutions, and research institutions. The results of the collaboration network analysis show that the development of Quantum Leadership is still concentrated in a number of countries and certain institutions, while the participation of developing countries is still relatively limited. These findings indicate the importance of encouraging international research collaboration, strengthening academic networks, and increasing research capacity in institutions that are not yet part of the center of science development. For universities, the results of this research can be used as a basis for the development of a leadership curriculum that includes material on organizational complexity, digital transformation, organizational learning, and collaboration-based leadership. For research institutions, the resulting bibliometric maps can be used to identify emerging research topics, build partnerships with institutions with similar competencies, and determine future research priorities. In addition, information on publication trends, theme evolution, and collaboration networks can be used as the basis for the formulation of more targeted research policies so as to strengthen scientific contributions in the field Strategy and Organizational Behaviour (Adams et al., 2025).

Overall, the practical contribution of this research lies in its ability to provide a scientific roadmap that can be used by various stakeholders in making evidence-based decisions. For organizations, the results of the research provide direction in developing a more adaptive, collaborative, innovative, and technology-based leadership system. For managers, this research is a reference in designing leadership competency development that integrates strategic dimensions, organizational behavior, and digital transformation. For academics and researchers, the bibliometric results provide information on themes that have developed, collaborative networks that have been formed, and research opportunities that are still open. Meanwhile, for policymakers and educational institutions, this research provides a basis for formulating leadership development policies, strengthening research collaboration, and preparing curricula that are relevant to the needs of modern organizations. Thus, this research not only produces academic contributions through mapping the development of Quantum Leadership, but also provides practical benefits that can support organizational development,

improve leadership quality, and strengthen the research ecosystem in an increasingly complex and dynamic organizational era.

4.7 Research Implications

The results of this study provide important implications for the development of science Strategy and Organizational Behaviour, especially in strengthening the position Quantum Leadership as a relevant leadership paradigm to deal with the complexities of modern organizations. Based on the results of bibliometric analysis, Quantum Leadership did not develop as a stand-alone concept, but was formed through the integration of various contemporary leadership paradigms, namely positive leadership, ethical leadership, digital leadership, and distributed leadership. These findings indicate that the development of leadership theory in the future needs to be carried out in a more integrative manner by considering the relationships between concepts that have been developing separately. In addition, the evolution of the research theme towards organizational resilience, strategic agility, AI implementation, technological advancement, and sustainable business practice It shows that the leadership paradigm needs to be understood in the context of an increasingly dynamic and technology-based organizational system. This implication reinforces the view that leadership effectiveness is no longer only determined by the individual capabilities of the leader, but also by the organization's capacity to build collaboration, learning, and adaptation to changing environments (Dong et al., 2026). Thus, the results of this study provide a basis for the development of a leadership model that is more in line with organizational characteristics in the era of digital transformation.

From a managerial perspective, this research implies that organizations need to make adjustments to leadership practices that have been dominated by hierarchical and linear approaches. Bibliometric results show that themes such as innovation, organizational resilience, strategic agility, digital leadership, and AI implementation is an important part of the development of Quantum Leadership. This condition shows that organizations need a leadership system that is able to accelerate organizational learning, strengthen cross-functional collaboration, and improve the organization's ability to respond to rapid and uncertain changes. Therefore, organizations need to develop leadership development programs that focus not only on technical competencies, but also on the ability to sensemaking, adaptation, collaborative communication, data-driven decision-making, and the use of digital technology. The literature on which the research is based also shows that digital leadership, ethical leadership, and positive leadership are important foundations in building organizations that are able to survive and thrive in complex environments (Ekşili, 2023). Thus, the practical implications of this research lead to the need to transform the leadership development system to be more responsive to changes in the organizational environment.

This research also has methodological implications in the development of leadership studies. The results of the analysis show that the bibliometric approach is able to provide a systematic picture of intellectual structure, collaboration networks, theme evolution, and research gaps in the field of Quantum Leadership. The use of co-authorship, co-occurrence, country collaboration, organization collaboration, overlay visualization, and density visualization analysis allows the identification of patterns of scientific development that are difficult to obtain through the review of the narrative literature. Therefore, further research can utilize the bibliometric approach as an initial stage to map the development of a research field before conducting empirical testing or conceptual model development. In addition, the results of this study show that the use of bibliographic data from Dimensions combined with visualization

using VOSviewer is able to produce comprehensive information about the direction of development of Quantum Leadership.

