Literature Review

R.A.N. Vol. 11 (2) 2025
ran.udec.cl
RAN
REVISTA ACADEMIA & NEGOCIOS

Neuromanagement Ontology

ONTOLOGÍA DEL NEUROMANAGEMENT

Javiera Müller Núñez[1*]
Universidad de Valparaíso

Jonathan Vásquez Verdugo[1]
Universidad de Valparaíso

* Corresponding author

1 Escuela de Auditoría,
Facultad de Ciencias Económicas y Administrativas,
Universidad de Valparaíso,
Blanco 1911, 2340000,
Valparaíso, CHILE

Abstract

Purpose: To develop and apply an ontology-based framework that facilitates a structured and theoretically grounded understanding of the neuromanagement field.

Methodology: In the first phase, neuromanagement ontology is constructed on theoretical foundations. The second phase involves a systematic search in Scopus and Web of Science (2015–2024), where relevant articles are identified, coded, and mapped onto this ontology, allowing for the identification of both under-explored and extensively studied areas.

Findings: Research predominantly focuses on individual-level phenomena, based on decision-making and cognitive processes. In contrast, areas such as the implementation of incentive systems, organizational structure changes, and behavioral constructs (motivation, perception, and risk-aversion) remain significantly under-researched. Additionally, limited attention has been given to team dynamics, C-level executives, and principal-agent relationships.

Implications: The analysis reveals conceptual gaps in key areas of neuromanagement. Future attention to these blind spots could strengthen theoretical insights and improve organizational practices, particularly regarding decision-making, leadership, and incentive system design.

Originality: We introduce a novel ontology customized to systematically classify and visualize the neuromanagement literature, clearly differentiating between well-developed (bright spots) and under-explored areas (blind spots). This approach contributes to consolidating neuromanagement as a robust research field.

ARTICLE INFO
Received: 14 January 2025
Accepted: 22 April 2025

Keywords:
Knowledge mapping
Meta-analysis
Neuromanagement
Ontology analysis
Organizational dynamics

ISSN: 0719-7713 / 0719-6245
https://doi.org/10.29393/RAN11-12MGJJ20012

Resumen

Propósito: Desarrollar y aplicar un marco ontológico que permita una comprensión estructurada y teóricamente fundamentada del campo del neuromanagement.

Metodología: En la primera fase, se construye una ontología del neuromanagement basada en fundamentos teóricos. Luego, en la segunda fase mediante una búsqueda sistemática en *Scopus* y *Web of Science* (2015–2024), se identifican, codifican y mapean artículos relevantes sobre esta ontología, lo que permite revelar áreas poco exploradas, así como muy exploradas.

Resultados: Predominan estudios centrados en fenómenos individuales, basados en la toma de decisiones y su proceso cognitivo. En cambio, áreas como implementación de sistemas de incentivos, cambios de estructura organizacional y constructos conductuales (motivación, percepción y aversión al riesgo) se encuentran significativamente desatendidas. Asimismo, se identificó escasa investigación sobre dinámicas de equipo, altos ejecutivos (C-level) y relaciones principal-agente.

Implicaciones: El análisis revela vacíos conceptuales en áreas críticas del neuromanagement. La atención futura a estos puntos ciegos podría fortalecer tanto el desarrollo teórico como las prácticas organizacionales, especialmente en toma de decisiones, liderazgo y diseño de sistemas de incentivos.

Originalidad: Se introduce una ontología específicamente diseñada para clasificar y visualizar sistemáticamente la literatura del neuromanagement, identificando de forma explícita áreas desarrolladas (bright spots) y poco exploradas (blind spots), lo que contribuye a la consolidación del neuromanagement como área de investigación.

INFORMACIÓN ARTÍCULO

Recibido: 14 de Enero 2025
Aceptado: 22 de Abril 2025

Palabras Claves:
Mapeo del conocimiento
Meta-análisis
Neuromanagement
Análisis ontológico
Dinámica organizacional

INTRODUCTION

The application of neuroscience in management, known as Neuromanagement (Naranjo-Gil, Gomez-Ruiz & Sanchez-Exposito, 2011), explores the relationship between brain structure/functionality and the phenomena of interest in the discipline (Glimcher & Rustichini, 2004). This novel approach contributes, at least: (1) to address the invisibility issues of methods commonly used in the field (e.g., economic theories), and (2) to introduce new perspectives for studying corporate activities related to organizational human behaviors (Harrison & Ross, 2010), e.g., incentives, human behavior in organizations, decision-making, and estimation procedures (Naranjo-Gil et al., 2011). Findings can help improve incentive systems and enhance the evaluation of senior executives' competence in dealing with stressful situations (Braidot, 2013). However, as a growing discipline, it is necessary to define its development to better understand how its body of knowledge evolves.

In any growing discipline framing theories and applications are necessary to understand the development of the body of knowledge. Efforts towards this goal can systematically identify key areas, as well as guide and organize the progress in the field.

In this regard, La Paz et al. (2015) state that meta-analysis provides significant contributions. In emerging and conceptually fragmented fields such as neuromanagement, traditional literature reviews may struggle to capture the full complexity of theoretical constructs. As noted by Ramaprasad & Syn (2015) and further developed by Sandberg & Alvesson (2021), ontology-based approaches provide a systematic alternative by organizing knowledge into dimensions and elements.

