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Mapping the Landscape of Leadership Dynamics in a VUCA Era: Insights from a Bibliometric Review

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ABSTRACT

This study explores the rapidly expanding research domain of leadership in the volatile, uncertain, complex, and ambiguous (VUCA) environment through a comprehensive bibliometric review. A bibliometric review was conducted, analyzing annual publications, key sources, country collaborations, and keyword co-occurrence to map the growth and focus areas of research on leadership in VUCA environments. The analysis reveals a notable increase in publications from 2020, peaking in 2023. Leading contributors include the United States and India, with diverse sources covering agile management, business resilience, and educational leadership. Network visualization shows robust global collaboration, particularly between the United States and the United Kingdom. Keyword analysis identifies key themes such as digital transformation, agile leadership, and emotional intelligence. This study emphasizes the growing need for adaptive and innovative leadership strategies to address the complexities and uncertainties of the modern global landscape.

KEYWORDS: *VUCA World, Leadership, Digital Transformation, Volatility, Uncertainty, Complexity, and Ambiguity*

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1. INTRODUCTION

In light of the constantly growing global landscape of today, the notion of a VUCA world—characterized by volatility, uncertainty, complexity, and ambiguity—has acquired substantial importance in the field of leadership studies. The VUCA framework was initially developed by the U.S. Army to depict the uncertain and quickly shifting post-Cold War world. Since that time, it has been widely used in business and management contexts to identify the difficulties that organisations encounter when navigating an environment that is becoming more dynamic and complex **(Taskan et al., 2022)**. Global occurrences like the COVID-19 crisis have made leadership in volatile and uncertain circumstances ever more crucial. These disturbances have brought attention to the need for flexible leadership approaches that can handle complexity, maintain organisational resilience, and deal to unanticipated crises **(Adnan et al., 2021; Cameron & Green, 2019)**. Consequently, there has been a discernible rise in scholarly investigations delving into several facets of leadership inside volatile and uncertain environments (VUCA). These include the formulation of agile leadership frameworks, the significance of emotional intelligence, and the influence of technological change on leadership tactics **(Nowacka & Rzemieniak, 2021; Kaivo-oja & Lauraeus, 2018)**.

This study seeks to fill this gap by conducting a bibliometric review of the literature on this aspect of leadership in a VUCA environment. By analyzing the patterns of scientific production, the most influential sources, and the collaborative networks among countries, this review aims to provide a holistic overview of the current state of research. Additionally, the study examines the co-occurrence of keywords to identify the primary areas of focus within the literature, offering insights into the evolving discourse on leadership in a VUCA context. In summary, this study offers a thorough examination of the scholarly landscape related to leadership in a volatile and uncertain world, emphasising the growing importance of this subject matter in light global challenges. The results of this bibliometric review will provide substantial novel insight for

academics and professionals alike, deepening our understanding of how leadership is being researched and used in today's uncertain and complex situations.

1.1. Research Questions

1. What are the emerging trends in leadership research within VUCA contexts, and which sources have emerged as the most influential in shaping this field?
2. Which countries are leading in the research on leadership in VUCA environments, and how do their contributions illustrate global research patterns and collaborative efforts?
3. What are the key themes and focus areas revealed through keyword co-occurrence analysis in the study of leadership dynamics in VUCA environments?

2. Literature Review

2.1. Leadership

In today's business environment leadership is one of the most complex and multidimensional phenomena. It has been thoroughly researched throughout the years and has become more important than ever in today's fast-paced and increasingly globalized environment. Over time, there have been significant changes to the notion of leadership **(Martz, 2008; Rosenhead et al., 2019; Ruben & Gigliotti, 2016).** It was first defined as an individual trait, primarily concentrating on certain leaders, usually executives in major US private companies **(Avolio et al., 2009). Lawal (1993)** defined leadership as the act of persuading others to confidently and voluntarily work towards an organisational objective. "The process of persuading others to focus their energies on achieving a specific goal or goals" is the common definition of leadership. But in more recent times, it has evolved to encompass a larger and more varied spectrum of individuals who may hold leadership positions, irrespective of factors like gender, colour, national origin, and so on. In the current corporate climate, taking on a leadership role has become increasingly difficult. Take the lead. In a VUCA environment, managerial control needs to be backed by innovation and creativity. Ambidexterity is one of the best organisational models for achieving this **(Nadler & Tushman, 1990; 1996; Tushman & O'Reilly, 1996).**