This approach is in line with recommendations in the literature regarding the use of science mapping and sensemaking bibliometrics to understand the evolution of a field of science systematically (Lim & Kumar, 2023). Thus, this study provides methodological implications in the form of strengthening the use of bibliometrics as one of the effective approaches in management and leadership research. In addition to theoretical, practical, and methodological implications, the study also provides implications for future research directions. The results of the study show that Quantum Leadership still has a wide scope for development, especially related to the preparation of operational definitions, the development of measurement indicators, and empirical testing in various organizational and cultural contexts. The findings on the limited international collaboration network and the dominance of several countries in research development also show the importance of expanding cross-border and cross-disciplinary cooperation to enrich conceptual and empirical perspectives.

In addition, the development of the theme AI implementation, organizational resilience, strategic agility, and technological advancement indicates that future Quantum Leadership research needs to be directed at the integration of leadership, artificial intelligence, data analytics, and digital transformation as part of modern organizational strategies. Thus, the main implication of this study is that Quantum Leadership has great potential to develop as a future leadership paradigm, but its development requires conceptual strengthening, expansion of empirical evidence, and increased scientific collaboration in order to be able to make a more significant contribution to the development of science Strategy and Organizational Behaviour (Adams et al., 2025).

4.8 Research Limitations

This research has several limitations that need to be considered in interpreting the results and in the development of further research. First, this study uses the Dimensions database as the only source of bibliographic data collection. Although Dimensions has a wide scope of publications and is able to provide complete metadata for bibliometric analysis, the use of a single database could potentially cause not all relevant publications on Quantum Leadership to be identified. Differences in index coverage, indexing policies, and metadata updates can affect the number of documents obtained and the network structure generated. Therefore, the mapping results in this study represent the characteristics of publications available in Dimensions at the time of the data collection process and do not reflect the overall development of the literature globally.

The second limitation has to do with the nature of Bibliometrik Analysis which is oriented towards mapping the structure of knowledge based on publication metadata. The analysis is carried out through co-authorship, co-occurrence, co-citation, bibliographic coupling, overlay visualization, and density visualization able to describe the relationship between authors, organizations, countries, or research themes, but does not evaluate the quality of substance, strength of argumentation, or empirical validity of each article analyzed. Thus, the results of this study describe the pattern of scientific development and the relationship between bibliographic elements, rather than measuring the effectiveness of Quantum Leadership in improving organizational performance or explaining the causal relationship between variables. These limitations are a common characteristic of bibliometric approaches that focus more on mapping intellectual structure and research evolution (Lim & Kumar, 2023).

The next limitation relates to the development of the concept Quantum Leadership which is still in the stage of conceptual evolution. The results of the study show that the intellectual

structure of Quantum Leadership is still largely built through its association with positive leadership, ethical leadership, digital leadership, and distributed leadership (Hsieh et al., 2023). This condition shows that there is no widely agreed operational definition or indicator in the literature, so the publication search process still depends on concepts that have a theoretical relationship with Quantum Leadership. As a result, the results of this mapping better describe the research ecosystem related to Quantum Leadership than the literature that explicitly uses the term.

In addition, this study uses bibliographic data collected at a single point in time (cross-sectional bibliometric snapshot), so that the results of the analysis only reflect the conditions of publication development at the time the data was collected. The development of publications, collaboration networks, and the evolution of research themes will continue to change as new articles are published. Therefore, further research is recommended to update data periodically, expand bibliographic data sources, and combine bibliometric analysis with systematic studies and empirical research so that the development of Quantum Leadership can be understood more comprehensively and provide a stronger basis for the development of leadership theories and practices in the future that can be related to other fields of science such as can be seen in some of the tables below.

