From Neural Processes to Managerial Practice: A Bibliometric Analysis of Neuromanagement Literature (2012–2025)

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Purpose:

This study aims to provide a bibliometric analysis and a systematic review of the neuromanagement literature from 2012 to 2025. By combining PRISMA-guided screening with network-based mapping, this study identifies the conceptual evolution, which can help future literature identify potential research gaps and core themes linking neuroscience and management.

Design/Methodology/Approach:

Data were extracted from the Web of Science and Scopus databases using the search string "neuromanagement" OR "neuro-management" OR "neuroleadership", and systematically screened for 57 eligible items. The bibliometric analysis, covering annual scientific production, co-authorship networks, keyword co-occurrence, thematic mapping, and bibliographic coupling, was performed using Biblioshiny (R-Studio) and VOSviewer. The PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines structured the systematic screening.

Findings:

The final data set consisted of 57 documents published by 37 sources with 154 authors. The domain recorded an annual growth of 8.82% in publications with an average of 10.18 citations per document. The percentage of international co-authorship was only 5.26%, which indicates limited collaboration between countries. The main contributing countries were China, Italy and Romania. The thematic analysis identified four major thematic categories of neuroleadership, cognition and decision-making, emotional intelligence, and neurotechnological applications while the keyword co-occurrence analysis generated five interconnected clusters. The results indicate that neuromanagement is expanding, but it is still theoretically fragmented and geographically concentrated.

Originality/Value:

This is among the first studies to systematically map the neuromanagement domain through a combined bibliometric and systematic approach, along with summarized annotated bibliographies. It guides a path for scholars and practitioners interested in the study and implementation of neuromanagement.

Keywords: Neuromanagement, Organizational Cognitive Neuroscience, Neuroleadership, Cognitive neuroscience, Decision-making, Bibliometric analysis, VOSviewer, Biblioshiny.

Introduction:

With neuroscience successfully integrated into marketing, research linking neuroscience and management has also led to the emergence of 'Neuromanagement'. Neuromanagement is an interdisciplinary field that explores how brain processes influence managerial cognition,

leadership, motivation, and decision-making [1][2][3]. This represents a paradigm shift in organizational sciences: shifting the focus from simply observing what managers do to understanding how their neural and emotional systems influence judgment and behavior. Since its initial conceptualization by Ma Qingguo and colleagues in the 2010s, neuromanagement has progressed from a theoretical concept into a structured research domain that links neuroeconomics, neuromarketing, and behavioural management [4][5]. Early research concentrated on the neural basis of leadership and communication [6][7], and more recent work has included emotion regulation [8] and technological understanding within Industry 5.0 [9][10]

The neuromanagement literature also demonstrates the application of neuroscientific tools, such as electroencephalography (EEG), functional near-infrared spectroscopy (fNIRS), and event-related potentials (ERPs), to study cognitive functions in management. This illustrates that neuromanagement integrates both experimental foundations, such as EEG-based measures, and practical frameworks, such as neuroleadership for decision-making and safety [11][12]. Recent findings carried out from 2021 to 2025 show that neuromanagement is increasingly being applied in empirical, practical, and technology-based studies. [13] used electroencephalographic measures and skin conductance data when conducting structured job interviews and identified stages related to the stress of candidates and their level of engagement, thus showing what the neurophysiological data can contribute to the human resource evaluation. In relation to the extension of neuromanagement to workplace relations and well-being of employees, [8] proved that affective workplace events had an impact on how people evaluated organizational conditions, which emphasizes the need for developing management skills related to emotions in the context of neuroleadership. From the perspective of the literature review, [14] used co-word analysis to analyse neuroleadership and suggested research areas that connect brain-based leadership with happiness management in organizations, well-being of employees, along with value creation in organizations. Most recent experiments in the field expanded the field towards managerial creativity and collaborative decision making. For instance, [57] studied managers' individual and ingroup behaviour when problem solving measuring the data through electroencephalography (EEG) and identified different neurophysiological markers of ideation, social interaction, and collaborative decision-making. Similarly, [15] studied neuroleadership and human-AI collaboration and showed how different structures of AI leadership affected subjective leadership outcomes and neural activities. Together, these studies show that neuromanagement is being applied in areas such as recruitment, workplace emotions, employee well-being, managerial creativity, collaborative decision-making, and human–AI leadership. At the same time, the differences in contexts, methods, and research focus show that the field is still developing in a fragmented manner. This supports the need for a bibliometric analysis that brings together the existing research and identifies its main themes, leading contributors, intellectual structure, and future research directions [16].

On the other hand, scholars such as [17] have warned that neuromanagement risks "methodological isolation," where similar terminology (e.g., neuroleadership, neurotrust, cognitive management) may have a common theoretical basis. Although scholars have highlighted how behavioral issues in organizations can be reinterpreted through brain activity and mental processes e.g. [3], a significant gap remains in understanding the importance of neuromanagement for management theory and organizational performance. If this theoretical gap is not addressed, neuromanagement research may continue to be merely a collection of empirical patterns instead of developing new theoretical frameworks [9]. Using data from two databases, Web of Science and Scopus, which provide comprehensive coverage and are widely used to extract bibliographic records [18], and analyzed with Biblioshiny and VOSviewer, this study aims to address the following research question:

RQ1: How have scientific articles on neuromanagement evolved to date?

RQ2: Which authors have contributed most to this subject?

RQ3: What have been the main themes of neuromanagement to date?
RQ4: What is the gap analysis and future outlook on neuromanagement based on the findings?

Research Objectives:

Given the emerging and interdisciplinary nature of neuromanagement, this study seeks to provide a structured understanding of how the field has developed and how its major research areas are connected. The study combines performance analysis, bibliometric mapping, and a summarized annotated bibliography to examine both the quantitative growth and the conceptual development of the literature. Accordingly, the specific objectives of this study are:

To examine the growth and evolution of neuromanagement research published between 2012 and 2025.

To identify the leading authors, countries, journals, influential publications, and collaboration patterns within the field.

To map the conceptual and intellectual structure of neuromanagement through thematic mapping, keyword co-occurrence analysis, and bibliographic coupling.

To identify the major themes, existing research gaps, and potential future directions in neuromanagement through bibliometric analysis and a summarized review of the eligible studies.

By systematically visualizing the intellectual framework of neuromanagement, we aim to improve both academic understanding and practical application in the field. Scientifically, neuromanagement helps researchers identify links between cognitive neuroscience and organizational behavior [19][7]. Practically, it guides efforts to enhance effective leadership and employee well-being through neuroscientific approaches [20] [13].

Novelty of the Study:

Previous bibliometric studies have examined different areas related to neuroscience and management. For instance, [21] analysed neuroscientific research within the management and organization literature, though the paper is not in English. Another article by [22] focused mainly on the relationship between neuroscience, entrepreneurial leadership, innovation, and entrepreneurship. Moreover, [23] studied the broader field of organizational neuroscience from 2007 to 2020 and gave particular attention to the neuroscientific methods used in empirical studies. More recently, [24] provided a broad bibliometric mapping of publications related to neuromanagement and organizational neuroscience from Scopus and Web of Science. These studies have contributed to understanding the relationship between neuroscience, management, leadership, and organizational behavior; however, they deem to be different according to their scopes, period of analysis, selection criteria, and focus of analysis.

The novelty of the present study, therefore, lies in its focused examination of neuromanagement and neuroleadership literature, with results covering publications between 2012 and 2025. Unlike broader reviews of organizational neuroscience or neuroscience in entrepreneurship, this study applies clearly defined eligibility criteria to identify studies directly related to managerial and leadership contexts, while excluding publications mainly concerned with neuromarketing and neuroeconomics. It also treats neuroleadership as an important part of the wider neuromanagement domain. Methodologically, the study combines PRISMA-guided screening with performance analysis, thematic mapping, keyword co-occurrence, and bibliographic coupling using Biblioshiny and VOSviewer. In addition to bibliometric mapping, the eligible studies are organized into a summarized annotated bibliography covering five areas of application. This allows the numerical and network-based findings to be supported by a more detailed understanding of the subjects examined in the literature. Therefore, the contribution of this study does not depend on claiming that no previous bibliometric research exists. Instead, it provides an updated, focused, and structured analysis that brings together the development, intellectual structure, major themes, contributors, and practical areas of neuromanagement research.

Methodology:

The methodology used in this study focuses on using bibliometric techniques to analyze the field of neuromanagement. The papers were also systematically reviewed to be categorized and summarized for a more detailed analysis. A bibliometric analysis thoroughly assesses literature on a particular topic to define knowledge boundaries and pinpoint research needs [25][26]. The review procedure was structured according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards. PRISMA involves a comprehensive procedure to select eligible papers that guides researchers to analyze existing literature present in scientific literature databases [27]. The PRISMA flow diagram for our paper is (Figure 1a):

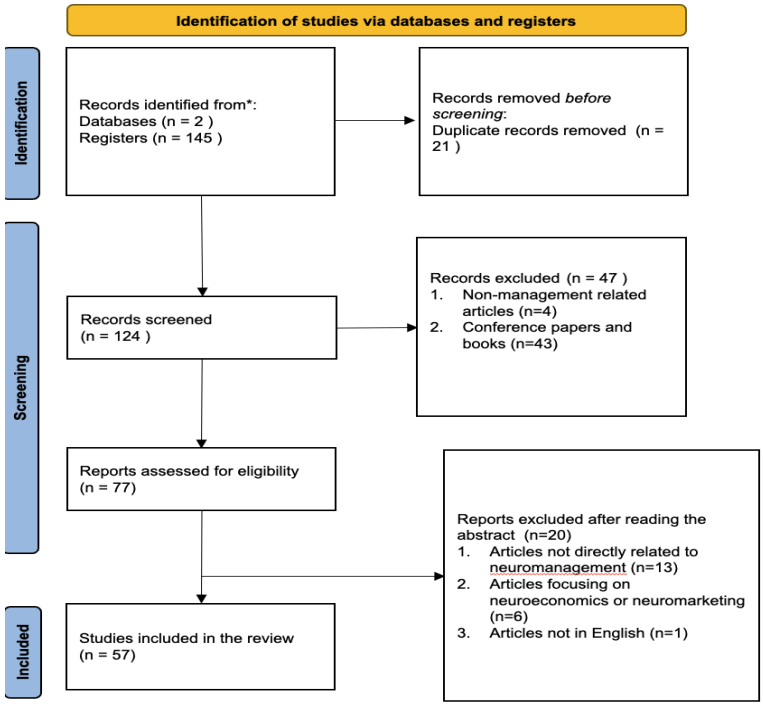

Figure 1. PRISMA flow diagram (Source: Authors' development)

Methodological Workflow:

In addition to the PRISMA screening process presented in Figure 1summarizes the complete methodological workflow of the study. It shows the stages of database selection, literature retrieval, screening, data preparation, software implementation, bibliometric analysis, categorization of the eligible studies, and interpretation of the findings. The framework has been included to provide a consolidated overview of the research process and improve its reproducibility.