2.2. VUCA World

VUCA refers to extremely unpredictable market conditions that frequently change and are influenced by a variety of events, incidents, and occasions **(Taskan et al., 2022).** In this environment, a strong conceptual map and visionary view are essential for business success and sustainability **(Peter et al., 2011; Kumar et al., 2024)**. The concept of VUCA was first coined by the US Army to describe modern combat scenarios. VUCA is a complex and dynamic environment that requires organizations to be agile and adaptable in order to succeed **(Chen & Zhang, 2019; Khan & Afridi, 2023).** The VUCA framework—Volatility, Uncertainty, Complexity, and Ambiguity, which is often used to describe the challenging conditions organisations face in today's dynamic environments. These terms are defined in **Sequeira's (2019)** study and are provided below.

Volatility: This refers to unpredictable and rapid changes. Although the situation might be unstable, it is not necessarily difficult to understand. The key to handling volatility is to ensure that you have more resources (both material and human) than you might need, allowing you to overdeliver when unexpected changes occur.

Uncertainty: In uncertain situations, the events are unpredictable, but they can often be detected early, and their causes can be identified. The strategy here is to have a team that constantly monitors the environment, looking for early signs of potential risks. This proactive approach allows for early detection and better preparation for the effects.

Complexity: Complexity involves situations with many interconnected parts, where the available information might be overwhelming. To tackle complexity, it's essential to assemble a diverse team of specialists. Their collective expertise allows them to understand the nuances of complex situations and find effective solutions.

Ambiguity: Ambiguity is when there's no clear roadmap, and the causes and relationships between factors are unclear. To navigate ambiguity, it's important to engage in strategic, exploratory thinking. This involves generating and testing hypotheses through experiments designed to explore possibilities and gather insights that can be applied to future scenarios.

By adopting these strategies, organizations can better navigate the challenges posed by a VUCA environment. In the VUCA world, it has become extremely important for leaders to opt for a dynamic stance rather than a rigid mindset. Agility, creativity, and readiness for risk are essential in a volatile, uncertain, and conflicting (VUCA) business environment **(EY, 2014; Horney et al., 2010).** Organisations use constantly evolving disruptive information technology as the primary enabler to thrive in volatile, uncertain, and complex environments (VUCA).

2.3. Leadership Styles and VUCA Environment

Numerous studies have consistently emphasized the pivotal role of leadership in navigating VUCA (Volatile, Uncertain, Complex, and Ambiguous) environments. Effective leadership in such contexts demands a high degree of adaptability, creativity, and the strategic use of digital technologies **(Esenyel, 2024).** Leadership competencies are increasingly recognized as vital strategic assets for coping with the challenges posed by VUCA conditions **(Syamsir et al., 2025**). **Kumar et al. (2024)** identify four essential attributes of effective leaders—idealized influence, individual consideration, intellectual stimulation, and inspirational motivation—which collectively enhance a leader's strategic capability to steer organizations through volatile scenarios. Decision-making becomes particularly intricate under VUCA circumstances due to the unpredictability associated with crises. **Kılıç and Çalışkan (2025)** stress the importance of leaders being able to anticipate disruptions while managing information, infrastructure, planning, and political dimensions effectively within such complex contexts.

Modern leadership theories have evolved in response to the demands of VUCA conditions, enabling organizations to adopt more diverse and effective leadership models **(Tuyen, 2025).** Among these, adaptive leadership stands out as a fitting approach, as it emphasizes leaders' need to remain flexible and responsive amidst rapid changes **(Heifetz et al., 2009; Kane et al., 2015**). Tools like the Collective Leadership Survey are also useful in assessing which leadership styles align best with the complexities of a VUCA environment, helping leaders evaluate and enhance their effectiveness accordingly **(Koh, 2024).**

Moreover, recent findings suggest that in highly volatile settings, instrumental leadership—particularly through mechanisms like outcome monitoring—is perceived as more effective than traditional transformational or transactional styles, which may lose their efficacy under such circumstances **(Hüttemann, 2025).** Heliotropic leadership, which promotes a positive and resilient organizational culture, is also vital in maintaining employee engagement and morale during uncertain times **(Esenyel, 2024). Sarjito (2023)** underscores that situational leadership style can boost the strategic effectiveness of defence policies within VUCA settings. Furthermore, **Zamani and Ait Soudane (2022)** argue that strategic leadership must be embedded into organizational frameworks, guiding policy, structure, and decision-making processes. As **Rath et al. (2021)** point out, the VUCA framework challenges both organizations and their leaders, reinforcing the importance of leadership agility in fostering sustainable innovation and ensuring long-term success **(Syamsir et al., 2025).**