Table 2. Number of top 10 researchers in the last 5 years with the most citations

No	Authors	Title	Years	Cites	Publisher	Recomendation
1	Li, Ling	Reskilling and Upskilling the Future-ready Workforce for Industry 4.0 and Beyond	2022	727	Information Systems Frontiers	It is highly recommended as the main reference for Industry 4.0 issues, workforce transformation, reskilling, upskilling, and digital human resource readiness.
2	Rammer, Christian; Fernández, Gastón P.; Czarnitzki, Dirk	Artificial intelligence and industrial innovation: Evidence from German firm-level data	2022	387	Research Policy	It is powerful to support the study of AI, industrial innovation, and corporate innovation performance. Suitable for state of the art.
3	Tang, Yuk Ming; Chau, Ka Yin; Fatima, Arooj; Waqas, Muhammad	RETRACTED ARTICLE: Industry 4.0 technology and circular economy practices: business management strategies for environmental sustainability	2022	225	Environmental Science and Pollution Research	Not recommended as a primary reference because the article is in a retracted status. It can be mentioned only as a note of literary caution.
4	Ram, Ram; Purwanto, Purwanto; Sudarno, Sudarno	Industry 5.0 and sustainability: An overview of emerging trends and challenges for a green future	2024	214	Innovation and Green Development	It is recommended to strengthen the discussion of Industry 5.0, sustainability, green future, and sustainable industry trends.
5	Vărzaru, Anca Antoaneta; Bocean, Claudiu George	Digital Transformation and Innovation: The Influence of Digital Technologies on Turnover from Innovation Activities and Types of Innovation	2024	158	Systems	It is relevant to discuss digital transformation, digital technology, and its influence on organization/company innovation.

No	Authors	Title	Years	Cites	Publisher	Recomendation
6	Browder, Russell E.; Dwyer, Sean M.; Koch, Hope	Upgrading adaptation: How digital transformation promotes organizational resilience	2023	151	Strategic Entrepreneurship Journal	It is very relevant for the theory of organizational resilience, digital capability, adaptation, and strategic entrepreneurship.
7	Busch, Christian	Towards a Theory of Serendipity: A Systematic Review and Conceptualization	2022	127	Journal of Management Studies	It is recommended to enrich the conceptual foundation of serendipity, opportunity discovery, innovation, and organizational behavior.
8	Anshari, Muhammad; Hamdan, Mahani	Understanding knowledge management and upskilling in Fourth Industrial Revolution: transformational shift and SECI model	2022	119	VINE Journal of Information and Knowledge Management Systems	Suitable for discussing knowledge management, SECI model, upskilling, and organizational transformation in the 4IR era.
9	Nyagadza, Brighton	Sustainable digital transformation for ambidextrous digital firms: systematic literature review, meta-analysis and agenda for future research directions	2022	115	Sustainable Technology and Entrepreneurship	Recommended as an SLR reference for sustainable digital transformation, ambidexterity, digital firms, and future research agendas.
10	Maganga, Deusdedith Pastory; Taifa, Ismail W.R.	Quality 4.0 conceptualisation: an emerging quality management concept for manufacturing industries	2022	100	The TQM Journal	Relevant for the study of Quality 4.0, quality management, manufacturing, digitalization, and Industry 4.0.

Source: Data processed by researchers, 2026

Based on the table of 10 previous researchers/publications in the last five years, namely the period 2022–2026, it can be seen that studies on leadership, digital transformation, innovation, sustainability, and organizational readiness to face technological changes are important concerns in the contemporary management literature. Li's publication (2022) occupies the highest position with 727 citations, showing the strong relevance of the issue of reskilling and upskilling of the workforce in facing the Industry 4.0 era and future competency changes. Furthermore, Rammer, Fernández, and Czarnitzki (2022) obtained 387 citations through a study on artificial intelligence and industrial innovation based on corporate data, which confirms that digital technology has become an important determinant in the development of organizational innovation. Other prominent publications discuss Industry 5.0, sustainability, digital transformation, organizational resilience, knowledge management, and Quality 4.0.

This suggests that cutting-edge research is no longer only focused on organizational effectiveness internally, but also on the organization's ability to adapt, innovate, manage knowledge, and maintain sustainability in a complex environment. However, there is one article that has a retracted status so it is not recommended as the main reference. Overall, these publications provide a strong conceptual and empirical basis for building a study of leadership, innovation, digital transformation, and organizational sustainability. These findings also show that there are opportunities for further research to integrate the concepts of adaptive leadership, digital capabilities, and organizational sustainability in a single more comprehensive analytical framework. Thus, the list of publications can be used as a starting point in compiling the state of the art, identifying research gaps, and strengthening novelty arguments in studies oriented to modern leadership and organizational strategic changes, especially in the context of public institutions, business, education, and health services in the global digital era.