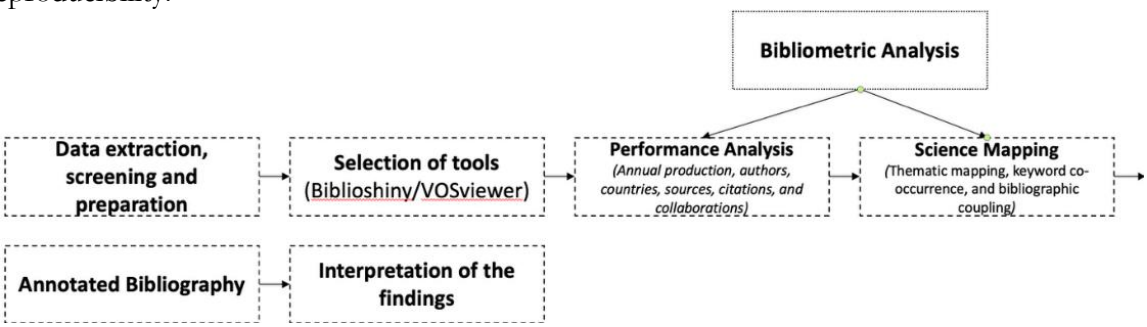

Figure 2. Methodological workflow of the study (Source: Authors' development)

Search Strategy and Tools:

To conduct a bibliometric analysis and systematic literature review on the expanding concept and research of neuromanagement, we selected papers published in the Web of Science (WoS) and Scopus. Both databases are leading interdisciplinary research databases and provide

an extensive coverage of high-quality published papers [23][28][29]. WoS and Scopus databases have been chosen due to the fact that they are multidisciplinary databases that offer bibliographic and citation metadata in an organized form that is appropriate for conducting bibliometric analyses and compatible with Biblioshiny and VOSviewer softwares. Using both databases at once allows for reducing the dependence on one source and increasing coverage because WoS and Scopus cover diverse journals, disciplines, countries, and languages [30][31]. Dimensions were not included because differences in database coverage and metadata structures would require further harmonization and could introduce additional duplication into the merged dataset. PubMed database was not chosen due to its focus on biomedical and life-science literature, while the current research is related to the management and organizational neuroscience applications. Although Google Scholar provides broad coverage, it was not selected because its limited search transparency and restricted options for systematic data extraction make it less suitable for a reproducible bibliometric analysis [32]. The selection of WoS and Scopus was therefore considered appropriate for maintaining a focused, consistent, and reproducible dataset.

The search string, '"neuromanagement" OR "neuro-management" OR "neuro management" OR "neuroleadership"' was used in both the databases. We included neuroleadership to further expand our search horizon. This is in line with previous conceptualizations that frame neuromanagement as the application of neuroscience to management and organizational issues [3][33], and following editorial guidance that mentions 'Neuro-leadership applied to neuromanagement issues' within the neuromanagement domain [3], Neuromanagement and Neuromarketing Research Topic), we decided to include neuroleadership as part of the wider neuromanagement family [34][35].

Both databases, (Web of Science and Scopus), yielded 145 records. We extracted the data in .BibTeX and .txt formats for the bibliometric softwares and reference manager. After removing 21 duplicate entries using reference manager Zotero v7.0.29, 124 articles remained for screening. Titles and abstracts were examined to exclude non-management-related studies (n = 4) and conference papers and books (n = 43). The remaining 77 articles were assessed for eligibility based on their relevance in the neuromanagement domain. Following the eligibility criteria, 20 papers were excluded-13 were not directly related to neuromanagement, six focused primarily on neuroeconomics or neuromarketing, and one was not in English. Once these inclusion/exclusion criteria were completed, 57 studies were included in the review and this indicatesthat the field of neuromanagement is still in its emerging stage with growing scholarly attention. In such cases, bibliometric mapping is useful for identifying budding themes and potential research gaps [61][62].

We then merged both the parent files in the Biblioshiny software and downloaded the file in .xlsx format, and manually removed the excluded and non-eligible items in Microsoft Excel 365. Biblioshiny is a web based application of the Bibliometric R-Studio package (v 2025.05.1+513), designed in the R programming language and helps in performing a comprehensive bibliometric analysis [36]. We also used VOSviewer (v1.6.20), another widely used software for bibliometric studies. It facilitates a detailed bibliometric analysis, especially for thematic evolution through keywords [37].

We further categorized the eligible items for this study into five groups for a summarized annotated bibliography. These categories are (Figure 3)

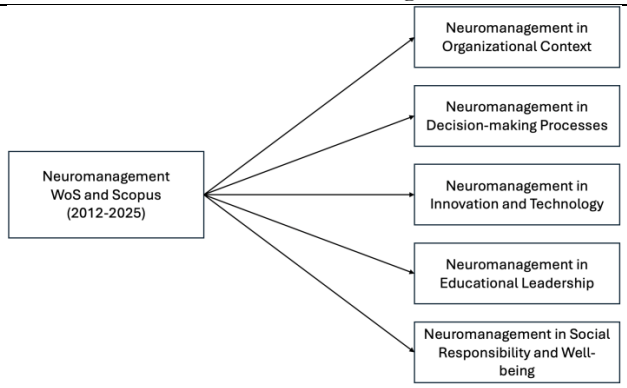

Figure 3. Categories of the eligible articles on Neuromanagement (Source: Authors' development)

Validity, Reliability, and Reproducibility:

The validity of the study was supported by using Web of Science and Scopus, which provide broad and structured data coverage for bibliometric analysis. The study uses various bibliometric techniques to analyse the data which allows the field of neuromanagement to be examined from different perspectives [61][62]. Furthermore, reliability was maintained by removing duplicate records through the reference management software (Zotero) and applying the same inclusion and exclusion criteria throughout the screening process, while by reporting the search string, databases, software versions, analytical thresholds, and screening stages, the study maintains its reproducibility. The PRISMA flow diagram and methodological workflow further provide a clear record of how the final dataset was selected and analysed.

Results and Discussion:

We focus on two bibliometric methods in this study: Performance Analysis (Descriptive Bibliometrics), which concentrates on quantitative assessment, and Science Mapping (Relational/Structural Bibliometrics), which examines the relationships and the intellectual structure of the field [61].

To perform the analysis, we employed seven core bibliometric analyses: *annual scientific production, country and author collaborations, leading authors and sources, citation impact, thematic mapping, keyword co-occurrence, and bibliographic coupling*, as these collectively offer a comprehensive understanding of the field. These analyses are particularly suitable for emerging domains with limited publications, where the goal is to identify research gaps and evolving trends [62]. Advanced analyses (e.g., historiographic mapping or co-citation of references) were excluded because they require larger datasets for stable and interpretable networks [38].

Data Summary:

The summary of the data analyzed in Table 1 shows that the 57 documents, extracted from WoS and Scopus included in this study were from 37 sources with an annual growth rate of 8.82%. The average document age of 4.61 years and 10.18 citations per paper suggest that the field is gradually gaining recognition. With 154 contributing authors and an average of 2.98 co-authors per paper, collaboration is moderate, although international co-authorships (5.26%) remain limited, with a concentration of research within specific regions. The large number of author keywords (203) and Keywords Plus (222) demonstrates conceptual diversity within neuromanagement.

Table 1. Summary of the data (Source: Authors owns creation)

Timespan	2012–2025
Sources	37
Documents	57
Annual Growth Rate (%)	8.82
Document Average Age	4.61

Average Citations per Doc	10.18
Keywords Plus (ID)	222
Author's Keywords (DE)	203
Authors	154
Authors of Single-Authored Docs	14
Co-Authors per Doc	2.98
International Co-Authorships (%)	5.263

Annual Scientific Production:

The annual scientific output (Figure 4) of neuromanagement studies from 2012 to 2025 demonstrates how the field has evolved from an initial concept to a more systematic discipline over time. The trend between 2012 and 2016 shows scattered data, with an average of one article per year; however, this early phase reveals that the concept shifted from cognitive sciences to managerial sciences [4] and to the connection between neurosciences and social sciences [5]. In 2017, an advanced approach called hyperscanning was utilized to study leadership and communication in line with neuroscience [1][60] showing an upward trend in research. Meanwhile 2018 marks further development from empirical studies to applications such as neurotrust [18] and neuroscience and organizational behaviour [7].

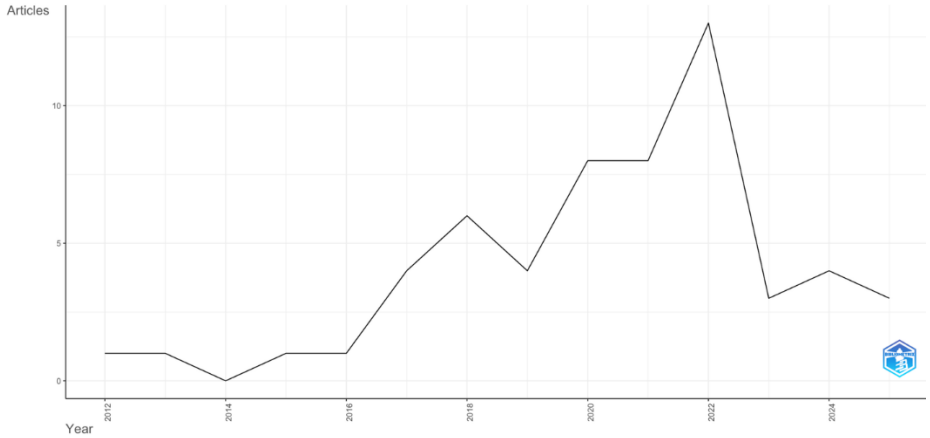

Figure 4. Annual Scientific Production of Articles (Source: Authors' development)

Neuromanagement as a field of study matured in subsequent years, particularly from 2020 to 2025, with ten or more publications on the topic annually. Neuroscience methodologies such as neuroimaging, electroencephalography (EEG), and Functional Near-Infrared Spectroscopy (fNIRS) have been applied in managerial studies [39][12]. Studies by [11] and[11] on EEG-based organizational safety and in decision-making indicate that research has advanced towards problem-solving using neuroscience-related technologyhas also been further elaborated through research in Industry 5.0 contexts, as seen in the works[57][9]. It is essential to note that the rising trajectory in the literature suggests that neuromanagement has evolved from exploratory studies to a developing interdisciplinary field, between 2012 and 2025, answering RQ1 of this study.