This method reveals overlaps, gaps, and inconsistencies, making it especially valuable for emerging fields by facilitating both synthesis and theory development. Consequently, we adopted an ontological approach that enables for the formal organization of key concepts, actors, and relationships within the field. Ontologies, in this sense, serve as theory-building tools that help identify conceptual gaps, overlaps, and patterns of emphasis within a fragmented body of knowledge (Ramaprasad & Syn, 2015; Sandberg & Alvesson, 2021).

We propose two main research questions: (1) How can a comprehensive framework of Neuromanagement's body of knowledge be constructed? and (2) What are the current emphases and gaps within that knowledge base? Addressing these questions is essential for identifying overrepresented areas ("bright spots") and underexplored domains ("blind spots"), thereby supporting more coherent theory-building and practical application. To this end, we adopted an ontological methodology to define the Neuromanagement domain, and subsequently map relevant literature indexed in Scopus and Web of Science (2015–2024) onto this structure. The goal is to classify, analyze, and visualize how the field has evolved and where future research efforts can be directed.

The following section outlines the theoretical foundations of Neuromanagement and subsequently reviews the relevant literature. Then, we describe the methodology aims to construct the ontology and how literature mapping is performed. Finally, we present the findings and implications, followed by a discussion of future research directions and concluding remarks.

Fundamentals of Neuromanagement

A central question, long debated by scholars and practitioners, is how individuals make decisions within organizations. Research has shown that the brain must process a wide range of inputs, including organizational cues, to arrive at a course of action (Waldman et al., 2017). Yet, this process can be inconsistent—sometimes leading to impulsive or erratic behavior. As Satpathy (2012) notes, human decision-making is shaped by multiple, often competing, internal mechanisms. In this context, neuroscientific tools offer valuable insights that can complement and expand traditional management approaches (Suomala, 2018).

Traditional management research on organizational behavior relies heavily on economic models that assume individuals make rational decisions based on available information. However, people make seemingly irrational choices influenced by desires and emotions (Naranjo-Gil et al., 2011). Over 90% of human decisions are driven by the subconscious, yet individuals rationalize them through logical or economic reasoning. Agency theory (Jensen y William and Meckling,1976) suggests that decision-making delegation between principals and agents creates conflicts due to differing interests, necessitating control mechanisms. The economic agent's motivation, intentions, and psychological states are typically unobservable. Consequently, exploring non-economic factors through non-traditional approaches becomes essential. Neuroeconomic methods help overcome the problem of unobservability by directly examining the neural substrates of choice and valuation (Glimcher & Rustichini, 2004).

Neuroscience studies the structure and functions of the brain and nervous system (Chattopadhyay, 2020) using non-invasive methods such as Transcranial Magnetic Stimulation (TMS), functional Magnetic Resonance Imaging (fMRI), Position Emission Tomography (PET), MagnetoEncephaloGraphy (MEG), and electroencephalography (EEG). EEG and fMRI are the most widely employed in Neuromanagement (Suomala, 2018). Its goal is to explain how nerve cells affect behavior and are influenced by external factors (Braidot, 2013). Neuroscience is applied in disciplines such as psychology, medicine, philosophy, engineering, and economics (Chattopadhyay, 2020). We examined its application in understanding organizational behavior and decision-making (Glimcher & Rustichini, 2004). Neuromanagement explores the relationship between brain structure/functionality and management elements (Naranjo-Gil et al., 2011; Glimcher & Rustichini, 2004). This novel approach presents two advantages. First, it addresses the unobservability issues of methods commonly used in the field (e.g., economic theories). Second, it provides new insights into the relationship between organizational elements and human behaviors (Harrison and Ross, 2010), such as incentives, human behavior in organizations, decision-making processes, and estimation procedures (Naranjo-Gil et al., 2011), as neuromanagement research helps organizational leaders in better comprehending how their subordinates' brains function and respond to external stimuli (Kouravand, 2024).

Advances in technology and brain science enable neuroeconomics to analyze business problems using neuroscience techniques, predicting how decisions and policies affect individuals' subconscious (Harrison & Ross, 2010). For example, Hannah et al. (2013) used quantitative electroencephalogram (qEEG) to study leadership complexity and its influence on adaptive decision-making. Other studies have explored isolated management factors such as leadership (Hannah, 2013; Kouravand, 2024) or entrepreneurship (Massaro et al., 2020). However, a cohesive framework for advancing this research area remains lacking. Although previous studies have contributed to important findings, the field still lacks a unified structure that connects those insights in a meaningful way. Without such a framework, it becomes difficult to identify how different concepts relate to each other, or to build theories that can guide future research in a consistent direction. In this context, a cohesive framework means more than just a summary of existing work—it involves organizing the main ideas, methods, and results of the field into a well-connected system. Creating such a framework is therefore not just helpful, it is essential to support the growth of Neuromanagement as a solid and interdisciplinary area of study.