3. Methodology

Researchers may quantify and evaluate the influence and circulation of academic research in a particular subject with the use of bibliometric analysis, one of the most useful scientometrics techniques **(Garfield, 1979)**. The Scopus database was selected for data extraction in this dissertation due to its extensive coverage, practicality, and alignment with the current literature. On August 14, 2024, the researcher extracted a dataset on Leadership in the VUCA world from Scopus, using the search string: "VUCA" OR "VUCA world" OR "VUCA environment" AND "Leadership" OR "Leadership style" OR "Leadership styles" OR "Leader" OR "Leaders" within the **TITLE-ABS-KEY** query, resulting in 305 articles. To ensure comprehensive coverage, the researcher limited the timeframe to **2014-2024**, which produced 304 papers. Further refining the selection to articles in the **Final publication stage**, 302 papers were identified. These papers were then exported in a comma-separated value (.csv) format. Bibliometric data analysis for this study was conducted using Biblioshiny software for performance analysis and VOS Viewer for network visualization.

4. Performance Analysis

4.1. Annual Scientific Production

Table 1 provides an overview of the annual scientific production on Leadership strategies in a VUCA, showcasing the growing interest and research activity in this field over the past decade. From a modest start with 4 articles published in both 2014 and 2015, the number of publications saw a gradual increase, with 9 articles in 2016, marking the beginning of a noticeable upward trend. This growth accelerated significantly from 2017 onwards, with 23 articles published that year, followed by a slight dip in 2018 to 13 articles. However, the momentum picked up again in 2019 with 26 articles, and it continued to rise sharply in 2020 with 29 articles. The most substantial growth occurred in 2021 and 2022, with 38 and 51 articles published, respectively, reflecting heightened scholarly interest likely influenced by the global disruptions and uncertainties brought on by the COVID-19 pandemic. The peak was reached in 2023, with an impressive 77 articles published, indicating that the topic has become increasingly relevant and critical in recent years. As of August 14, 2024, there have already been 28 articles published, suggesting that the field continues to attract significant academic attention and may surpass previous years' outputs by the end of 2024. This table, taken as a whole, shows a distinct rising trend in the scholarly output on

Leadership Dynamics in a VUCA environment, indicating the increasing significance of understanding and developing leadership tactics to navigate the complexity and unpredictability of the modern world.

Table 1: Annual Scientific Production

Year	Article
2014	4
2015	4
2016	9
2017	23
2018	13
2019	26
2020	29
2021	38
2022	51
2023	77
2024 *(till 14 August 2024)*	28