Contributions and Collaborations by Countries and Authors:

With each country having a distinct thematic focus, the geographical distribution (Figure 5) of the literature on neuromanagement reveals that the most prolific contributions come from China (n = 26), Italy (n = 16), and Romania (n = 11), followed by the USA (n = 7) and Cyprus (n = 6). The thematic orientation indicates that Chinese scholars (e.g., Cheng et al., 2022; Ma et al., 2019) have focused on neuroergonomics, safety and decision-making sciences, while Italian authors such as [1] and [40], have imminent work on EEG-based leadership and emotional regulation. Moreover, Romanian researchers such as [11][41] have contributed their work through the amalgamation of digitalization and cognitive algorithms in managerial contexts. This

shows the geographical diversification of neuromanagement research, particularly after the year 2020.

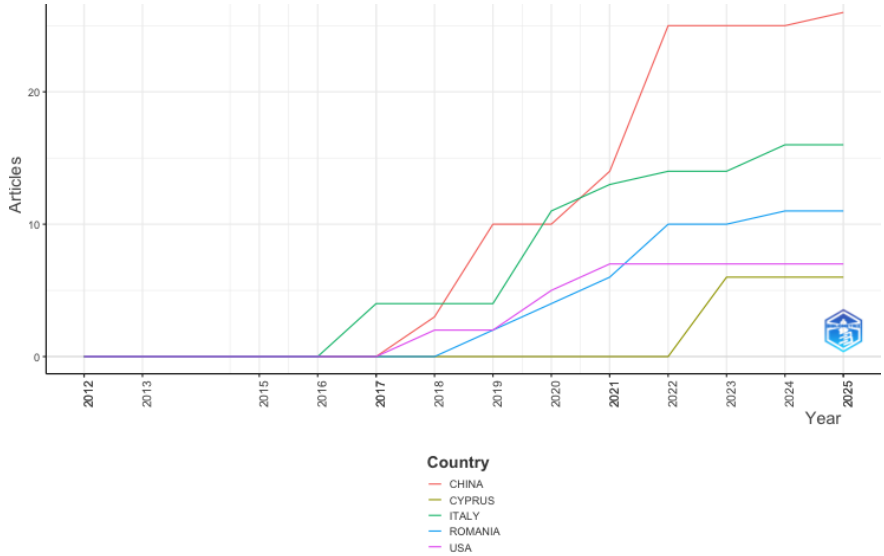

Figure 5. Country-wise Production of Articles (Source: Authors' development)

These findings contribute to RQ2 by identifying the leading countries and showing that the growth of the field remains geographically concentrated with limited international collaboration.

Interestingly, on the other hand, author-level co-authorship analysis (as shown in the Lotka distribution) [42] (figure 6) indicates that work on neuromanagement is geographically isolated, which limits the methodological diversity and the cross-validation of results. This concern has also been emphasized by [43] and[15] who stressed the importance of international cooperation in neuromanagement and neuroleadership studies. This analysis also indicates that the geographical collaboration gap persists.

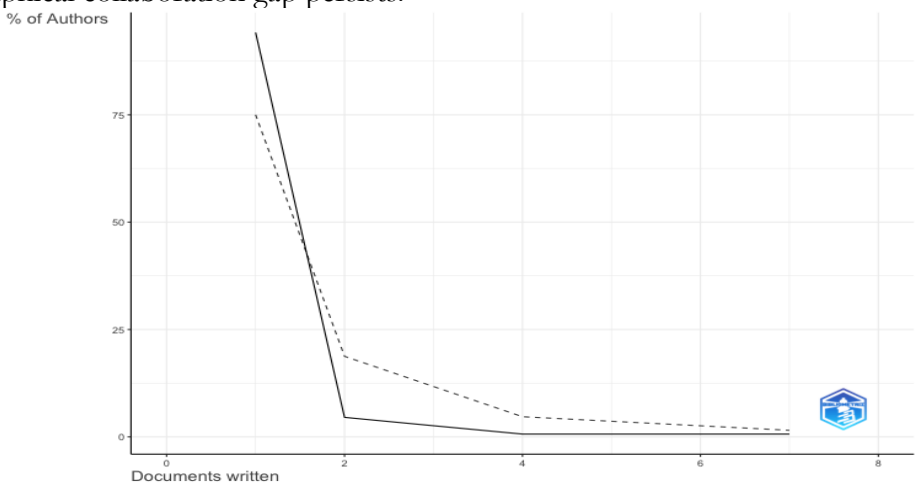

Figure 6. Author Productivity through Lotka's law (Source: Authors' development)

Prominent Authors, Collaborations, and Most Relevant Sources:

Productivity analysis by author level identifies 154 authors, some of whom have continuous contributions in the field (Figure 7), whereas, in contrast, a broad base of authors has published one or two studies. M. Balconi, author of seven papers, and I. Venturella, author of four papers, are significant contributors whose work should not be overlooked in the literature on neuromanagement.

Furthermore, significant, high-quality research, such as Neuromanagement and Leadership, and Neuromanagement and Communication, emphasizes the human resource

management aspect of organizations through neuroscience [44][60]. Additional collaborations have demonstrated advancements in research methodologies through the study of hyperscanning, moral cognition, and neuroempowerment of executive functions in the workplace [6][37][45]. The most recent work by the authors demonstrates the growth of the field as they examine EEG measures to analyze creativity and group decision-making among managers. The study [58] also reflects earlier work on EEG/ERP-based analyses of cognition, risk, and decision making among managers in previous contributions. Moreover, P. Zak's work in neuromanagement investigates the neuroscience of trust and its impact on organizations, connecting neurochemical mechanisms to performance [18][46]. Additionally, M. Zito's work on job assessment and K. Abili's meta-synthesis of cognitive science applications in management highlight the diverse perspectives shaping this emerging field [12][47]. The prevalence of co-authorship among leading contributors further highlights the collaborative and multidisciplinary nature of neuromanagement research, which integrates psychology, neurology, and organizational science.

Source productivity analysis (figure8) shows that neuromanagement research has been published across a thematically consistent range of journals, linking the fields of neuroscience, psychology, and management. Of the 37 recognized sources, a small number of outlets account for the majority of contributions, indicating that the discipline is still establishing its publication base. *Frontiers in Psychology* published six articles on neuromanagement and related subfields. 'Notable contributions include Job Assessment Through Bioelectrical Measures' [12] and 'Brain-Adjusted Relational Leadership' [41] which demonstrate the use of neurobiological insights in leadership assessment and interpersonal dynamics within businesses. *Frontiers in Neuroscience*, with five papers, ranks second with seminal papers such as 'Application of Neural Technology to Neuro-Management and Neuromarketing' [2] and 'Human Decision-Making Behaviors in Engineering and Management: A Neuropsychological Perspective' [48], have played a key role in establishing the methodological boundaries of the field. [58] also conducted one of the earliest ERP-based studies on managerial enforcement cognition, in Frontiers in Neuroscience, demonstrating the journal's methodological rigor. The rest of the journals, *Neuropsychological Trends, NeuroQuantology,* and *Sustainability*, published three articles each, indicating the growth of neuromanagement in emerging journals.

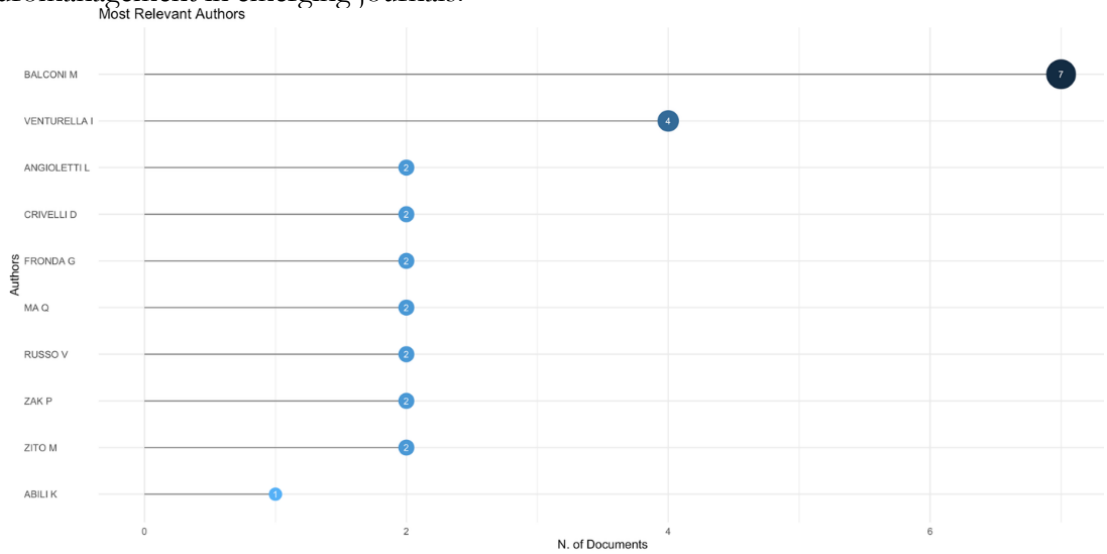

Figure 7 Most Relevant Authors (Source: Authors' development)

Figures 6 and 7 further answer RQ2 by identifying the most productive authors and the journals that have provided the main publication platforms for neuromanagement research.