Related Works

There are at least three reviews about the development of Neuromanagement in literature. One of them consists in a literature review of 8 articles (Erkal, H. 2017) and the other two correspond to bibliometric analysis (Chattopadhyay, 2020; Cucino et al., 2021). The three articles underscore the need for review studies about neuroscience in management as well as highlight the areas of neuromanagement where scholars have concentrated their efforts. For example, Chattopadhyay (2020) implements queries on academic databases, which relate to consumer neuroscience, neural signals and organization and marketing. The findings of this study suggest that the application of neuroscience in management opens a new era in the field (Cucino et al., 2021), but only a few scholars have explored it.

Research at the intersection of neuroscience and management has grown steadily in recent years, giving rise to what is now referred to as neuromanagement—an interdisciplinary field that seeks to understand how neural processes influence managerial behavior, decision-making, and organizational dynamics (Becker *et al.,* 2011; Waldman *et al.,* 2017). While contributions are still emerging, studies on organizational neuroscience, neuroeconomics, and behavioral strategy have laid important groundwork by integrating insights from cognitive neuroscience with management theory. Relevant streams of research have addressed topics such as leadership and brain activation patterns (Balthazard *et al.*, 2012), moral decision-making in business contexts (Greene & Haidt, 2002), and motivation and performance under incentives (Ariely *et al.,* 2009). This review aims to contribute by systematically identifying and organizing existing knowledge through an ontology-based approach, helping to clarify the current state of the field and identify conceptual blind spots that may guide future research.

To provide a clearer perspective on the field's development, we incorporate a brief timeline of foundational contributions at the intersection of neuroscience and management. Early conceptual groundwork emerged with Glimcher & Rustichini (2004), who introduced neuroeconomic principles to explain valuation and choice beyond traditional economic assumptions. Subsequently, Becker et al. (2011) and Senior et al. (2015) articulated the potential of integrating neuroscience into organizational studies, coining the term organizational cognitive neuroscience. Around the same time, Balthazard et al. (2012) applied quantitative electroencephalography (qEEG) to study leadership complexity, and Ariely et al. (2009) examined motivational responses under different incentive structures with stimulus techniques. Later works include linking brain function with leadership effectiveness (Waldman et al., 2017) and Cucino et al. (2021) contributed bibliometric and scoping reviews that mapped the emergence of the field across domains like consumer neuroscience. Despite these contributions, the field remains conceptually fragmented. We offer an ontology-based framework to consolidate, classify, and visualize the accumulated knowledge, thereby supporting a more coherent development of neuromanagement. Certainly, these reviews contribute to bridging the gap in the examination of neuromanagement development. However, none of them offer a systematic guide or framework to assist future research in focussing on those blind spots or consolidating existing areas of investigation investigated – hereafter referred to as bright spots.

The development of a discipline could be a complicated and confusing process. Without any alignment and roadmap, its analysis becomes non-trivial (Vásquez & La Paz, 2019). Given an unclear picture of the body of knowledge, any analysis may cover only one part of the entire corpus of interest and can end up producing incomplete and biased conclusions (Ramaprasad & Syn, 2015; Vásquez & La Paz, 2019). These issues can be found in literature reviews, which systematize the description of the discipline's growth, but may fail to enlighten undiscovered areas.

One way to systematically identify unexplored areas of interest is to use ontologies and map the literature onto them. This approach has been applied in various disciplines, such as information technology (La Paz *et al.,* 2015; Vásquez & La Paz, 2019) and sustainable social development (Sanjeev et al., 2021). However, to the best of our knowledge, no study that has combined ontology with mapping to examine the growth of the neuromanagement discipline.

METHODOLOGY

We propose a two-phase method, starting with the definition of an ontology for the body of knowledge to be reviewed, followed by the data collection and the coding according to the ontology.

Ontology Definition

Ontologies emerge from the process of deconstructing and reconstructing the combinatorial complexity of a phenomenon. They enable to define the dimensions, elements, and boundaries of an object of study (Ramaprasad, 2015). Through a comprehensive literature review, we propose an ontology for neuromanagement. This ontology comprises five dimensions: **activity**, **management element**, **technique approach**, **behavior element**, and **organizational core**. Each dimension encompasses a set of constituent elements, as illustrated in Figure 1. The five dimensions are organized with associated symbols, terms, and connecting phrases to trace meaningful combinations across dimensions. A selection of one element from each dimension results in a sentence that articulates a potential area of inquiry within neuromanagement. For example, selecting the first element from each dimension yields the following research focus: *"Interpret the impact of incentives by functional techniques on the attitude of decisions made by an individual."* This ontology is flexible and scalable; it can be expanded or simplified by adding or removing dimensions and/or elements. The rationale behind its construction is grounded in prior scholarly work, discussed in the following sections.

Activity		Management Elements		Technique Approach		Behavior Elements		Organizational Core
Interpret	the impact/Influence of	Incentives	by	Functional	techniques on the	Attitude	on decisions made by a/an	Individual
Analyze		Structure		Structural		Emotion		Team
Explore		Information		Stimulation		Risk-aversion		Chief
Evaluate		Culture				Communication		Principal
		Performance				Motivation		
		External Analysis				Percepcion		
		Leadership						

Figure 1. Proposed ontology for neuromanagement research body. *Source:* Own elaboration.