4.2. Most Relevant Sources

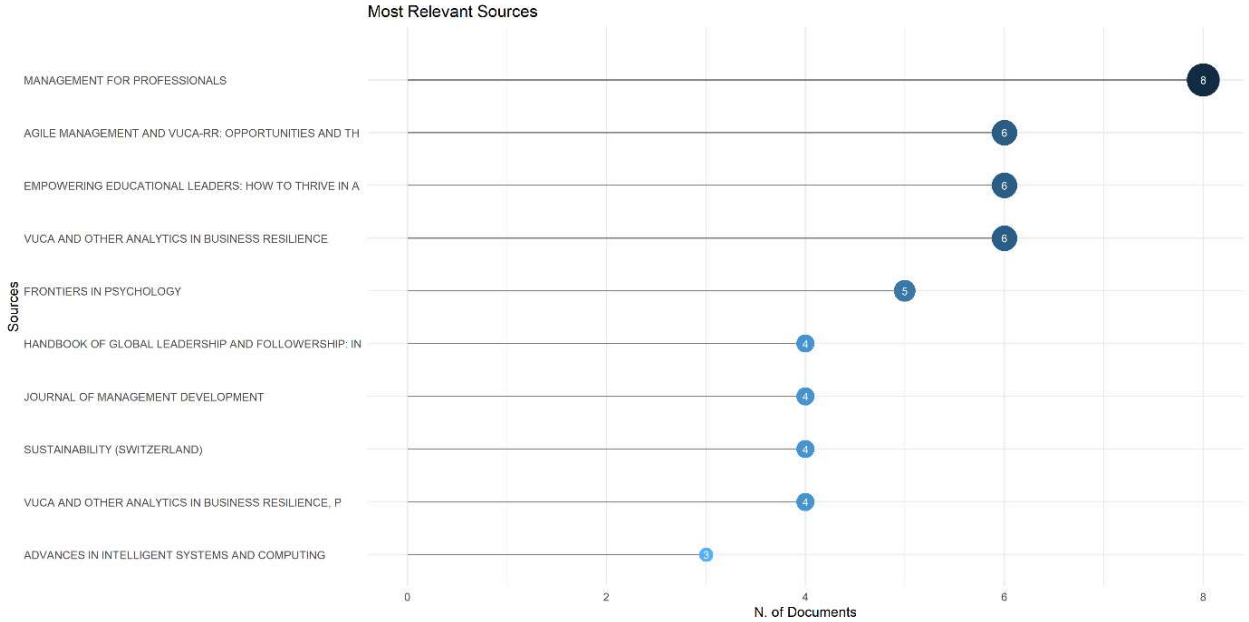

Figure 1: Top 10 Most Relevant Sources
Source: Biblioshiny

Figure 1 highlights the top 10 most relevant sources contributing to the research on Leadership in a VUCA environment, showcasing the key publications that have shaped this academic field. The leading source, "Management for Professionals," has published 8 articles, indicating its significant role in disseminating knowledge on professional management practices in VUCA environments. Three sources— "Agile Management and VUCA-RR: Opportunities and Threats in Industry 4.0 Towards Society 5.0," "Empowering Educational Leaders: How to Thrive in a Volatile, Uncertain, Complex and Ambiguous World," and "VUCA and Other Analytics in Business Resilience"—each contributed 6 articles, underscoring their focus on agile management, educational leadership, and business resilience within the context of VUCA challenges. "Frontiers in Psychology" follows with 5 articles, reflecting the psychological perspective on leadership dynamics in uncertain environments. The "Handbook of Global Leadership and Followership: Integrating the Best Leadership Theory and Practice," "Journal of Management Development," "Sustainability (Switzerland)," and "VUCA and Other Analytics in Business Resilience, Part B" each contributed 4 articles, highlighting their relevance to both theoretical and practical aspects of leadership in VUCA contexts. Finally, "Advances in Intelligent Systems and Computing" has 3 articles, indicating a growing interest in the intersection of intelligent systems and leadership in volatile environments. Collectively, these sources underscore the interdisciplinary nature of research on leadership dynamics in a VUCA world, spanning management, psychology, sustainability, and technological innovation.