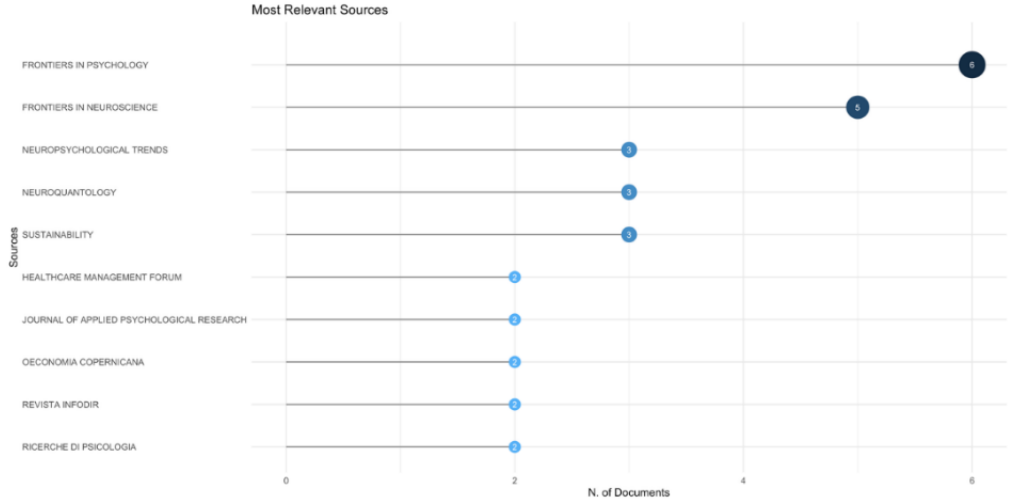

Figure 8. Most Relevant Sources (Source: Authors' development)

Citation Analysis and Impact:

The most frequently cited article worldwide (Figure 9) is published in Oeconomia Copernicana with 90 citations, accounting for 5.07% of the total citation share. Their work was crucial in linking neuromanagement decision making with cognitive modelling and technology. This emphasizes the influence of research on brain processes in managerial decisions. The second most cited work by [49]in the Emerging Science Journal (59 citations), further explained the concept of neuroleadership in educational contexts, highlighting the importance of emotional regulation and brain-based learning. The studies [10] in Frontiers in Neuroscience and [18] in the Consulting Psychology Journal, had 38 global citations. Cheng's research integrated eye-tracking and neuroergonomic evidence to explain cognitive mechanisms in management-related safety contexts, whereas Zak's foundational work on organizational trust and oxytocin formulated one of the initial biochemical theories of workplace behavior. [13] cited 26 times, proposed the concept of happiness management via neuroleadership in Humanities and Social Sciences Communications, merging affective neuroscience with well-being and leadership paradigms. Similarly, as these studies are well-represented in the above analyses,[42] with 24 citations, [6] with 23 citations and [39] with 22 citations further reinforce the empirical foundation of the field and showcase its emergence.

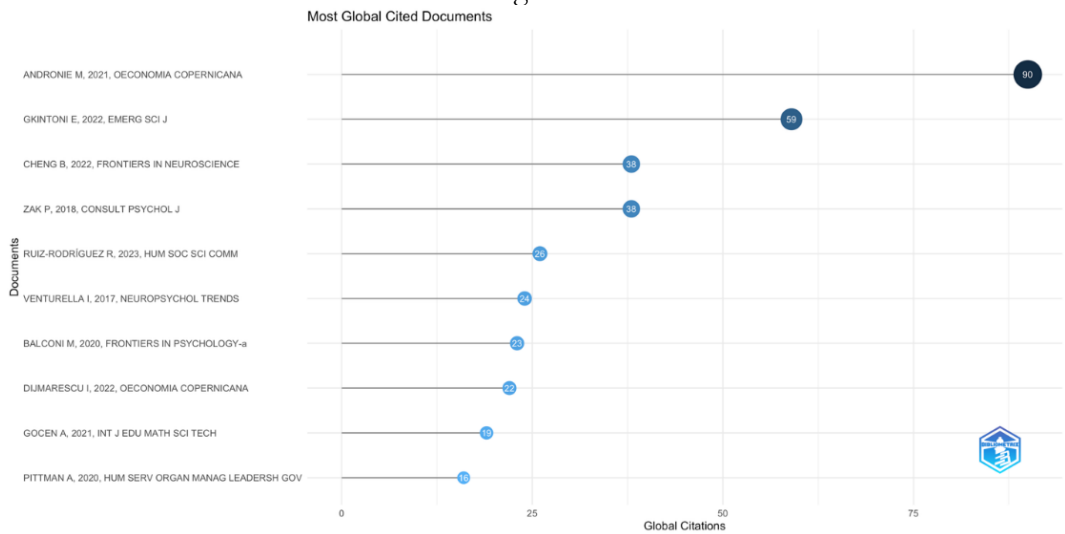

Figure 9. Most Global Cited Documents (Source: Authors' development)

Figure 8 supports RQ2 by identifying the publications that have had the strongest citation influence and have contributed to the development of the field.

Conceptual Structure of the Field: Thematic Mapping:

To analyze the web of neuromanagement, we employed graph theory concepts such as density and centrality. By employing a clustering methodology, topological analysis enables the identification of elaborate research areas and collaboration patterns. [50]. Density, also known as internal cohesion, measures the strength of links and indicates thematic development within a keyword cluster [51]. A higher density value indicates greater coherence among keywords. Centrality analysis assesses the level of interaction and the strength of connections between a particular theme and other components within the network [52]. This emphasizes the significance of the theme in the overall development of the research field. A larger number of connections between different themes demonstrates the extent of centrality a theme holds within the network. In our analysis, density is displayed on the y-axis and centrality on the x-axis, respectively, as shown in (Figure 9). Further details on these quadrants can be found in the study by [49] for readers seeking additional explanations. The top-right quadrant, known as the first quadrant, represents high density and strong centrality, indicating internal cohesion and prominence within the setup.

A thematic map of the conceptual framework of neuromanagement (figure 10) was created using author keywords (minimum frequency = 2, walktrap clustering). Eleven keyword clusters appeared, which can be categorized into four primary thematic groups: (1) leadership and neuroleadership, (2) neuromanagement as an emerging paradigm, (3) cognition and decision-making, and (4) specialized or emerging niches (e.g., EEG–based assessment, culture and trust, neuromarketing, and emotional intelligence).

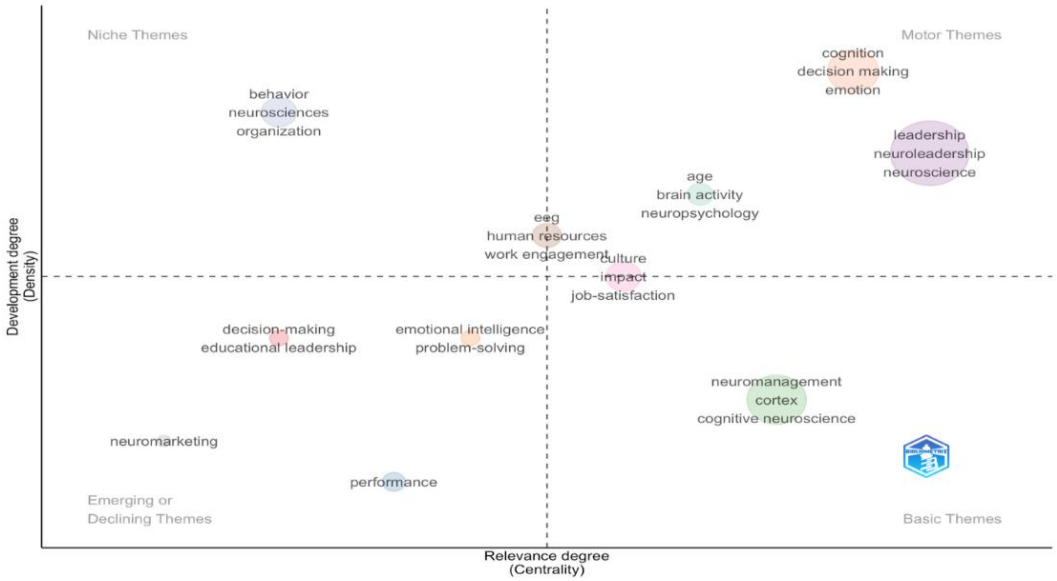

Figure 10. Thematic Mapping (Source: Authors' development)

Core motor themes: Leadership / Neuroleadership and Cognition:

The leadership cluster (centrality = 10.99; density = 87.72) was the most central theme on the map. It comprises the keywords leadership, neuroleadership, neuroscience, human, management, manager, and human experiment, along with neurophysiological terms such as brain, electroencephalogram, and neurofeedback. This cluster represents a unified study area that combines traditional leadership and organizational behavior with neuroscience. The second key theme was the cognition cluster (centrality = 5.10; density = 114.58). This cluster focuses on cognition, decision making, emotion, attention, cooperation, electroencephalography, motivation, and interpersonal communication. This illustrates that neuromanagement is viewed as the use of cognitive neuroscience to inform managerial decisions and knowledge processes, in line with [53] [58] who discussed about the relationship between cognition, management decisions, and communication.

Basic and transversal theme: Neuromanagement as a Field:

The neuromanagement cluster (centrality = 3.84; density = 47.66) functioned as a key theme linking several clusters. Keywords: neuromanagement, cortex, cognitive neuroscience, communication, leadership, automation, and fNIRS. [2][3][15] proposed that neuromanagement functions as an integration linking leadership, cognition, performance, and neuromarketing domains.

Niche themes: EEG assessment, culture and trust, performance:

The EEG cluster (centrality = 0.67; density = 72.22), which focused on EEG, human resources, and work engagement, highlights specialized applications of neuroscience in management, particularly in HR and job design. The works of [54] on neuroleadership and engagement, and [12] on bioelectrical job assessment can be viewed in this light. The culture cluster (centrality = 0.83; density = 71.88) focused on culture, job satisfaction, self, impact, and work environment. Several authors, such as [55],[44] and [18] in their works link organisational trust, culture, and performance with neuromanagement, expanding its context. The performance cluster (centrality = 0.42; density = 20.00) links neuromanagement to performance and education or knowledge, as in the work of [56]. Although the theme was relatively small, it remained conceptually important.