Table 3. Keywords Clustering Clusters

No	Cluster	Keywords	Recomendation
1	Cluster 1: Quantum Leadership as New Leadership Paradigm	quantum leadership; quantum thinking; new leadership paradigm; wholeness; interconnectedness; uncertainty; chaotic environment; complexity; change	This cluster can be used as the basis of the main theory because it explains quantum leadership as a new leadership paradigm that is different from traditional leadership. Suitable for building conceptual definitions and research novelty.
2	Cluster 2: Healthcare and Nursing Leadership	nurse leaders; healthcare organizations; person- centred care; synergistic teamwork; value-based leadership; staff benefits; patient care	This cluster is relevant if the research is directed at leadership in the health sector, especially how leaders create synergistic teamwork and human-centered services.
3	Cluster 3: Innovation Performance and Organizational Sustainability	employee innovation performance; organizational sustainability; organizational intelligence; knowledge sharing; innovative culture; SMEs; fourth industrial revolution	This cluster is highly recommended for empirical research because it links quantum leadership to employee innovation performance and organizational sustainability. It can be used to build relationships between variables.
4	Cluster 4: Employee Job Performance and Work Engagement	job performance; work engagement; employee behavior; leader-member exchange; LMX; career development; enterprise sustainability	This cluster can be used to strengthen a research model that places job performance as a bound variable, as well as work engagement and LMX as mediators or moderators.
5	Cluster 5: Public Governance and Civil Servant Competency	civil servants; BKPSDM; competency development; strategic implementor; follower as leader; public relations; transparency; governance	This cluster is suitable for the context of public organizations or bureaucracy, especially if quantum leadership is associated with the development of ASN competencies, governance, transparency, and professionalism of apparatus.
6	Cluster 6: Leadership Types and Institutional Role	leadership types; ombudsman; charismatic leadership; transformational leadership; moral leadership; democratic leadership; quantum leadership	This cluster is useful as a theoretical comparison because it places quantum leadership with other types of leadership. However, this cluster should be used as supporting literature, not the main reference.

Source: Data processed by researchers, 2026

The results of the clustering show that the study of quantum leadership develops in six main themes, namely the new leadership paradigm, health leadership, innovation performance, employee performance, public governance, and leadership type comparison. The new paradigm cluster affirms quantum leadership as an approach that emphasizes connectedness, change, complexity, and uncertainty. Meanwhile, the innovation and employee performance cluster shows that this concept is starting to be directed at improving employee innovation performance, work engagement, and job performance. The health and public governance cluster shows an expansion of the context of the application of quantum leadership. Thus, this theme has opportunities to develop strong empirical research in the fields of organization, public service, and human resource management.