Foundational contributions to management theory have consistently highlighted key elements such as structure, incentives, information, culture, and leadership as central to understanding and influencing organizational behavior (Anthony & Govindarajan, 2008; Mintzberg, 1979; Kaplan & Norton, 2004). These elements are also present in integrated frameworks of performance management and strategic control, where external analysis serves as a contextual factor and performance is positioned as a central evaluative dimension (Simons, 1995; Kaplan & Norton, 2004).

In neuroscience, diverse technique approaches offer a multifaceted framework for examining the brain's complex architecture and dynamic processes. These include *structural*, *functional*, and *stimulation* techniques, each contributing unique insights into brain connectivity and its relation to cognition and behavior (Wang et al., 2015; Bergmann et al., 2016). Structural techniques focus on the physical connections between brain regions, typically studied through imaging methods such as structural MRI (Wang et al., 2015). Functional techniques examine the statistical dependencies between brain areas, using methods like fMRI, EEG, and MEG to understand how various brain regions cooperate during different tasks (Wang et al., 2015). Stimulation techniques involve modulating brain activity and are often used in conjunction with neuroimaging to explore causal relationships in brain networks (Bergmann et al., 2016).

The Behavior Element dimension captures constructs frequently studied in management, including attitudes, emotions, risk aversion, communication, motivation, and perception (Lebel & Lebel, 2018). Finally, the Organizational Core dimension refers to the fundamental components of organizational structure: individuals, work teams, and the relationships between principals and agents. These elements represent the foundational units responsible for executing, coordinating, and controlling organizational activities (Jensen & Meckling, 1976).

Collection of Articles

We conducted structured searches in two major academic databases to identify relevant literature. In Web of Science (WoS), we searched for articles with the terms *"neuroscience"* and *"management"*, or the keyword *"neuromanagement"*, in the title, across all available years up to 2024. A similar strategy was applied in Scopus, targeting titles with *"neuromanagement"* or a combination of *"neuroscience"* and *"management"*, limited to peer-reviewed articles. The WoS search returned 64, and the Scopus search returned 75. Then, we implemented a review procedure consisting of the domain checking, validation, and duplicate removal. The application of these procedures resulted in a final list of 35 unique articles

Mapping into the Ontology

To map the articles, two coders applied ontology to each article using a coding matrix, with rows representing articles and columns representing ontology elements. A value of "1" indicated the presence of an element in the title or abstract, while "0" indicated its absence. This approach helped isolate core contributions and avoid redundancy, commonly found in literature reviews, particularly in the introduction section.

For transparency, we present examples of how elements were identified. For instance, references to incentive structures linked to performance were coded as "Incentives," while discussions of decision rights or delegation were mapped to "Authority and Responsibility." These coding rules were refined through iterative validation.

Finally, a two-stage screening process was used to determine study inclusion and exclusion, with criteria detailed in the following table.

Table 1. Inclusion and exclusion criteria used for article selection in the literature review.

Inclusion criteria	Exclusion criteria
Index Scopus or Web of Science.	Not indexed in Scopus or WOS
Source type articles.	Editorials, book reviews, conference abstracts, or non-peer-reviewed content.
Scope related to management control, organizational behavior, or information systems.	Focused on technical aspects without engaging with organizational constructs.
Addressed at least one of the dimensions or elements defined in our ontology.	Were duplicates.

Source: Own elaboration.

In line with the recommendations for systematic reviews, we explicitly applied the PICOS framework as shown in Table 2.

Table 2. PICOS Framework to guide study selection in neuromanagement research.

Element	Description
Population	Articles focused on individuals, teams, managers, or decision-makers in organizational contexts (e.g., business, management, or workplace settings).
Intervention	Management practices or organizational mechanisms (e.g., incentives, leadership, structure, culture) assessed using neuroscientific techniques.
Comparison	Comparisons across types of neuroscientific techniques (e.g., stimulation vs. functional), levels of analysis (e.g., individual vs. team), or management practices applied in similar settings.
Outcomes	Behavioral or cognitive responses relevant to organizational functioning (e.g., motivation, risk-aversion, communication, emotion, decision-making).
Study Design	Peer-reviewed final articles (2015 - 2024) indexed in Scopus or Web of Science.

Source: Own elaboration.

Validation and Reliability

We employed an **iterative sampling process** to assess the **validity and reliability** of the coding procedure. In each round, inter-coder agreement was measured using three metrics:

- Cohen's Kappa (K): inter-rater agreement adjusted for chance (Kraemer, 2014).
- Jaccard Coefficient (JC): similarity based on elements identified by at least one of the coders (Tan et al., 2016).
- Cosine Similarity (CS): angular similarity between the coding vectors of each coder.

To capture the relative importance of each ontology element, we computed **weighted metrics** (WK, WJC, WCS), based on the frequency of elements across the sample. The validation process included three iterations, each involving an independently coded random subsample (~10% of articles). After coding, we calculated the weighted metrics and conducted debriefing sessions to resolve discrepancies and refine coding criteria as needed.