Emerging and peripheral themes: Decision-making and emotional intelligence:

The thematic map also revealed several emerging themes with comparatively lower centrality and density. The decision-making cluster (centrality = 0.25; density = 62.5) combined decision-making with educational leadership. [47][58] studied neuroleadership and its application in academic institutions for improved administrative activities and decision-making, linking educational leadership with neuroscience. The emotional intelligence cluster (centrality = 0.50; density = 62.5), linking emotional intelligence and problem solving, is small but has a strong conceptual significance. This indicates that neuroleadership skills in Industry 5.0 reflect a shift towards incorporating brain-based emotional competencies alongside complex problem-solving in digital environments [9].

Keyword Co-Occurrence Analysis (Author Keywords):

The keyword co-occurrence network (Figure 11) shows the conceptual framework of neuromanagement research by mapping the most common and interconnected author keywords. Using a minimum threshold of two occurrences per keyword, 58 out of 397 keywords appeared twice. This analysis revealed five major thematic clusters.

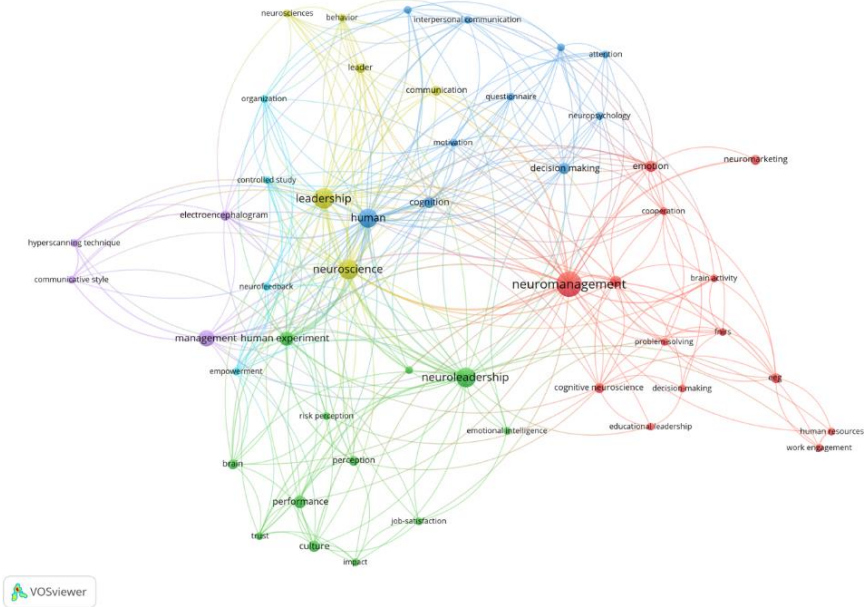

Figure 11. Keyword Cooccurrence (Source: Authors' development)

Cluster 1 (Red) focuses on keywords such as "neuromanagement," "emotion," "cognition," "decision-making," "EEG," "fNIRS," and "brain activity", representing the experimental foundation of neuromanagement by combining neuroscientific tools with decision-making challenges within organizations. Cluster 2 (Blue) includes keywords like "leadership," "cognition," "human," "communication," "attention," "motivation," and "interpersonal communication," and Cluster 3 (Green) with keywords "neuroleadership," "culture," "performance," "trust," "job satisfaction," "risk perception," and "emotional intelligence" further highlights cognitive-behavioral leadership processes while linking neuroscience with organizational communication and HR concepts. Cluster 4 (yellow) contains the keywords "neuroscience," "neurosciences," "organization," "controlled study," "neurofeedback," and "" electroencephalogram. and cluster 5 (purple) with keywords, "management," "human experiment," "empowerment," "communicative style," and "hyperscanning technique" emphasizes how neuromanagement concepts can be applied practically.

These five clusters showed strong connections among the terms "neuromanagement," "leadership," "neuroleadership," and "neuroscience," confirming their significance as central ideas in the field. The total link strengths for "neuromanagement" (TLS > 40) and "leadership" (TLS > 35) indicate that the domain has multidisciplinary aspects as well, encompassing cognitive neuroscience, behavioral management, and organizational psychology. Figures 10and 11answer RQ3 by showing that leadership, cognition, decision-making, emotion, and neuroscientific technologies form the main conceptual areas of neuromanagement research.

Bibliographic Coupling (Documents):

Bibliographic coupling (figure 12) shows the structural links among recent studies through shared references, highlighting clusters of studies based on similar theoretical foundations. Of the 57 qualifying documents, 43 met the minimum criteria for sharing two references indicating the publication years 2017-2024.

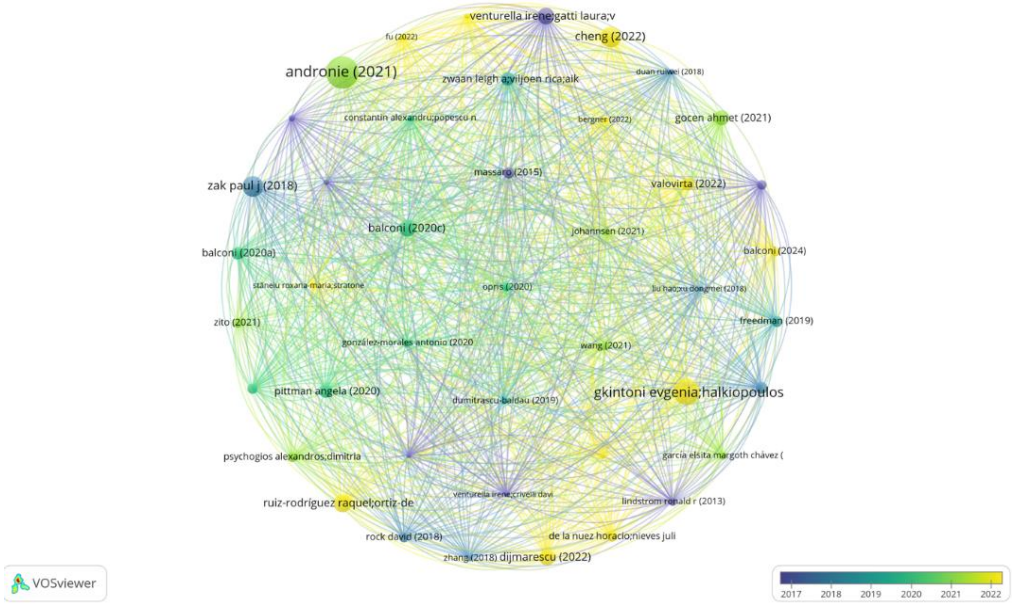

Figure 12. Bibliographic Coupling-Documents (Source: Authors' development)

The colour gradient in the overlay visualisation indicates an evolution from experimental studies (2015–2019) toward application and diversification (2020–2024). For instance, earlier works (blue-green tones) established the theoretical and physiological foundations of neuromanagemente.g. [7],[18],[5],[63]. Mid-phase research (green-yellow) explored cognitive leadership and decision-making aspects with the application of neuroscience tools e.g. [17],[37],[52]. Recent studies (bright yellow) emphasise AI integration and real-world

applications through neuroscience, such as workplace adaptability and neuromarketing e.g. [10], [11],[13]. Figure 12contributes to RQ3 and RQ4 by showing the movement from early theoretical and experimental studies towards technological and organizational applications, while also identifying areas that remain less developed.

Comparison with Previous Bibliometric Studies:

The publication pattern identified in the present study supports earlier findings that neuromanagement has gradually developed from a limited research area into an emerging interdisciplinary field. [21], through the WoS database, extracted thirty-eight studies and also found that interest in neuromanagement research had increased over time, though the literature in their study was mainly concentrated in the European countries. The present findings show a somewhat different geographical pattern, with China emerging as the leading contributor, followed by Italy and Romania. This difference may be explained by the wider use of both Web of Science and Scopus, the later period covered by the present study, and the increasing application of neuroscience in areas such as safety management, decision-making, neurotechnology, and artificial intelligence. The geographical findings are also consistent with [22], whose broader analysis identified China as the leading contributor and reported that international collaboration remained limited. However, the international co-authorship rate reported by [22] was 17.73%, compared with 5.26% in the present study. This difference may result from the broader search terms, and inclusion of different publication types in the earlier study. Despite these differences, the analysis by both studies shows that the geographical growth of neuromanagement shows a lack of strong international collaboration. This concentration may limit the extent to which the findings can be generalized across different organizational and cultural environments.

The thematic findings also show similarities with earlier bibliometric research. For instance, [21] identified decision-making, cognition, leadership, and behavioural strategy as important themes within organizational neuroscience. Similarly, [20] identified organizational, biological, cognitive, and emotional approaches within neuroscience-based management and entrepreneurship research. The present study also found leadership, cognition, decision-making, and emotion to be central areas, while additionally identifying neurotechnological applications, EEG-based assessment, organizational trust, and emotional intelligence as developing themes. Similarly, the rise of the applications of neurotechnology as a developing topic is supported by studies done on group decision making of managers using EEG and human-AI co-leadership [27], [14]. Similarly [22] reported that decision-making, leadership, emotion, ERP, the brain, and cognition formed the main conceptual areas of neuromanagement research. The consistency among these studies indicates that leadership and cognitive decision-making have become relatively stable foundations of the field, whereas technological, emotional, and organizational applications are still developing.