Table 4. Ten previous researchers on the influence between Variables

No	Researcher Name	Journal	Methods and Population and Sample	Research Results of the Influence Between Variables	Country of Origin
1	Rammer, Christian; Fernández, Gastón P.; Czarnitzki, Dirk	Artificial Intelligence and Industrial Innovation: Evidence from German Firm-Level Data	Quantitative; using firm-level data from the 2018 German Community Innovation Survey. Population/sample: companies in Germany.	Variables: the use of AI and innovation performance. Results: the use of AI is positively related to product innovation and process innovation; companies that use AI more broadly have higher innovation outcomes.	Belgium; Germany
2	Vărzaru, Anca Antoaneta; Bocean, Claudiu George	Digital Transformation and Innovation: The Influence of Digital Technologies on Turnover from Innovation Activities and Types of Innovation	Quantitative; using neural network analysis and cluster analysis on company data in the European Union.	Variables: digital technologies, innovation activities, innovation revenue. Results: digital technologies such as AI, Big Data, cloud computing, robotics, and IoT have an impact on innovation revenue and organizational competitiveness.	Romania / European Union
3	Singh, Rashmit; Chandrasekhar, Deepak; Hillemane, Bala Subramania Mungila; Sukumar, Arun; Jaffrey-Sadeghi, Wahid	Network Cooperation and Economic Performance of SMEs: Direct and Mediating Impacts of Innovation and Internationalisation	Quantitative; using SEM. Sample: 117 SME exporters in India.	Variable: network cooperation, innovation performance, internationalisation performance, economic performance. Results: innovation and internationalization mediate the relationship between network cooperation and the economic performance of SMEs.	India; English
4	Abdulmuhsin, Amir A.; Hussein, Hayder Dhahir; AL-Abrrow, Hadi; Masa'deh, Ra'ed; Alkhwaldi, Abeer F.	Impact of Artificial Intelligence and Knowledge Management on Proactive Green Innovation: The Moderating Role of Trust and Sustainability	Quantitative; a survey of mid-line managers of 24 government oil and gas organizations; analysis using SmartPLS/SEM.	Variables: AI, knowledge management, trust, sustainability, proactive green innovation. Results: AI and knowledge management have a positive effect on proactive green innovation; Trust and sustainability strengthen these relationships.	Iraq; Jordan
5	Hussainey, Khaled; Albitar, Khaldoon; Alkaraan, Fadi	Corporate Narrative Reporting on Industry 4.0 Technologies: Does Governance Matter?	Quantitative; computerized textual analysis and regression. Sample: 1,001 firm-year observations from UK non-financial company FTSE All- Share for the period 2013–2018.	Variables: corporate governance and corporate reporting on Industry 4.0. Results: the quality of corporate governance improves narrative reporting related to Industry 4.0 transformation.	English
6	Aggarwal, Arun; Jaysinghani, Dinesh; Nabi, Kamrunnisa	Effect of Organizational Justice and Support on Organizational Commitment and Employee Turnover Intentions: The Mediating Role of Employee Engagement	Descriptive quantitative; SEM. Sample: 432 employees of IT companies in India.	Variables: organizational justice, organizational support, employee engagement, organizational commitment, turnover intention. Results: fairness and organizational support increased engagement; engagement increases commitment and lowers exit intent.	India

No	Researcher Name	Journal	Methods and Population and Sample	Research Results of the Influence Between Variables	Country of Origin
7	Zhou, Peiyan; Zhou, Shuya; Zhang, Ming; Miao, Shujuan	Executive Overconfidence, Digital Transformation and Environmental Innovation: The Role of Moderated Mediator	Quantitative; using data from a panel of public companies in China for the period 2007–2019.	Variabel: executive overconfidence, digital transformation, environmental innovation, industry competition, policy uncertainty. Hasil: executive overconfidence mendorong digital transformation dan environmental technology innovation; digital transformation menjadi mediator penting.	China
8	Valdez-Juárez, Luis Enrique; Castillo-Vergara, Mauricio; Ramos-Escobar, Elva Alicia	Innovative Business Strategies in the Face of COVID-19: An Approach to Open Innovation of SMEs in the Sonora Region of Mexico	Quantitative; online surveys using LimeSurvey; PLS-SEM analysis. Sample: 498 SMEs in the trade sector in Sonora, Mexico.	Variables: business strategy, innovation management, e-commerce, home office, economic indicators, business performance. Results: innovation management, e-commerce, and home office have a positive effect on the business performance of SMEs.	Chili; Mexico
9	Cai, Han; Zhu, Lingfeng; Jin, Xiu	Validating the Causal Relationship between Quantum Leadership and Employee Innovation Performance from the Perspective of Organizational Sustainability	Quantitative; causal and mediation models; data was collected from 345 employees of Chinese SMEs in the context of the Fourth Industrial Revolution.	Variables: quantum leadership, employee innovation performance, organizational intelligence, knowledge sharing, innovative culture. Results: quantum leadership has a positive effect on innovation performance; organizational intelligence and knowledge sharing to become serial mediators; Innovative culture strengthens the influence of knowledge sharing.	South Korea; China as a sample context
10	Zhou, Xinglei; Chen, Liming	How Quantum Leadership Style Affects Employees' Job Performance	Quantitative; survey of 468 employees from 17 companies in 14 cities in China.	Variables: quantum leadership, job performance, work engagement, leader-member exchange/LMX. Results: quantum leadership has a positive effect on job performance; work engagement to become a mediator; LMX moderates the relationship between quantum leadership and work engagement.	China

Source: Data processed by researchers, 2026

Based on the table, previous research in the last five years shows a strong tendency to test relationships between variables through quantitative approaches, particularly SEM, PLS-SEM, regression, and panel data analysis. The dominant themes include digital transformation, artificial intelligence, innovation performance, organizational sustainability, green innovation, employee engagement, and job performance. Articles directly addressing quantum leadership are limited, but the findings of Cai et al. and Zhou & Chen show that quantum leadership is beginning to be empirically tested as a predictor variable for innovation performance and job performance. This opens up opportunities for more robust and specific future research.

