encyclopedia

MDPI

Entry

The Emergence of Neuroleadership in the Knowledge Economy

Constantin Bratianu [1] and Roxana-Maria Staneiu [2,*]

[1] UNESCO Department of Business Administration, Faculty of Business Administration, Bucharest University of Economic Studies, 012244 Bucharest, Romania; constantin.bratianu@gmail.com
[2] Faculty of Management, National University of Political Studies and Public Administration SNSPA, 012244 Bucharest, Romania
* Correspondence: roxana-maria.staneiu@facultateademanagement.ro; Tel.: +40-764477634

Definition: "The Emergence of Neuroleadership in the Knowledge Economy" explores the field of neuroleadership in today's constantly changing economy, highlighting the transition from traditional leadership to neuroleadership. Neuroleadership renders itself as a novel approach to the leadership theory, which brings together insights from neuroscience, psychology, and leadership studies. It emphasizes understanding the workings of the brain and human behavior in order to drive leadership effectiveness, at individual, team, and organizational levels. Additionally, the knowledge economy is characterized by the significant role of knowledge and intellectual capital when it comes to driving economic growth and organizational development. It highlights the creation, dissemination, and sharing of knowledge as important pillars for productivity and competitive advantage, shaping industries and transforming leadership traditional models. Through an extensive literature review and by employing the Dulewicz and Higgs leadership model, the authors showcase what are the intellectual, managerial, and emotional competencies that make neuroleadership the next natural step in leading teams and organizations. This article proposes a comparative matrix between traditional leaders and neuroleaders, and highlights a novel framework for better understanding neuroleadership.

Keywords: neuroleadership; knowledge economy; leadership; neuroscience; knowledge dynamics

check for updates

Citation: Bratianu, C.; Staneiu, R.-M. The Emergence of Neuroleadership in the Knowledge Economy. *Encyclopedia* **2024**, *4*, 1100–1116. https://doi.org/10.3390/encyclopedia4030071

Academic Editors: Luis Machado and Raffaele Barretta

Received: 21 April 2024
Revised: 24 June 2024
Accepted: 29 June 2024
Published: 1 July 2024

Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

Uncertainty has been one of the most critical global challenges humans need to face [1,2]. This may also be perceived as a psychological incentive, which urges leaders to make the most out of their experience and expertise to identify the right solutions to new types of problems, challenging the old ways that proved helpful in the past, but no longer serve the purpose. In a world which is structurally governed by the inherently unpredictable nature of the future, the power of knowledge stands out as a strategic pillar [3]. This can be used together with one's ability to learn, explore, and share the information within the organization to ensure the successful usage of available tangible and intangible resources [4].

The fast-paced changes in today's world, together with the evolution of generations and the emergence of new challenges, have transformed and impacted the nature of work. The knowledge economy has become the cornerstone of this transformation, where organizations are asked to adapt to the complexities and cognitive demands of the modern workforce. According to recent studies [5], the global workforce currently comprises around 38% of Gen Z and Millennials, a percentage which is projected to reach approximately 58% by 2030. Taking into consideration that the highly skilled and educated "knowledge workers" form a growing segment of the workforce, organizations must preserve their competitive advantage through innovative ways of leading people. This will result in a better strategy for retaining talent and enriching their human capital. Therefore, although it is essential for organizations to always consider a healthy cost structure to ensure business continuity, this is no longer enough if the companies aim to secure a competitive advantage

in this new landscape. There is a growing importance of innovation and a huge focus on quality in order for organizations to differentiate from the competition and remain relevant in the market. Thus, organizations need to become not only more adaptable but also more innovative in how they prepare their management and leadership capabilities because this kind of innovation-driven mindset needs to be cultivated at all management levels, and the leaders are the first and foremost change agents.

The current business environment is governed by turbulence while constantly evolving, with companies facing challenges that seemed impossible in the past (such as a global pandemic, quiet quitting, and the exponential rise of generative AI as both an opportunity and threat). However, despite the uncertainty and unpredictability, there are some companies that are flourishing by adopting new approaches to management and leadership to better respond to these novel types of problems, such as stress management [6]. Understanding the diverse responses to stress is important for effective leadership under the current workplace dynamics. Leaders need to be aware of the fact that people may react differently—some may openly express distress, while others may hide it or show performance issues. It is essential not to overlook these variations and instead adopt a nuanced approach to support individuals' well-being and maintain team and organizational resilience. While traditional leadership theories have offered valuable insights into various leadership styles and approaches, there is a growing interest in the emerging field of neuroleadership [7].

Neuroleadership incorporates insights from neuroscience and psychology to provide a new perspective on effective leadership. By understanding how the brain functions and how psychological processes influence outcomes, neuroleadership offers a deeper understanding of human behavior and explains how this can help in the process of leading people [8]. Neuroleadership does not imply abandoning traditional leadership practices and theories. Instead, the neuroscience shifts build on those skills to substantially expand leaders' capacity in this new disruptive era. Therefore, cognitive knowledge becomes essential in the knowledge economy framework.

With the rapid evolution of technology, particularly artificial intelligence (AI), industries are undergoing significant transformations, and work processes are being redefined. Consequently, there is a growing demand to utilize knowledge from neuroscience in order to enhance leadership practices, facilitate change, quickly adapt, and achieve sustainable performance.