Iteration 1

Initial agreement was moderate (WK = 0.58; WJC = 0.62; WCS = 0.71), prompting a debriefing. Three main issues emerged:

1. **Ambiguous phrasing**: Coders disagreed on whether implicit mentions (e.g., "performance evaluation") indicated the presence of "Performance Metrics." The revised rule required explicit references to KPIs, tools, or formal mechanisms.
2. **Conceptual Overlap**: Terms like "Culture" and "Norms" were often co-occurring. Coders agreed to treat "Culture" as broad organizational values and "Norms" as specific behavioral expectations.
3. **Construct granularity**: General references to "decision-making" were insufficient to code "Authority and Responsibility" unless delegation or decision rights were clearly indicated.

Iteration 2

After adjustments, agreement improved (WK = 0.75; WJC = 0.79; WCS = 0.85). A brief debriefing followed for further clarification.

Iteration 3

Results showed high consistency (WK = 0.84; WJC = 0.87; WCS = 0.91). At this point, coding standards were deemed reliable, and the remaining articles were divided for independent coding.

This iterative process not only ensured coding reliability but also sharpened the operational definitions of ontology elements, reinforcing both the empirical rigor and conceptual clarity of the framework.

FINDINGS

The coding process yielded two key outcomes. The first, shown in Figure 2, presents the frequency of each ontology element across the sample. The data reveal that the most common research activities are exploration and evaluation, whereas interpretation is least represented, pointing a gap in confirmatory studies. Among managerial elements, the most frequently studied are performance, external analysis, and leadership. In contrast, there is a notable absence of work focused on structure, entrepreneurship, and incentive systems, despite their significance in management control literature. From a neuroscience perspective, stimulation techniques appear most frequently, often in hypothetical or scenario-based studies. Functional techniques follow, likely due to their dynamic nature and suitability for cognitive-behavioral research. And structural techniques are entirely absent, likely due to their high cost and static design, making them less compatible with real-time decision-making studies. In terms of organizational behavior, the most frequently coded elements are attitude, emotion, and communication, while risk aversion, motivation, and perception appear far less often, phenomena of prominent interest in economics and psychology. The figure also reveals a strong focus on individuals, with limited attention to teams and C-level executives. Notably, there are no studies addressing the principal role (e.g., owners or stakeholders), a key concept in agency theory. This omission restricts the application of neuromanagement to governance and ownership contexts and signals a promising area for future research.

whereas interpretation is the least represented, pointing to a gap in confirmatory studies.

These findings underscore a significant gap, particularly given the central role of agency theory in economics and management. We argue that neuromanagement has the potential to bridge this gap, especially through research focused on decision-making at the top management team level.

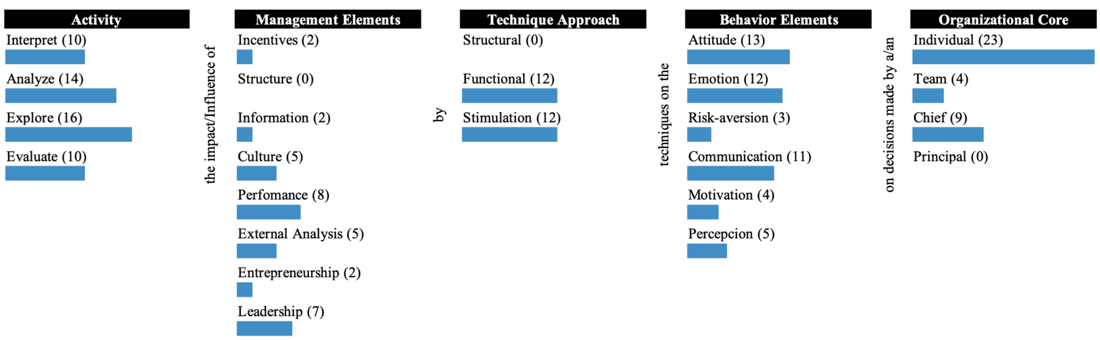

Figure 2: Frequency of articles mapped to each element (number) and relative frequency (bars). *Source:* Own elaboration.

By selecting the most and least frequent elements in each dimension of the ontology, we constructed a set of "bright" and "blind" spots, which represent areas of relative maturity and neglect, and may serve as guidance for future research development in this field. For instance, searching for *bright* spots, the influence of performance, culture, and leadership on attitude, emotion, and communication, often studied through simulation and functional techniques, dominates literature. Conversely, *blind spots* emerge in low-frequency intersections, such as the effect of structure and incentives on risk-aversion and perception, particularly at the principal level and using structural techniques. Consequently, the bright and blind spots identified through the coding process are:

More Frequent – Bright Spots

- *Explore the influence of performance by simulation/functional techniques on the attitude on decisions made by an individual.*
- *Analyze* the impact/influence of *culture/external analysis* by *simulation/functional* techniques on the *emotions* on decisions made by an *individual*.
- *Evaluate* the impact of *leadership* by *simulation/functional* techniques on the *communication* on decisions made by an *individual*.

Less Frequent – Blind Spots

- *Interpret* the influence of changes in *structure* by *structural* techniques on the *risk-aversion/motivation/perception* on decisions made by a *principal*.
- *Interpret* the influence/impact of *incentives* by *structural* techniques on the *risk-aversion* on decisions made by a *principal*.