Summarised Annotated Bibliography:

The 57 eligible documents on neuromanagement for this study were further elaborated and discussed in the form of an annotated bibliography (Table 2). They are organized in a structured format and categorized into five groups: neuromanagement in organizations, neuromanagement in decision-making processes, neuromanagement in Innovation and Technology, neuromanagement in educational leadership, and neuromanagement in social responsibility and well-being. Table 2 contributes mainly to RQ4 by organizing the studies into five application areas and showing where further theoretical, empirical, and practical research is still required

Table 2. Summary of the Annotated Bibliographies

Theme/Paper	Author(s)	Year	Journal	What the study explores
Neuromanagement in Organizational Contexts				
Motivation of Enterprise Motivation Management Mechanism Based on Neuromanagement.	Zhang, X.	2018	NeuroQuantology	Limitations of the conventional motivation management techniques in Chinese firms Significance of internal and material as well as external and spiritual motivation Influence of intrinsic motivation on spiritual motivation and employee engagement
Neuromanagement. What about emotion and communication	Balconi, M., & Venturella, I.	2017	Neuropsychological Trends	Focuses on emotional processing (arousal, valence) and its neurological basis (EEG, autonomic responses) in situations of communication. Analyses non-verbal (facial expressions, EMG) and verbal communication in managerial settings.Presents the need for neuromanagement to combine emotional and communicative functions to transcend purely rational approach to organizational behavior.
Application of Cognitive Science in Management (A Meta-Synthesis Study)	Abili, K., Narenji Thani, F., & Mazari, E.	2020	Journal of Applied Psychological Research	Meta-synthesis of over 2,000 studies identifying how cognitive science applies to management. Defines three major applications: (1) management functions (leadership, decision-making, planning, supervision, cognitive control), (2) management styles (neuroleadership, rational-brain leadership, wise leadership, self-management), and (3) management domains (cognitive management and cognitive business management).Emphasizes the interdisciplinary nature of cognitive science in linking neuroscience with management and leadership practices.Argues that cognitive science contributes to more adaptive, self-aware, and evidence-based managerial behaviors.
Job Assessment Through Bioelectrical Measures: A Neuromanagement Perspective	Zito, M., Bilucaglia, M., Fici, A., Gabrielli, G., & Russo, V.	2021	Frontiers in Psychology	Explores bioelectrical measures (EEG, HRV) to assess stress and engagement during job performance. Proposes neuroassessment-based metrics for evaluating employee cognitive load and satisfaction. Demonstrates the potential of biosignal analysis for developing healthy workplace ecosystems
What about emotion and communication	Balconi, M., & Venturella, I.	2017	Neuropsychological Trends	Explores emotional processing (arousal, valence) and its neural correlates (EEG, autonomic measures) in communication contexts.Examines non-verbal (facial expression, EMG) and verbal communication processes in management settings.

				Proposes that neuromanagement must integrate emotional and communicative processes to go beyond rational models of organisational behaviour.
The role of neuroleadership in work engagement	Zwaan, L. A., Viljoen, R., & Aiken, D.	2019	SA Journal of Human Resource Management	Examines neuroleadership principles as drivers of employee engagement and productivity Shows that leaders who apply neuroscience-informed strategies foster motivation and commitment Advocates neuroleadership training to enhance cognitive empathy, reward balance, and emotional regulation at work
The neuroscience of high-trust organizations	Zak, P. J	2018	Consulting Psychology Journal	Identifies oxytocin as the biochemical foundation of trust in organizational cultures Demonstrates that trust-based environments enhance performance, innovation, and employee retention. Provides neurobiological evidence linking empathy, recognition, and fairness with high-performing organizations.
Neuromanagement and leadership	Michela Balconi, Irene Venturella	2017	Ricerche di Psicologia	Uses hyperscanning to study manager-employee interaction during performance evaluation. Compares two communication styles (authoritative vs cooperative) and their neural/psychophysiological markers. Suggests neuroscience methods are useful for exploring interpersonal dynamics in organisational leadership situations.
Leadership and credition: Followers' neural response to leaders who are perceived as transformational	Bergner, S., Rybnicek, R., & Koschutnig, K.	2022	Frontiers in Behavioral Neuroscience	Finds a positive correlation between the strength of neural activation and the perceived level of transformational leadership. Shows that these neural activations predict followers' motivation at work, over and above behavioural leadership ratings. Provides a neuro-foundation for understanding how followers' beliefs about leadership influence organisational outcomes.
Research on the Behavior of Factors That Influence the International Virtual Project Team Performance, Using Data Modeling Techniques	Dumitraşcu-Bîldău, I., & Dumitraşcu, O	2019	Sustainability	Examines factors influencing the performance of international virtual project teams (IVPTs). Emphasizes the importance of communication, collaboration, and cultural diversity for IVPT success. Analyzes variables affecting IVPT performance and highlights the value of clear communication and tools for non-verbal communication. Discusses the impact of cultural diversity and provides recommendations for supporting cultural sensitivity and teamwork. Mentions applications of neuromanagement for effective IVPT management.

The Dialogue Between Two or More Brains: The "Hypercanning" for Organization	Balconi, M., & Fronda, G.	2020	Frontiers in Psychology	Discusses hyperscanning technology and its potential use in organizational settings. Focuses on synchronization during communicative exchanges and explores its neuro- and physiological correlates. Highlights brain synchrony as the basis of functional mutual inter-relationships. Explores the advantages and moral implications of using hyperscanning technology in organizations.
Management decisions through the neuro management in the universities of zone 3 of Ecuador	García, F. M. C	2021	Journal of Advanced Pharmacy Education and Research	Examines how neuromanagement principles support decision-making in Ecuadorian higher education institutions. Focuses on cognitive and emotional factors that enhance leadership, communication, and teamwork among university administrators. Highlights the importance of integrating neuroscience-based insights into academic management processes. Suggests that neuromanagement contributes to more empathetic, transparent, and effective institutional decision-making.
Neuroleadership: Affective experiences in the workplace and their influence on employees' evaluative judgements	de la Nuez, H., Nieves, J., & Osorio, J.	2023	International Journal of Hospitality Management	Investigates how affective events at work influence employees' evaluative judgments of organizational factors. Uses a six-month field study in a hotel chain involving lower-level employees and middle managers to assess neuroleadership impacts. Finds that affective events significantly improve employees' judgments of work environment and organizational variables, highlighting the role of emotion-based leadership. Emphasizes the importance of neuroleadership skills in managing emotions and enhancing employee well-being and workplace perceptions.
Research on the Behavior of Factors That Influence the International Virtual Project Team Performance, Using Data Modeling Techniques	Dumitraşcu-Bîldău, I., & Dumitraşcu, O.	2019	Sustainability	Examines behavioral and cognitive factors influencing international virtual project team (IVPT) performance. Uses data modeling to identify the relationship between cognitive coordination and team productivity. Suggests neuromanagement applications in improving virtual teamwork, decision-making, and cross-cultural understanding.
Neuroleadership: A Journey Through the Brain for Business Leaders	Ghadiri, A., Habermacher, A., & Peters, T	2012	Management for Professionals, Springer Nature	Presents a comprehensive overview of neuroleadership, linking them to leadership behavior and organizational performance. Explains neural bases of motivation, decision-making, and emotional regulation relevant to managerial effectiveness.

				Highlights how understanding brain mechanisms can enhance empathy, adaptability, and conflict resolution in leaders. Provides practical frameworks for applying brain-based insights to leadership development and executive training.
The Neuroscience of Organizational Trust and Business Performance: Findings from United States Working Adults and an Intervention at an Online Retailer	Johannsen, R., & Zak, P. J.	2021	Frontiers in Psychology	Investigates the neurobiological foundations of organizational trust and its relationship with business performance. Measures oxytocin levels and behavioral trust indicators among U.S. working adults and retail employees. Positions trust as a neurochemical driver of organizational effectiveness within neuromanagement frameworks.
Brain Mapping of Cognitive Empathy in Neuroleadership Using Quantitative Electroencephalography (qEEG)	Khazraei Hafezi Fekr, H., Yazdani, H. R., & Zarci Matin, H.	2024	Journal of Applied Psychological Research	Employs qEEG to map neural correlates of cognitive empathy among leaders in organisational settings Finds specific brain-regions and spectral-patterns associated with increased empathetic processing in leadership roles Argues that neuroleadership training should incorporate empathy-driven brain-based metrics to enhance leader-followership Suggests that utilising qEEG metrics can improve leader selection, development, and evaluation in complex organisational environments
Neurofeedback in the workplace: From neurorehabilitation hope to neuroleadership hype?	Massaro, S	2015	International Journal of Rehabilitation Research	Critically examines the application of neurofeedback from clinical rehabilitation to corporate leadership training Questions ethical and practical boundaries between neuroscience-based enhancement and pseudoscientific practices Encourages rigorous validation before integrating neurofeedback into workplace leadership development programs
Leadership Rebooted: Cultivating Trust with the Brain in Mind	Pittman, A	2020	Human Service Organizations Management Leadership & Governance	Focuses on cultivating organizational trust through neuroleadership principles Argues that understanding brain-based mechanisms of trust can enhance leadership authenticity and collaboration Suggests integrating neuroscience insights into leadership education to foster resilient and transparent organizations Develops a relational leadership model based on cognitive neuroscience and social constructionism
Brain-Adjusted Relational	Psychogios, A., & Dimiriadis, N.	2021	Frontiers in Psychology	Explains how shared consciousness and empathy between leaders and followers create synchronized neural patterns Promotes brain-

Leadership: A Social-Constructed Consciousness Approach to Leader-Follower Interaction				adjusted relational approaches as a foundation for effective communication and mutual understanding in teams. Examines the cognitive and emotional dimensions of managerial communication Highlights how neuromanagement principles enhance framing, persuasion, and interpersonal trust.
Neuromanagement and communication	Venturella, I., & Crivelli, D.	2017	Ricerche di Psicologia	Examines the neurochemical and physiological correlates of effective managerial communication Focuses on how communication ability reflects stronger teamwork and leadership alignment Introduces hyperscanning as a promising tool for studying group dynamics and collaborative efficiency
When brains dialogue by synchronized or unsynchronized languages: Hyperscanning applications to neuromanagement	Venturella, I., Gatti, I., Vanutelli, M. E., & Balconi, M.	2017	Neuropsychological Trends	Uses hyperscanning to analyze neural synchronization during managerial communication and cooperation Finds that synchronized brain activity reflects stronger teamwork and leadership alignment Introduces hyperscanning as a promising tool for studying group dynamics and collaborative efficiency
Transforming elements to promote neuromanagement	Soto-Ortigoza, M., & Espinosa-Fernández, E.	2022	Human Review	Discusses cognitive, emotional, and ethical components essential for fostering neuromanagement culture. Identifies organizational transformation strategies based on neuroscience and emotional intelligence. Promotes development of neurocompetent managers able to balance productivity and empathy
A neuroscience-based approach to changing organizational behaviour	Rock, D.	2018	Healthcare Management Forum	Introduces the neuroscience foundations of organisational behavior Explains how understanding reward-threat neural responses improves leadership communication and engagement strategies. Promotes neuroleadership as a tool to guide behavioral transformation in healthcare organizations.
Neuromanagement in Decision Making Processes				
Neuromanagement decision making in facial recognition biometric authentication as a mobile payment technology in retail,	Džmijrescu, I., Itagan, M., Rolhiu, I., Geman, M., Ruscu, C., & Džmijrescu, A.	2022	Oeconomia Copernicana	Examination of the use of facial recognition biometric authentication as a mobile payment technology in retail, dining, and hotel business models. Exploration of the advantages of facial recognition biometric authentication, including improved security and customer convenience.