Table 5. Proposed measurement instruments

Construct	Dimensions	Indicator	Source
Quantum Leadership	Quantum thinking	Leaders are able to see the organization as an interconnected system; leaders are open to change; Leaders are able to think non-linearly in dealing with complex problems.	Harrington (2022); Cai, Zhu, & Jin (2024)
Quantum Leadership	Interconnectedness	Leaders encourage cross-sectional collaboration; building synergistic working relationships; understand that a leader's decisions impact the entire organization's system.	Harrington (2022); Cai, Zhu, & Jin (2024)
Quantum Leadership	Adaptability to uncertainty	Leaders are able to make decisions in uncertain situations; responsive to environmental changes; able to manage complex and dynamic organizational conditions.	Harrington (2022); Zhou & Chen (2025)
Quantum Leadership	Value-based leadership	Leaders emphasize shared values, beliefs, responsibilities, and goals; Leaders direct the members of the organization to work based on meaning and contribution.	Harrington (2022)
Employee Innovation Performance	Idea generation	Employees come up with new ideas; finding new ways to get work done; propose creative ideas for organizational improvement.	Janssen (2000); De Jong & Den Hartog (2010)
Innovative Culture	Support for creativity	The organization supports employee creativity; accepting differences of opinion; provide a work climate that encourages innovation.	Hurley & Hult (1998)
Knowledge Sharing	Knowledge donating	Employees are willing to share work experience; provide important information to peers; explain the knowledge they have to help work together.	Van den Hooff & De Ridder (2004); Bock et al. (2005)
Work Engagement	Dedication	Employees feel that their work is meaningful; pride in work; feeling enthusiastic and challenged in carrying out their duties.	Schaufeli et al. (2002); Schaufeli, Bakker, & Salanova (2006).
Innovative Culture	Openness to innovation	The organization supports new ideas; provide space for experimentation; Value creativity and innovation.	Hurley & Hult (1998); Cai, Zhu, & Jin (2024)
Work Engagement	Vigor	Employees have high energy while working; remain enthusiastic in the face of adversity; have mental endurance in completing work.	Schaufeli, Salanova, González-Romá, & Bakker (2002); UWES mengukur vigor, dedication, dan absorption.

Source: Data processed by researchers, 2026

Based on the proposed measurement instrument table, the research framework shows that the Quantum Leadership variable is measured through the dimensions of quantum thinking, interconnectedness, adaptability to uncertainty, and value-based leadership. These variables together with Innovative Culture are estimated to affect Employee Innovation Performance

through the Knowledge Sharing and Work Engagement mediation mechanism. Knowledge sharing plays a role in the process of knowledge exchange, while work engagement describes the psychological involvement of employees in work. Furthermore, employee innovation performance is measured through the ability to produce, promote, and implement innovative ideas as the end result of the leadership process and organizational culture. This model describes the mechanisms by which adaptive leadership and an innovative environment drive improved employee innovation behavior.