A second outcome of the coding process are the dyads (a.k.a. co-occurrences), which capture how often pairs of elements appear simultaneously in the same article. The resulting dyads are shown in Figure 3.

Dyads: frequency of articles mapped with both elements		Activity				Management Elements								Technique			Behavior Elements						Org. Core			
		Interpret	Analyze	Explore	Evaluate	Incentives	Structure	Information	Culture	Perfomance	External Analysis	Entrepreneurship	Leadership	Structural	Functional	Stimulation	Attitude	Emotion	Risk-aversion	Communication	Motivation	Percepcion	Individual	Team	Chief	Principal
Activity	Interpret																									
	Analyze	3																								
	Explore	3	3																							
	Evaluate	2	4	1																						
Management Elements	Incentives	0	2	2	0																					
	Structure	0	0	0	0	0																				
	Information	0	0	1	1	0	0																			
	Culture	0	3	2	1	0	0	0																		
	Perfomance	1	5	1	5	0	0	0	3																	
	External Analysis	2	4	1	0	0	0	0	1	1																
	Entrepreneurship	1	1	0	2	0	0	0	0	0	0															
	Leadership	3	1	4	1	0	0	0	0	1	0	0														
Technique Approach	Structural	0	0	0	0	0	0	0	0	0	0	0	0													
	Functional	6	2	3	6	0	0	1	0	4	1	1	5	0												
	Stimulation	4	5	3	5	2	0	0	0	2	0	2	4	0	7											
Behavior Elements	Attitude	2	7	4	6	0	0	2	4	5	3	1	1	0	3	3										
	Emotion	5	3	6	6	0	0	0	0	4	1	1	2	0	6	4	4									
	Risk-aversion	1	2	1	1	0	0	1	0	0	1	1	0	0	2	1	2	0								
	Communication	6	1	5	3	0	0	1	0	2	0	1	4	0	5	5	1	6	0							
	Motivation	1	3	3	0	2	0	0	0	0	2	0	0	0	0	2	2	1	0	0						
	Percepcion	3	1	0	2	0	0	0	0	0	0	0	3	0	4	5	1	1	0	3	0					
Organizational Core	Individual	9	10	8	9	2	0	2	3	6	3	2	4	0	10	11	11	8	3	9	4	5				
	Team	0	2	2	0	0	0	0	2	1	2	0	1	0	0	0	3	0	0	0	0	0	1			
	Chief	4	1	2	4	0	0	0	1	4	1	1	5	0	8	6	2	5	0	5	0	3	6	1		
	Principal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Figure 3. Frequency of articles mapped with one element from the left and one from the top. *Souce:* Own elaboration.

Figure 3 shows that *individual*-level elements dominate the most frequent dyads, particularly combinations such as individual–analysis and individual–emotion. This highlights the current literature's strong focus on cognitive and affective processes at the individual level.

In contrast, *team*, *C-level*, and *principal* co-occurrences are largely absent, reinforcing the lack of multi-level analysis. Similarly, an examination of pairings between neuroscience techniques and behavioral elements shows that stimulation is most often used to study emotion and perception, while structural techniques are entirely absent. These trends suggest a methodological bias toward individual decision-making using non-invasive, task-based tools, with limited exploration of organizational-level constructs.

Indeed, from figure 3 we could see that a blind spots with zero articles were, for instance, from management element "Incentives" with Behavior elements attitude, emotion, risk-aversion, communication, perception. Also, changes in organizational culture with behavior element attitude, emotion, risk-aversion, communication, motivation, perception. Otherwise, a bright spot, meanwhile more frequent are in bright colors for instance, activity "Interpret" with "functional" technique approach and behavior element "communication" and "emotion" in "individual" organizational core. From the perspective of blind spots, promising gaps include the use of functional techniques in studying emotion and communication, and the application of structural techniques to motivation.

Future Research Directions based on Blind Spots.

The identified blind spots offer compelling opportunities for future research. In this section, we connect these gaps to key areas in management, using the dimensions and elements of the proposed ontology.

From a management control perspective, topics such as incentives, structure, culture, information systems, and performance remain understudied in neuromanagement. Applying neuroscience methods could offer novel insights into how individuals respond to changes in incentives, organizational design, or cultural norms.

A particularly promising area is the study of incentives, especially the distinction between intrinsic and extrinsic drivers. While this distinction has been widely explored in psychology and behavioral economics, it has received little attention in neuromanagement. Individuals may, for instance, respond differently to decisions such as organizational performance, everyday choices or decisions to socially responsible actions, among others. Uncovering the neural basis of this distinction could enrich our understanding of workplace motivation.

Regarding the organizational core, existing research is heavily focused on individuals, with limited attention to teams, executives, and principal-agent relationships. Incorporating frameworks such as agency theory and upper echelons theory could help explore how leadership or governance influence behavioral outcomes at different organizational levels.

Neuroscientific techniques — especially functional imaging and stimulation—are well suited to studying constructs like risk aversion and perception in decision-making contexts. For example, future studies could examine how changes in incentive systems influence team responses to uncertainty or team composition (e.g. personality traits). In addition, future research might examine how leadership communication affects perception in high-stress settings or different contexts.