4.3. Countries' Scientific Production

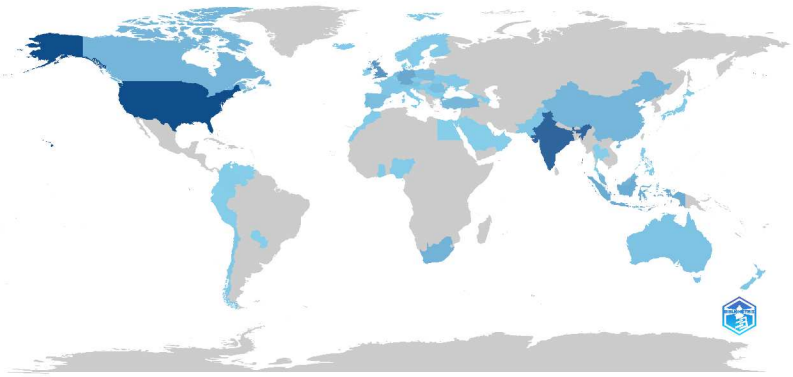

Figure 2: Countries' Scientific Production
Source: Biblioshiny

Table 2 and figure 2 highlights the top 5 countries leading in scientific production on "Leadership Dynamics in a VUCA World," showcasing their contributions to the global research landscape. The United States (USA) is the most prolific, with 121 documents, indicating its dominant role in shaping the discourse on leadership in volatile, uncertain, complex, and ambiguous environments. India follows closely with 97 documents, reflecting its significant and growing academic interest in VUCA-related leadership challenges, likely driven by its dynamic economic and organizational contexts. The United Kingdom (UK) ranks third with 50 documents, emphasizing its strong research tradition and focus on leadership studies. Germany, with 35 documents, also contributes substantially, indicating a robust engagement with VUCA concepts, particularly in relation to its industrial and technological sectors. Indonesia rounds out the top five with 30 documents, showcasing its emerging role in this research area, possibly reflecting the country's interest in leadership strategies amidst rapid socio-economic changes. Overall, these countries represent key hubs of scholarly activity on leadership dynamics in a VUCA world, each contributing to the global understanding of how leadership can effectively navigate complex and uncertain environments.

Table 2: Top 5 Countries' Scientific Production

Country	No. of Document
USA	121
India	97
UK	50
Germany	35
Indonesia	30

5. Network Visualization

5.1. Country Collaboration

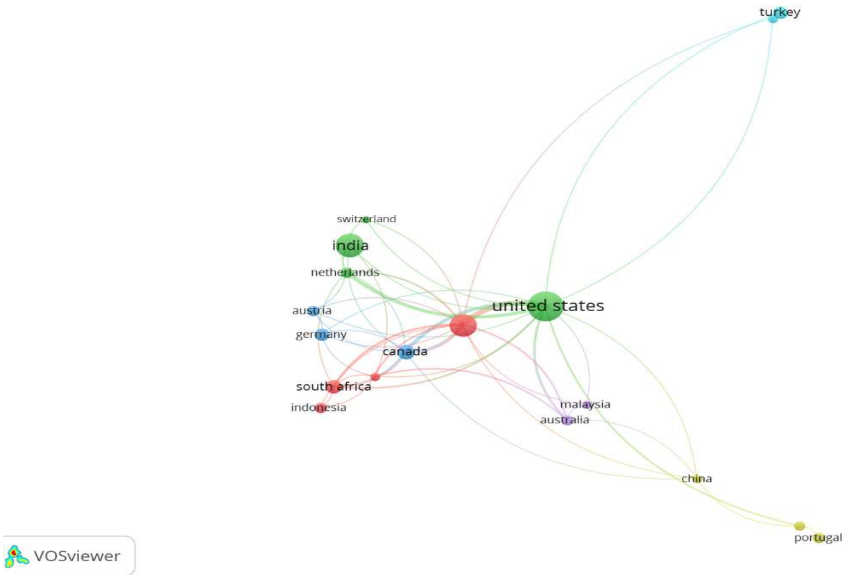

Figure 3: Network Visualization of Country Collaboration
Source: VOSviewer

Figure 3 presents a network visualization of the global research landscape on "Leadership Dynamics in a VUCA World." The minimum number of documents of a country was set to 5. Out of the 66 countries, 19 meet the thresholds. Highlighting the collaborative efforts of various countries grouped into six distinct clusters. Each cluster represents a network of countries that have closely collaborated in this research domain.

Cluster 1 (Red): This cluster includes France, Indonesia, South Africa, and the United Kingdom, with the UK being the dominant contributor with 40 documents and a total link strength of 30. This indicates the UK's significant role in international collaboration within this cluster. South Africa also contributes notably with 16 documents and a total link strength of 11, suggesting its active participation. France, with 7 documents and a link strength of 10, and Indonesia, with 9 documents and a lower link strength of 3, show moderate involvement in this cluster.

Cluster 2 (Green): The largest and most influential cluster includes the United States, India, the Netherlands, and Switzerland. The United States leads with 66 documents and a total link strength of 35, indicating its central role in global research on this topic. India follows with 45 documents and a total link strength of 6, showing active involvement but less collaborative reach compared to the US. The Netherlands and Switzerland contribute 10 and 5 documents respectively, with moderate link strengths, indicating their supportive but less dominant roles in this research area.

Cluster 3 (Blue): This cluster consists of Austria, Canada, and Germany. Canada is the most active contributor with 19 documents and a total link strength of 19, highlighting its strong collaborative ties within this cluster. Germany, with 13 documents and a link strength of 5, and Austria, with 10 documents and the same link strength, show balanced participation but with less influence compared to Canada.

Cluster 4 (Yellow): China, Portugal, and Spain form this cluster, with China leading in link strength (5) with document production (9). Spain, with 8 documents and a total link strength of 4, and Portugal, with 9 documents and a link strength of 1, demonstrate moderate collaboration, contributing to the global discourse but with less impact compared to other clusters.