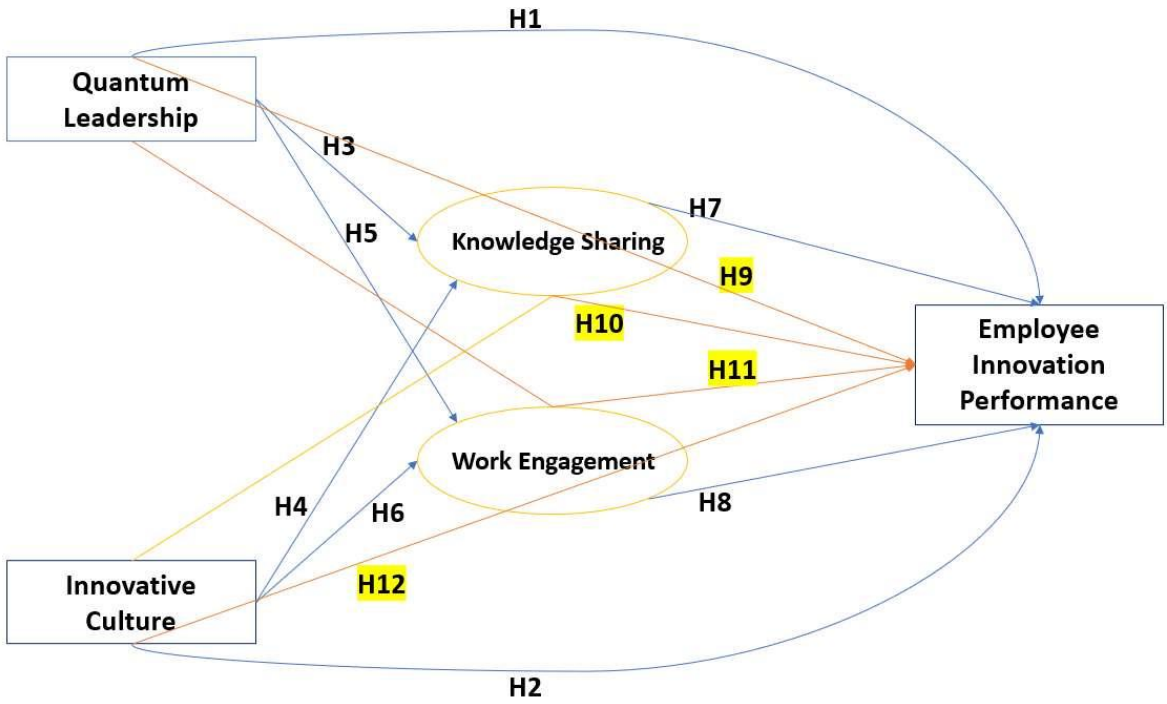


Figure 8. Conceptual Model

H1	Quantum Leadership has a positive effect on Employee Innovation Performance.
H2	Innovative Culture has a positive effect on Employee Innovation Performance.
H3	Quantum Leadership has a positive effect on Knowledge Sharing.
H4	Innovative Culture has a positive effect on Knowledge Sharing.
H5	Quantum Leadership has a positive effect on Work Engagement.
H6	Innovative Culture has a positive effect on Work Engagement.
H7	Knowledge Sharing has a positive effect on Employee Innovation Performance.
H8	Work Engagement has a positive effect on Employee Innovation Performance.
H9	Knowledge Sharing mediates the influence of Quantum Leadership on Employee Innovation Performance.
H10	Knowledge Sharing mediates the influence of Innovative Culture on Employee Innovation Performance.
H11	Work Engagement mediates the influence of Quantum Leadership on Employee Innovation Performance.
H12	Work Engagement mediates the influence of Innovative Culture on Employee Innovation Performance.

Model Explanation

This model places Quantum Leadership and Innovative Culture as the main factors that influence Employee Innovation Performance. Quantum leadership is seen as able to form an adaptive, collaborative, and open mindset to change. Meanwhile, innovative culture creates a work environment that supports creativity, courage to try new things, and tolerance for innovation risks.

The influence of these two variables is not only direct, but can also occur through Knowledge Sharing and Work Engagement. Knowledge sharing allows knowledge, experience, and information to be disseminated more effectively among employees. Work engagement reinforces the employee's psychological drive to work energetically, dedicated, and fully engaged. Thus, the stronger the quantum leadership and innovative culture, the higher the chances of employees demonstrating innovative performance.

Table 6. Research Variable Structure

Code	Variable Type	Construct	Reasons for Selection
X1	Independent Variables	Quantum Leadership	It is a key variable because quantum leadership emphasizes interconnectedness, adaptability, value, and the ability to deal with organizational complexity.
X2	Independent Variables	Innovative Culture	Innovative culture serves as an organizational factor that encourages creativity, experimentation, and acceptance of new ideas.
Z1	Mediation Variables	Knowledge Sharing	It serves as a mechanism that explains how leadership and innovative culture encourage knowledge exchange between members of the organization.
Z2	Mediation Variables	Work Engagement	Explain how leadership and organizational culture increase employee energy, dedication, and engagement at work.
Y	Dependent Variable	Employee Innovation Performance	Be the main output that describes the employee's ability to generate, promote, and implement innovative ideas.