restaurant, and hotel businesses models				
Be Creative to Innovate! EEG Correlates of Group Decision-Making in Managers	Balconi, M., Vandelli, G. V., & Angioletti, I.	2024	Sustainability	Explores EEG correlates of creative decision-making among managers in individual vs. group problem-solving conditions. Finds that individual creativity activities right PFC (delta, theta bands) while group creativity activates rPFC (delta, theta bands), reflecting cooperation and perspective-taking. Suggests that neuroscience can reveal socially sustainable work conditions that foster creativity, collaboration, and innovation in organizations.
A Systematic Review of Eye-Tracking Studies of Construction Safety	Cheng, B., Luo, X., Mei, X., Chen, H., & Huang, J	2022	Frontiers in Neuroscience	Comprehensive review of eye-tracking studies in the context of construction safety, focusing on hazard recognition performance. Methodology used in the systematic review, including literature search, study selection, and content analysis. Analysis of study characteristics, such as publication details, participants, devices used, experimental tasks, eye-tracking indicators. Relationships between eye-tracking indicators and hazard recognition performance in different work environments and worker personalities. Discussion on the potential of eye-tracking methods for enhancing construction site security and workers' decision-making in engineering.
A Study of Construction Workers' Hazard Recognition Process Based on EEG Experiment	Zhang, Z., Ding, Z., & Chen, W.	2022	Lecture Notes in Operations Research	Conducts EEG experiments to analyze cognitive processing during hazard recognition in construction work. Finds that attention and workload levels predict safety awareness during hazard recognition. Suggests that neuromanagement insights can improve safety training and decision-making efficiency.
Cognitive mechanism of economic management risk based on EEG analysis	Duan, R.	2018	NeuroQuantology	Uses EEG analysis to explore the cognitive mechanisms underlying economic risk perception and management decisions. Identifies brainwave patterns associated with uncertainty, attention, and emotional arousal during financial decision-making. Suggests the potential of EEG-based neuromanagement tools for assessing managerial decision-making performance and stress regulation.
Neuromanagement decision making in facial recognition	Dżmijrescu, I., Itagan, M., Hurloiu, I.,	2022	Oeconomia Copernicana	Examines neuromanagement aspects of decision-making in adopting facial recognition biometric systems for mobile payments Highlights cognitive, emotional, and technological factors

biometric authentication as a mobile payment technology in retail, restaurant, and hotel businesses models	Geman, M., Ruscu, C., & Džmijrescu, A.			influencing user trust and adoption behavior. Suggests that biometric authentication improves efficiency and customer experience through cognitive ease and perceived security.
Human decision-making behaviors in engineering and management: A neuropsychological perspective	Fu, H., Ye, G., Chen, J., & Liao, P.-C.	2022	Frontiers in Neuroscience	Introduces neuropsychological perspectives on human decision-making within engineering and management disciplines. Emphasizes cognitive, emotional, and neural mechanisms that influence managerial and technical judgments. Encourages integration of neuroscience tools such as fMRI and EEG to better understand decision efficiency and bias.
Effect of risk preference on entrepreneurial cooperative behavior in industrial clusters: Based on neuromanagement and event-related potentials experiment	Liu, H., & Xu, D.	2018	NeuroQuantology	Investigates how entrepreneurs' risk preferences influence cooperative decision-making using ERP (event-related potential) experiments. Finds that individuals with higher risk tolerance show distinct neural patterns linked to quicker, reward-oriented cooperation. Concludes that neuromanagement can help predict and optimize entrepreneurial collaboration through neurocognitive insights.
Neuromanagement in Innovation and Technology				
Lightweight Framework for Perception Analysis Based on Multimodal Cognition-Aware Computing	Qian, X., Qiao, Y., Wang, M., Wang, X., Chen, M., and Di, W.	2022	Frontiers in Neuroscience	Introduction of a simple framework for perception analysis using multimodal cognition-aware computing, addressing the challenges in the field of neuromanagement. Highlighting the trend in psychology and neuroscience to utilize multimodal data in more natural settings and the existing challenges for real-time multimodal studies. Introduction of the Multimodal Cognition-Aware Computing (MCAC) framework as a systematic method for conducting extensive research in neuromanagement, specifically in FVCA (volatile, uncertain, complex, and ambiguous) environments. Demonstration of the viability and effectiveness of the MCAC framework through a real test case, comparing it with conventional methods and showcasing its advantages in enhancing experiment effectiveness and data analysis in complex VUCA environments.

EEG object recognition: Studies for criminal investigation and neuro-applications in social care	Constantin, A., Popescu, N., Popescu, D., Tiganoaia, B., Negoita, O. D., & Niculescu, A.	2020	International Journal of Advanced and Applied Sciences, 7(1)	Designs a brain-wave processing + machine-learning model to recognise visual objects from EEG signals Suggests applications in neuromanagement, neuromarketing, criminal investigation and social-care domains. Highlights the potential of EEG + machine learning in real-time object recognition and decision-support systems in organisational/technical contexts.
Neuroleadership Skills in Industry 5.0	Villegas, N. A., Patiño, L. V., & Araujo, E. S.	2025	Lecture Notes in Networks and Systems	Investigates essential neuroleadership competencies for Industry 5.0 workplaces Emphasizes adaptive decision-making, technological empathy, and human-machine synergy Promotes brain-based leadership development to manage digital transformation ethically and effectively
Neural Features of Processing Enforcement Phrases in Occupational Health and Safety Inspections: An Event-Related Potentials Study	Ma, Q., Shi, I., Hu, I., Liu, Q., Yang, Z. and Wang, Q.	2016	Frontiers in Neuroscience	Investigation of the neural aspects involved in processing enforcement phrases during occupational health and safety (OHS) inspections using event-related potentials (ERPs). Hypothesis testing on the differential effects of severe-and-deterrent enforcement phrases versus mild-and-polite enforcement phrases on P300 amplitudes. Significant differences found in the P300 component of the ERP waveform between the two groups, suggesting different attentional demands for processing severity and deterrence levels. Implications for enhancing safety communication and compliance in OHS inspections by utilizing enforcement phrases that elicit larger P300 amplitudes.
Functional Brain Network Analysis of Knowledge Transfer While Engineering Problem-Solving	Wang, F., Jiang, Z., Li, X., Bu, L., & Ji, Y.	2021	Frontiers in Human Neuroscience	Analyzes EEG-based functional connectivity during collaborative problem-solving tasks Reveals how brain network efficiency correlates with effective knowledge transfer and team creativity Suggests that understanding neural dynamics can optimize cognitive performance in engineering management.
Right evaluation of marketing stimuli with neuroscience: An electroencephalography experiment	González-Morales, A	2020	Computers in Human Behavior Reports	Uses EEG experiments to evaluate consumers' brain responses to different marketing stimuli. Analyzes how right-hemisphere activation reflects emotional engagement and preference formation Suggests applications of neuromarketing insights to improve strategic business decisions and customer experience design.
AI as Co-Leader: Effects of Human Consideration and AI	Lai, X., & Rau, P.-L. P	2025	International Journal of Human-	Investigates human-AI co-leadership by manipulating human leader consideration (high/low) and AI leader structure behavior (high/low) and measuring both leadership outcomes and

Structure Behaviors on Leadership Effectiveness and Neural Activation			Computer Interaction	prefrontal-cortex neural activation. Finds high AI structure correlates with increased job satisfaction, employee engagement and trust in leader; low AI structure slightly improves task speed Shows that neural activation in prefrontal regions differs across conditions, linking brain responses to leadership design in human-AI systems.
Application of Neural Technology to Neuro-Management and Neuro-Marketing	Opris, I., Ionescu, S. C., Lebedev, M. A., Boy, F., Lewinski, P., & Ballerini, L.	2020	Frontiers in Neuroscience	Introduces neural technologies such as BCIs and neurofeedback in management and marketing research. Highlights how real-time neural data can improve decision-making, consumer engagement, and managerial self-awareness. Emphasizes the ethical responsibility in interpreting neurotechnological results for management purposes.
Neuromanagement and Neuromarketing	Russo, V., Ma, Q., Clement, J., Jin, J., Liu, T., & Zito, M.	2022	Frontiers in Psychology	Introduces neuromanagement and neuromarketing as integrated disciplines for studying decision-making and attention. Stresses the role of neuroscience tools in analyzing consumer and managerial behavior.
Leveraging Neuroleadership and Adopting AI to Improve Human Capital Development in IT&C Business Organisations	Stanciu, R.-M., Stratone, M.-E., Dabija, D.-C., & Mitrican, P.	2024	Amfiteatru Economic	Analyzes the integration of neuroleadership and AI to enhance human capital in technology sectors Demonstrates how AI-based leadership models can optimize decision-making and team adaptability. Argues for the synergy of brain-based leadership and intelligent systems in organizational transformation.
Neuromanagement in Educational Leadership				
Contributions of Neuroleadership to the School Administrator and Teachers for the Development of Organizational Culture	Aksahin, A., Huseyinli, M., & Polat, M.	2023	International Online Journal of Education and Teaching	Examine neuroleadership principles as tools for improving school management and teacher collaboration. Emphasizes emotional regulation, empathy, and trust-building in educational environments. Suggests that neuroleadership fosters stronger organizational culture and communication effectiveness. Highlights the role of brain-based leadership in aligning cognitive and emotional processes for school development.
Neuromanagement and social responsibility: Key factors in university	Troncoso, M., Samuel, A., Illa-Suhincha, Pastor, G., Villavicencio,	2022	Revista de Ciencias Sociales	Examines the relationship between neuromanagement, ethics, and social responsibility in universities.Highlights how brain-based leadership fosters empathy, inclusion, and cognitive engagement in