Cluster 5 (Purple): Australia and Malaysia are the main contributors, with Australia producing 10 documents and having a total link strength of 9, indicating its active collaboration. Malaysia, with 7 documents and a lower link strength of 3, plays a supporting role within this cluster.

Cluster 6 (Sky-blue): The smallest cluster includes Poland and Turkey. Turkey leads with 14 documents and a total link strength of 3, while Poland, with 7 documents and a link strength of 4, shows balanced participation but with limited collaborative influence.

Overall, the network visualization highlights the varying degrees of research collaboration on leadership dynamics in a VUCA world across different countries. The United States, the United Kingdom, and Canada emerge as key hubs of collaboration, while other countries contribute significantly but with differing levels of influence and interconnectedness within the global research landscape.

5.2. Co-occurrence Analysis of All Keywords

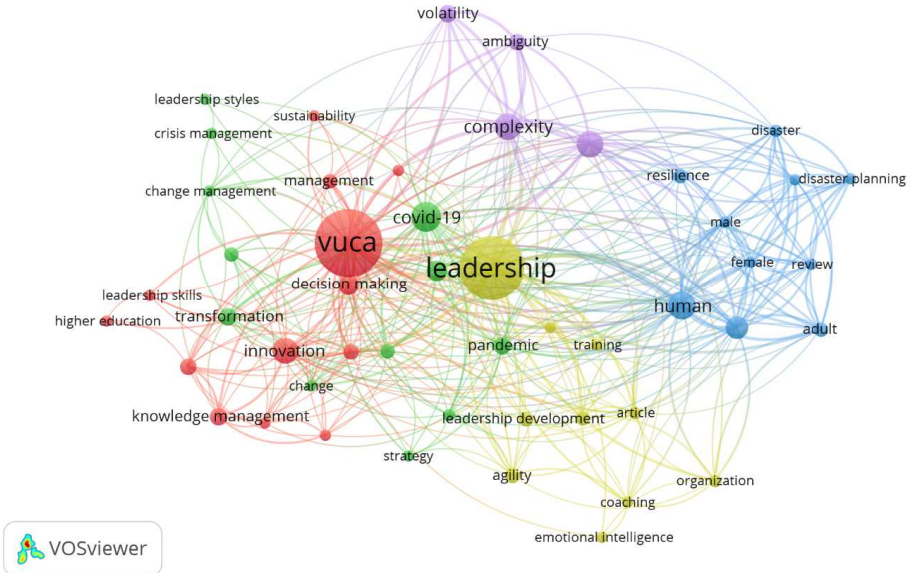

Figure 4: Co-occurrence Analysis of all keywords
Source- VOSviewer

Figure 4 provides a network visualization of the co-occurrence analysis of keywords related to "Leadership Dynamics in a VUCA World." In the process of mapping Figure 3, the minimum occurrence of a keyword was set to 5. Out of the 1342 keywords, 49 meet the thresholds. 49 elements in five clusters were obtained as an outcome.

Cluster 1 (Red): This cluster encompasses 13 keywords including "competition," "decision making," "digital transformation," "higher education," "industry 4.0," "innovation," "knowledge management," "leadership skills," "management," "organisational," "personnel," "sustainability," and "vuca." The presence of terms like "digital transformation," "industry 4.0," and "innovation" suggests a focus on how leadership is adapting to technological and industrial changes. Keywords such as "knowledge management" and "sustainability" further highlight the integration of modern management practices and long-term organizational goals within the VUCA framework.

Cluster 2 (Green): Consisting of 12 items, this cluster includes "agile leadership," "change," "change management," "human resource management," "leadership styles," "covid-19", "pandemic," "strategy," "transformation," "volatility", "uncertainties," and "vuca world." The emphasis here is on leadership adaptability and strategies for managing change, particularly in the context of crises such as the pandemic. Terms like "agile leadership" and "leadership styles" reflect a focus on evolving leadership approaches in response to fluctuating conditions.

Cluster 3 (Blue): This cluster features 10 keywords such as "adult," "disaster," "disaster planning," "disasters," "female," "human," "humans," "male," "resilience," and "review." It highlights the intersection of leadership with disaster management and resilience, addressing how different demographic groups and human factors are considered in planning and responding to crises.