Based on the proposed measurement instrument table, the research framework shows that the Quantum Leadership variable is measured through the dimensions of quantum thinking, interconnectedness, adaptability to uncertainty, and value-based leadership. These variables together with Innovative Culture are estimated to affect Employee Innovation Performance through the Knowledge Sharing and Work Engagement mediation mechanism. Knowledge sharing plays a role in the process of knowledge exchange, while work engagement describes the psychological involvement of employees in work. Furthermore, employee innovation performance is measured through the ability to produce, promote, and implement innovative ideas as the end result of the leadership process and organizational culture. This model describes the mechanisms by which adaptive leadership and an innovative environment drive improved employee innovation behavior.

5. CONCLUSIONS AND SUGGESTIONS

This research aims to map the development of Quantum Leadership in the field Strategy and Organizational Behaviour through a bibliometric approach using 2,293 publications obtained from the database Dimensions and analyzed using VOSviewer. The results of the study show that Quantum Leadership is a field of study that is experiencing increasingly rapid development, especially since 2022 until reaching the peak of publication in 2025. Bibliometric analysis shows that the intellectual structure of Quantum Leadership is still built through its association with positive leadership, ethical leadership, digital leadership, and distributed leadership as the

main conceptual foundations (Ekşili, 2023). In addition, the results network visualization, overlay visualization, and density visualization shows that research developments are increasingly leading to themes such as innovation, organizational resilience, strategic agility, AI implementation, technological advancement, and sustainable business practice, reflecting the growing attention to adaptive leadership in the face of complex organizational environments. The study also identifies that networks of scholarly collaboration have evolved at the author, organization, and state levels, although it still shows concentrations in a few specific institutions and countries. The findings show that Quantum Leadership has developed into a broader field of research, but still requires conceptual reinforcement and empirical development in order to become a more established leadership paradigm. Thus, this research succeeds in answering all problem formulations through mapping the development of publications, intellectual structures, collaboration networks, thematic evolution, and identification research gap which is still open in the study of Quantum Leadership.

The contribution of this research to the scientific field lies in the provision of scientific mapping that describes the position of Quantum Leadership in the development of the Strategy and Organizational Behavior literature comprehensively. In contrast to previous research that generally discussed Quantum Leadership conceptually, this study provides bibliometric evidence on how knowledge structures are formed, how collaborative networks develop, and how research themes evolve following changes in the organizational environment.

The findings of the study show that Quantum Leadership has great potential to develop as a leadership paradigm that integrates innovation, organizational learning, digital leadership, ethical values, and adaptability in one complete conceptual framework (Dong et al., 2026). In addition to making theoretical contributions through strengthening understanding of the development of the concept of Quantum Leadership, this research also makes a methodological contribution through the application of bibliometric analysis as an approach to identify intellectual structures, research trends, and opportunities for scientific development. Therefore, the results of this research are expected to be a reference for academics, researchers, practitioners, and policymakers in understanding the direction of Quantum Leadership development and determining future leadership research and development priorities.

Based on the findings of the study, there are several suggestions that can be considered for further research. First, future research needs to develop clearer operational definitions and indicators of measurement of Quantum Leadership so that this concept can be empirically tested in various organizational contexts.

Second, further research is suggested to combine bibliometric analysis with systematic literature review, qualitative studies, and quantitative research to be able to explain the causal relationship between Quantum Leadership and various organizational variables, such as innovation, organizational performance, organizational resilience, organizational learning, and digital transformation. Third, future research needs to expand bibliographic data sources by utilizing more than one database to make the coverage of the literature more comprehensive and allow comparison of results between publication indexes.

Fourth, considering that the research results show the development of the themes of AI implementation, organizational resilience, strategic agility, and technological advancement, future research needs to explore the integration of Quantum Leadership with artificial intelligence, data analytics, and digital ecosystems in supporting organizational strategic decision-making. In addition, it is necessary to conduct cross-country and cross-cultural research to test the validity of the concept of Quantum Leadership on various organizational characteristics so that the development of the theory becomes more universal. Thus, future

research is expected not only to expand the conceptual understanding of Quantum Leadership, but also to produce empirical evidence that is able to strengthen the contribution of this paradigm to the development of Strategy and Organizational Behavior science as well as leadership practices in increasingly complex and dynamic organizations.

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