educational management	R., Edmundo, R., Menor, C., & Antonio, M.			educational institutions.Suggests neuromanagement as a framework for sustainable and responsible academic governance.
Future-fit leaders for future-fit schools: Principal narratives of leading rural primary schools for 4IR imperatives	Clark, F. J., & Tiegard, P. K.	2022	Perspectives in Education	Presents the concept of "neuroleader" within the theoretical framework of neuroleadership for future-fit schoolsHighlights technology, digitisation and alternative instructional models as essential in low-resource rural contextsSuggests further research into fully digital rural school models and blended in-person/online schedules
Neuroleadership as an Asset in Educational Settings: An Overview	Gkintoni, E., Halkiopoulos, C., & Antonopoulou, H.	2022	Emerging Science Journal	Provides an overview of neuroleadership principles and their practical application in educational institutions.Emphasizes emotional regulation, empathy, and motivation as key elements of effective educational leadershipSuggests that neuroscience-informed leadership improves learning environments and teacher-student interactionsRecommends incorporating neuroleadership frameworks into leadership training and professional development programs in schools
Neuroleadership: A conceptual analysis and educational implications	Gocen, A.	2021	International Journal of Education in Mathematics, Science and Technology	Defines neuroleadership as applying neuroscience findings to leadership behaviour, focusing on aspects like multitasking, emotion management, optimal learning and psychological foundations.Emphasizes that educational leaders can use brain-based insights to coordinate educational processes and evidence-based leadership strategies in schools.Identifies themes such as cognition, emotion, social neuroscience and leadership behaviour as key in the neuro-educational leadership field.
Characterization of scientific diffusion on leadership in Cuban health magazines, 2020–2023	Raga, C. M. G., Nápoles, C. M. M., Suárez, C. N. R., Sánchez, C. J. R., & Leiva, R. F	2025	Revista Infodir	Analyzes leadership-related scientific publications in Cuban health journals between 2020–2023Identifies trends in research themes, authorship patterns, and dissemination channels within neuromanagement and healthcare leadershipSuggests that academic diffusion strengthens evidence-based leadership and cognitive management practices in health institutions
Neuromanagement in Social Responsibility and Well-Being				
Morality and management: an oxymoron? fNIRS and	Balconi, M., & Fronda, G.	2020	Cognitive, Affective, & Behavioral Neuroscience	Investigation of the relationship between morality and management, focusing on the neural process underlying moral judgment.Comprehensive literature review on moral decision-making and its management implications, drawing from various

neuromanagement perspective explain us why things are not like this				sources.Description of an experiment involving men and different moral decision contexts, with insights into cognitive and emotional processes.Emphasis on the importance of understanding the psychological and behavioral aspects of moral decision-making in a business context.
Neurocognitive self-empowerment in occupational and managerial contexts: contribution of mindfulness-based neurofeedback protocols.	Rovelli, K.	2022	Neuropsychological Trends	Importance of multi-factorial evaluation techniques for building neuropsychological profilesMindfulness-based neurofeedback protocols for improving employee attitudes and motivations. Cognitive neuromempowerment for enhancing cognitive function and emotional control in organizations Cognitive neuromempowerment for enhancing cognitive function and emotional control in organizations
Risk factors and causes of interpersonal conflict in nursing workplaces: Understandings from neuroscience	Freedman, B. D	2019	Collegian	Explores how neurobiological processes contribute to interpersonal conflict in healthcare organizations.Identifies emotional triggers, cognitive overload, and stress hormones as mediators of workplace tension.Emphasizes the importance of emotional intelligence and self-regulation in conflict prevention and resolution.Suggests that neuromanagement approaches can enhance empathy, communication, and team cohesion in nursing environments.
Leadership in health from a Neuroleadership Perspective	Garzón, I. V., Sinclay, A. G. P., & Gutiérrez, Y. V.	2021	Revista Infodir	Analyzes neuroleadership principles as applied to healthcare management and team coordination.Highlights the role of emotional regulation, empathy, and cognitive control in health-sector leadership.Emphasizes brain-based understanding of communication and decision-making to improve patient care outcomes.Suggests neuroleadership as a means to reduce stress, increase collaboration, and enhance organizational well-being in medical environments.
Neuroleadership: A Concept Analysis and Implications for Nursing	Hashish, A., & Aly, E.	2024	Journal of Neuroscience Nursing	Conducts a concept analysis using Walker and Avant's method to define neuroleadership in a nursing context.Identifies attributes of nurse neuroleaders such as cognitive-awareness, emotional regulation, and neuroscience-informed decision-making.Suggests development of measurement tools and frameworks for implementing neuroleadership in clinical settings.

Neuroleadership: Themes and limitations of an emerging interdisciplinary field	Kuhlmann, N., & Kadgien, C. A	2018	Healthcare Management Forum	Reviews neuroleadership as an emerging interdisciplinary field combining neuroscience, psychology, and leadership studies.Discusses how brain-based insights can improve healthcare management, communication, and team coordination.Highlights methodological limitations, including overinterpretation of neuroscience data and ethical considerations.Recommends future research to strengthen theoretical foundations and practical integration in leadership training and healthcare management.
Leadership needs to shift in the health system: Three emerging perspectives to inform our way forward	Lindstrom, R. R	2013	Healthcare Papers	Advocates a purposeful shift in healthcare leadership towards new frameworks including complexity leadership, neuroleadership, and prophetic leadership.Argues that how leadership decisions are made (process) is as important as what is decided, especially in patient-safety and system-change contexts.Emphasises integration of cognitive/emotional awareness and adaptive leadership to engage front-line ownership and achieve sustainable solutions.
Neural Features of Processing the Enforcement Phrases Used during Occupational Health and Safety Inspections: An ERP Study	Ma, Q., Shi, I., Hu, I., Liu, Q., Yang, Z., & Wang, Q	2019	Frontiers in Neuroscience	Uses ERP experiments to examine brain responses to enforcement language used in workplace safety inspections.Finds that harsh enforcement phrases trigger stronger negative emotional responses and increased cognitive conflict.Suggests that neutral or supportive communication improves compliance and reduces psychological resistance.Highlights the value of neuromanagement approaches in designing effective occupational health and safety communication strategies.
Neuroleadership: A new way for happiness management	Ruiz-Rodriguez, R., Ortiz-de-Urbin-Criado, M., & Ravina-Ripoll, R.	2023	Humanities & Social Sciences Communications	Explores neuroleadership as a framework for happiness management in organizations.Highlights emotional intelligence, brain-based empathy, and motivation as pathways to enhance well-being.Highlights emotional intelligence, brain-based empathy, and motivation as pathways to enhance well-being.Connects neuroleadership principles with positive organizational psychology for employee flourishing.
Is dialogue between the neuroscience and social sciences inevitable: Reflections on the scientific articles	Valenzuela, D	2016	Transformations in Business & Economics	Reflects on the theoretical convergence between neuroscience and social sciences in management research.Argues that neuromanagement emerges as a bridge discipline linking cognition, behavior, and organizational systems.

Source: Author's own creation

Conclusion:

This bibliometric analysis and a summarised annotated bibliography of 57 eligible studies from 2012 to 2025, sourced from WoS and Scopus, indicate that neuromanagement is an emerging and rapidly evolving field that connects neuroscience, psychology, and management. The increasing number of publications indicates academic interest, while the concentration of research in China, Italy, and Romania shows regional specialization rather than global dissemination. Moreover, despite a few studies with international co-authorships, the neuromanagement literature shows strong conceptual diversity, which is reflected in over 200 author keywords. Furthermore, thematic and keyword analyses identified four main clusters that revolve around neuroleadership, cognition and decision-making and the emerging applications of neuroscience tools and techniques such as EEG and emotional intelligence while complementing the analyses by indicating that the field is transitioning from exploration towards application, particularly through technologies such as EEG, fNIRS, and neurofeedback [59][60]. [61] emphasize the importance of the emotional aspects of time and cognition and how they are essential for understanding work and decision-making processes within organizational contexts. This highlights the importance of neuromanagement's focus on the interactions between emotion, cognition and performance. Moreover, disjointed collaboration networks and limited cross-regional research have emphasized the need for improved methodologies and multidisciplinary collaboration to enhance and reinforce replicability and theoretical integration.

Implications of the Study:

Theoretical Implications:

This study offers a structured analysis of neuromanagement research, providing a basis for identifying gaps and studying how the field is evolving. The study positions neuromanagement as a coherent subfield of organizational neuroscience, bridging cognitive, emotional, and behavioral dimensions of managerial functioning [3][62]. The results, especially in clustering the author keywords, reinforce that leadership and decision-making are neuromanagement's core theoretical anchors, and further dimensions, such as neuroethics, are gaining attention, in line with the study by [9]. This will enable future scholars to refine the theoretical models linking neural activity with managerial competence. It also promotes the bibliometric theory by illustrating how small samples of emerging fields can be rigorously analyzed using network-based visualization techniques, as also discussed by [63] and [64].

Managerial Implications and Recommendations:

The findings indicate that neuromanagement may contribute to leadership development, communication, employee well-being, and managerial decision-making. This will also enable managers to build psychologically aware data-driven cultures that promote productivity and prioritize well-being. Managers should, however, use neuroscientific findings together with behavioral and organizational evidence rather than treating neural measures as independent indicators.

Policy Implications and Recommendations:

The growing use of neural and biometric technologies in workplaces also requires attention to privacy, informed consent, fairness, and the protection of employee data. Policymakers and professional bodies may therefore develop guidelines for the responsible use of neuromanagement practices.

Limitations and Future Research:

Although this analysis offers valuable insights, it also has some limitations. Firstly, the dataset included only 57 publications, reflecting the early stage of the field. The use of Web of Science and Scopus may have excluded relevant studies indexed only in Dimensions, PubMed, Google Scholar, or regional databases. As a result, some biomedical, regional, grey-literature, or recently published contributions may not be represented in the dataset. The findings concerning publication volume, geographical contribution, and citation impact should therefore be

interpreted in relation to the coverage boundaries of the selected databases. As the field develops, expanding the search across databases such as Dimensions, Google Scholar, and PubMed may provide broader analysis. Additionally, we used Biblioshiny and VOSviewer, which, although enable robust visual mapping, could be complemented with more advanced analyses such as historiographic mapping or co-citation by references for deeper temporal and semantic understandings. Despite these limitations, this bibliometric analysis provides evidence of how the concept is emerging and evolving, justifies the research gap in the field, and paves the way for further studies. With these findings we also suggest that future research should move beyond the use of neuroscientific techniques alone and develop stronger theoretical explanations connecting neural processes with leadership, employee behavior, decision-making, and organizational outcomes. Greater cross-national collaboration and research across different sectors and cultural settings would also improve the wider applicability of the field.

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