Cluster 4 (Yellow): Including "agility," "article," "coaching," "education," "emotional intelligence," "leadership," "leadership development," "learning," "organization," and "training," this cluster points to the role of leadership development and emotional intelligence in organizational learning and training. The focus here is on enhancing leadership capabilities and fostering effective organizational practices through education and training.

Cluster 5 (Purple): This smaller cluster contains 4 items: "ambiguity," "complexity," "uncertainty," and "volatility." These keywords underscore the core elements of the VUCA environment, reflecting the fundamental challenges and attributes that leadership must address in navigating a complex and unpredictable world.

Overall, the figure illustrates the breadth and diversity of topics associated with leadership dynamics in a VUCA world, from technological and strategic aspects to human factors and leadership development. The clusters reveal a multifaceted view of how leadership is being studied and applied in various contexts, emphasizing the need for adaptability, resilience, and ongoing development in the face of a rapidly changing global landscape.

Table 3: Most Occurred Keywords

Keyword	Occurrence
vuca	77
leadership	73
covid-19	22
human	20
uncertainty	18
complexity	18
innovation	17
humans	14
decision making	12
vuca world	12
pandemic	10
volatility	10
transformation	10
knowledge management	10
ambiguity	9
digital transformation	9

Table 3 presents a detailed analysis of the most frequently occurring keywords in the context of "Leadership Dynamics in a VUCA World," reflecting the prevalent themes and concerns in the research literature. The term "vuca" tops the list with 77 occurrences, underscoring its centrality in discussions about leadership in a volatile, uncertain, complex, and ambiguous environment. "Leadership" follows closely with 73 occurrences, indicating its significant focus in the literature. The keyword "COVID-19" appears 22 times, highlighting the pandemic's impact on leadership research and its relevance in discussions of crisis management. Terms like "human" and "uncertainty," each with 20 and 18 occurrences respectively, point to the critical role of human factors and the challenges posed by uncertain conditions. "Complexity," also appearing 18 times, reflects the intricate nature of leadership challenges in a VUCA world. "Innovation" (17 occurrences) and "humans" (14 occurrences) emphasize the need for adaptive and forward-thinking approaches in leadership, while "decision making" and "vuca world"

both have 12 occurrences, further emphasizing the intricacies of navigating this environment. Other notable keywords include "pandemic," "volatility," "transformation," and "knowledge management" each have 10 occurrences, reflecting their importance in discussions about leadership adaptation and change management. Lastly, "ambiguity" and "digital transformation" each appear 9 times, indicating the need for clarity and technological adaptation in leadership strategies. Overall, the table illustrates a strong emphasis on the VUCA framework and its implications for leadership, with a clear focus on the challenges of uncertainty, complexity, and transformation.

6. Conclusion

This study reveals a rapidly growing field of research, reflecting the increasing significance of understanding leadership in the context of volatility, uncertainty, complexity, and ambiguity. Effective leadership is crucial in a VUCA world, Leaders today must exhibit adaptability, agility, and strategic foresight, with modern styles such as adaptive, instrumental, heliotropic, and situational leadership proving more effective than traditional models. Core traits such as resilience, emotional intelligence, and digital readiness are key to sustaining organizational success in complex and an ever-changing global environment.

The analysis of annual scientific production shows a significant rise in publications, particularly from 2020 onwards, reaching a peak in 2023, likely influenced by global disruptions such as the COVID-19 pandemic, which has heightened the focus on adaptive leadership strategies. The most relevant sources contributing to this body of research are diverse, covering topics from agile management and business resilience to educational leadership, indicating a broad and interdisciplinary interest in VUCA-related leadership challenges. The United States and India emerge as the leading contributors to this research, demonstrating their central roles in advancing the discourse on leadership in a VUCA context. Additionally, the network visualization of country collaboration highlights the global nature of this research, with clusters of countries working closely together, although the United States and the United Kingdom emerge as central hubs of collaboration. Finally, the co-occurrence analysis of keywords indicates a diverse range of focus areas, including digital transformation, agile leadership, disaster management, and emotional intelligence, reflecting the complexity and multifaceted nature of leadership in a VUCA world. These findings collectively underscore the increasing importance of understanding and developing leadership strategies that can effectively navigate the uncertainties and complexities of today's global environment.

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