These gaps also have practical implications. Organizations could use tools like EEG or fMRI to evaluate how employees respond to incentives or leadership styles, informing more effective and human-centered practices. Bridging these gaps can strengthen the connection between management theories such as agency theory, transaction cost economics, and upper echelons theory, as well as psychological frameworks like social comparison theory, organizational justice, behavioral decision theory, person-environment fit, level of aspiration theory, and social exchange theory.

Examples of promising future research topics include:

- *Interpret/explore/evaluate risk aversion when proposing an incentive system/modification of organizational structure/leadership with a functional technique at the team level.*
- A*nalyze/explore/explore the perception of teams/leadership when incorporating incentives/ structures modifications/information systems/ with functional technique.*

Another overlooked dimension is context. Variables such as industry, national culture, and organizational size may shape how leadership or incentives are perceived and processed. For example, a tech startup and a traditional bank may trigger different neural responses to performance-based pay. Accounting for such contextual moderators would improve both the relevance and applicability of neuromanagement findings.

A key challenge is the field's reliance on correlational, cross-sectional studies, which limits causal inference. Future research should prioritize experimental and longitudinal designs, using pre- and post-intervention measurements to assess impact—such as before and after a leadership development program or structural reorganization.

Beyond academic contribution, neuromanagement has potential for broader societal impact. By uncovering the neural and cognitive underpinnings of decision-making, communication, and motivation, it can guide more ethical and human-centered management practices. For instance, understanding how people process incentives, changes in organizational structure, changes in culture or leadership can support not only performance but also mental well-being.

CONCLUSIONS

Neuromanagement offers powerful insights into the cognitive and emotional mechanisms behind workplace decisions. Yet, the field remains underdeveloped, with limited and declining scholarly output, mostly concentrated in psychology research. This creates an opportunity for management, accounting, and organizational research to embrace and expand interdisciplinary dialogue.

The contribution was to propose and apply an ontology that maps the current body of knowledge in neuromanagement. It organizes the literature into five key dimensions, enabling the mapping of existing literature and the identification of bright and blind spots. Our analysis reveals a strong focus on individual-level research, particularly using stimulation and functional techniques. Topics like leadership, external analysis, and performance are frequently studied, while incentives, structure, and information systems are underrepresented. Similarly, attitude, emotion, and communication dominate the behavioral dimension, while motivation, perception, and risk aversion remain largely overlooked. Other neglected areas include emotion regulation, communication effectiveness, and decision-making biases, which are key to individual and organizational performance. Bridging these gaps could link neuromanagement with adjacent fields like behavioral economics and organizational psychology.

The role of the organizational core is also underexplored, particularly teams, top management, and principal-agent dynamics. Future research can benefit from engaging more deeply with theories like agency theory, upper echelons theory, and transaction cost economics to better understand how management practices influence neural responses across organizational levels.

Our limitations are the exclusive reliance on Scopus and Web of Science, as well as the potential subjectivity in coding. Nonetheless, this study offers a validated framework to organize and advance the field. By identifying key gaps and proposing directions for future inquiry, this work supports a more coherent, ethical, and human-centered research agenda in neuromanagement.

Conflict of Interest Declaration:

The authors declare that they have no conflicts of interest.

Funding:

The authors did not receive funding for this research.

Use of Artificial Intelligence (AI):

The authors declare that they did not receive assistance from an AI during the research process or during the writing of this document.

Author Contributions:

Conceptualization, Data Curation, Formal Analysis, & Research: all; Methodology: **JVV**; Project Management: **JMN**; Validation, Visualization, Writing – original draft, & Writing – review and editing: all.

All authors have read and agreed to the published version of the manuscript.

REFERENCES

Anthony, R. N., Govindarajan, V., Jaime, J. V., & Gómez, F. G. (2008). *Sistemas de control de gestión* (No. Sirsi) i9789701066416). McGraw-Hill.

Ariely, D., Bracha, A., & Meier, S. (2009). Doing good or doing well? Image motivation and monetary incentives in behaving prosocially. *American Economic Review*, 99(1), 544–555. https://doi.org/10.1257/aer.99.1.544

Becker, W. J., Cropanzano, R., & Sanfey, A. G. (2011). Organizational neuroscience: Taking organizational theory inside the neural black box. *Journal of Management*, 37(4), 933–961. https://doi.org/10.1177/0149206311398955

Bergmann, T., Karabanov, A., Hartwigsen, G., Thielscher, A., & Siebner, H. (2016). Combining non-invasive transcranial brain stimulation with neuroimaging and electrophysiology: Current approaches and future perspectives. *NeuroImage*, 140, 4–19. https://doi.org/10.1016/j.neuroimage.2016.02.012

Braidot, N. P. (2013). Neuromanagement y neuroliderazgo. *Ciencias Administrativas*, 1(2), 56–60. https://doi.org/10.24215/23143738e012

Chattopadhyay, R. (2020). Journey of neuroscience: Marketing management to organizational behavior. *Management Research Review*, 43(9), 1063–1079. https://doi.org/10.1108/MRR-09-2019-0387

Cucino, V., Passarelli, M., Di Minin, A., & Cariola, A. (2021). Neuroscience approach for management and entrepreneurship: A bibliometric analysis. *European Journal of Innovation Management*. https://doi.org/10.1108/EJIM-11-2020-0471

Erkal, H. (2017). Neuromanagement as a flourishing area in Management Science: A literature analysis. *International Journal of Engineering Sciences*, 1–5. https://doi.org/10.4172/2169-0286.1000119

Glimcher, P. W., & Rustichini, A. (2004). Neuroeconomics: The consilience of brain and decision. *Science*, 306(5695), 447–452. https://doi.org/10.1126/science.1102566

Hannah, S. T., Balthazard, P. A., Waldman, D. A., Jennings, P. L., & Thatcher, R. W. (2013). The psychological and neurological bases of leader self-complexity and effects on adaptive decision-making. *Journal of Applied Psychology*, 98(3), 393–411. https://doi.org/10.1037/a0032257

Harrison, G. W., & Ross, D. (2010). The methodologies of neuroeconomics. *Journal of Economic Methodology*, 17(2), 185–196. https://doi.org/10.1080/13501781003756543

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

Kaplan, R. S., & Norton, D. P. (2004). *Strategy maps: Converting intangible assets into tangible outcomes*. Harvard Business School Press.

Kraemer, H. C. (2014). Kappa coefficient. *Wiley StatsRef: Statistics Reference Online*, 1–4. https://doi.org/10.1002/9781118445112.stat00365.pub2

Kouravand, N. (2024). Neuro management and leadership. *International Journal of New Findings in Health and Educational Sciences (IJHES)*, 2(2), 12–24. https://doi.org/10.63053/ijhes.68

La Paz, A. I., Ramaprasad, A., Syn, T., & Vasquez, J. (2015). Editorial: An ontology of e-commerce—Mapping a relevant corpus of knowledge. *Journal of Theoretical and Applied Electronic Commerce Research*, 10(2), I–IX. https://doi.org/10.4067/S0718-18762015000200001

Lebel, L., & Lebel, P. (2018). Emotions, attitudes, and appraisal in the management of climate-related risks by fish farmers in Northern Thailand. *Journal of Risk Research*, 21(8), 933–951. https://doi.org/10.1080/13669877.2016.1264450

Massaro, S., Drover, W., Cerf, M., & Hmieleski, K. M. (2020). Using functional neuroimaging to advance entrepreneurial cognition research. *Journal of Small Business Management*, 61(2), 938–966. https://doi.org/10.1080/00472778.2020.1824527

Mintzberg, H. (1979). *The structuring of organizations: A synthesis of the research*. Prentice-Hall.

Naranjo-Gil, D., Gómez-Ruiz, L., & Sánchez-Expósito, M. J. (2011). Neuroscience and management: Challenges for behavioral research in organizations. *Journal of Positive Management*, 2(1), 45–58. https://doi.org/10.12775/jpm.2011.005

Ramaprasad, A., & Syn, T. (2015). Ontological meta-analysis and synthesis. In Proceedings of the Nineteenth Americas Conference on Information Systems, Chicago, Illinois. https://aisel.aisnet.org/amcis2015/ISHealthcare/GeneralPresentations/4

Sandberg, J., & Alvesson, M. (2021). Meanings of theory: Clarifying theory through typification. Journal of Management Studies, 58(2), 487–516. https://doi.org/10.1111/joms.12655

Sanjeev, A., Ramaprasad, A., & Naidu, C. J. P. (2021). Innovations of materials for sustainable social development: An ontology. Materials Today: Proceedings, 38, 1272–1276. https://doi.org/10.1016/j.matpr.2020.06.414

Satpathy, J. (2012). Issues in neuro-management decision making. Opinion: International Journal of Business Management, 2(2), 23–36. https://doi.org/10.5281/zenodo.1089248

Simons, R. (1995). Levers of control: How managers use innovative control systems to drive strategic renewal. Harvard Business School Press.

Suomala, J. (2018). The neuroscience research methods in management. In K. Järvinen & J. Suomala (Eds.), Innovative research methodologies in management (pp. 135–158). Palgrave Macmillan. https://doi.org/10.1007/978-3-319-74173-4_7

Tan, P. N., Steinbach, M., & Kumar, V. (2016). Introduction to data mining. Pearson Education India.

Vásquez, J., & La Paz, A. (2019). The knowledge body of requirement engineering in IST innovations: An ontological analysis. Journal of Technology Management and Innovation, 14(4), 78–84. https://doi.org/10.4067/S0718-27242019000400078

Waldman, D. A., Ward, M. K., & Becker, W. J. (2017). Neuroscience in organizational behavior. Annual Review of Organizational Psychology and Organizational Behavior, 4, 425–444. https://doi.org/10.1146/annurev-orgpsych-032516-113324

Wang, Z., Dai, Z., Gong, G., Zhou, C., & He, Y. (2015). Understanding structural-functional relationships in the human brain. The Neuroscientist, 21(3), 290–305. https://doi.org/10.1177/1073858414537560