The purpose of this paper is to highlight the similarities between traditional leadership and neuroleadership, and narrow down the most important principles of neuroleadership based on a critical comprehensive review of the literature. It aims to outline the differences and common ground between leaders and neuroleaders, and explain the competencies of the emerging neuroleadership in the knowledge economy.

2. Types of Traditional Leadership

The study of leadership has been a subject of interest across various disciplines, including psychology, sociology, and organizational behavior. Evolutionary psychology has been employed to understand the origins and development of leadership in humans. It has been discovered that the human brain is capable, through its psychological mechanisms, of solving complex problems when stimulated by leadership and fellowship [9].

Historical perspectives also play an important role in understanding leadership, as it is embedded within a wider historical frame [10]. Additionally, the influence of culture on leadership has been explored, with research indicating that leadership behaviors and practices vary according to gender, culture, knowledge, experiences, communication skills, and relationships [11].

It is important to acknowledge that leadership has significantly transformed over time, adapting to the growing needs and dynamic environments of organizations and societies. In the past, leadership was associated with a "command and control" approach, where leaders held all authority and made decisions without much input from others. As organi-

zations' understanding of effective leadership has progressed, people now acknowledge the importance of collaboration, empowerment, teamwork, and inclusivity. Therefore, leadership is no longer solely relying on one's individual power, but rather gravitates around creating a collective vision and involving others to work towards that vision, creating and ensuring trust [12]. This shift in leadership perspective has been influenced by various factors such as globalization, technological advancements, generations' evolution, mindset switches, global challenges, as well as an increased focus on diversity and inclusion.

The most popular leadership types can be understood through various lenses. Emotional intelligence, as highlighted by Goleman et al. [13], has gained significant popularity across the leadership literature. It emphasizes the importance of self-awareness, empathy, and motivation in effective leadership. Transformational leadership, as discussed by [14], has also gained recognition due to its dynamic and people-centric essence. This leadership style focuses on inspiring people towards a common vision, and it has been widely studied and applied in various organizational contexts.

Furthermore, the literature and research on leadership have also seen an increasing focus on authentic leadership [15]. This type of leadership emphasizes being genuine, transparent, and displaying moral and ethical behavior, aligning with a strong focus on ethical leadership in today's organizations and their corporate social responsibility (CSR) strategies. Additionally, democratic, autocratic, and laissez-faire leadership styles have been widely discussed in recent years [16]

In the context of knowledge management and the knowledge economy, leadership is a crucial asset for leveraging organizational information, which then transforms into knowledge and fosters innovation. Knowledge management emphasizes the creation, storage, and sharing of knowledge within an organization to enhance decision-making and overall performance. Effective leadership in knowledge management involves creating a culture that encourages knowledge sharing, collaboration, and continuous learning. In his book, Dalkir highlights the importance of leadership in facilitating knowledge creation and dissemination, emphasizing the role of leaders in promoting the knowledge management practices within an organization [17]. Hauptman and Neuringer discuss the dynamics of innovation within the knowledge economy, emphasizing the role of leadership in fostering a culture of creativity and employing knowledge creation as an instrument for driving organizational performance [18].

A comprehensive framework for understanding traditional leadership was put together in a comprehensive study which aimed to offer a complete guide to leadership competencies, created by Dulewicz and Higgs [19]. It incorporated 15 leadership competencies, designed under three main groups. These competencies encompass a range of knowledge (Q), namely intellectual (IQ), emotional (EQ), and managerial (MQ), providing a complex framework for evaluating leadership effectiveness. The intellectual competencies include strategic thinking, conceptual thinking, and change leadership, which are essential for guiding organizations through complex challenges and transformations. Emotional competencies, such as self-awareness and empathy, are important for fostering positive relationships and bringing people together. Additionally, the managerial competencies encompass areas such as achievement drive, planning and organizing, and control, which are vital for ensuring operational excellence and organizational performance.

Table 1 sets out the competencies of a traditional leader.

Table 1. Fifteen leadership competencies based on leadership style, adapted from Dulewicz and Higgs (2003) [19].

	Intellectual Group	Managerial Group	Emotional Group
Competencies	1. critical analysis and judgment 2. vision and imagination 3. strategic perspective	4. engaging communication 5. managing resources 6. empowering 7. developing 8. achieving	9. self-awareness 10. emotional resilience 11. motivation 12. sensitivity 13. influence 14. intuitiveness 15. conscientiousness

3. Evolution of Leadership through the Lenses of Knowledge Economy

The knowledge economy represents a shift from traditional production-based economies to those driven by the creation, distribution, and application of knowledge. It outlines the quintessential role of knowledge as a strategic resource for economic growth and development. Furthermore, the knowledge economy highlights the importance of knowledge transfer, innovation, and the effective utilization of intellectual capital for sustainable economic development. The knowledge economy also emphasizes the need for continuous learning, adaptability, and the optimal utilization of knowledge resources to ensure a healthy competitive advantage. Therefore, it becomes essential to have leaders who can drive change and navigate uncertainty in the knowledge economy.

Leadership plays an essential role in the organizational knowledge dynamics' processes [20,21]. Leaders foster a knowledge-sharing culture, promote creativity, and align knowledge processes with organizational goals. They are important when it comes to shaping the organizational environment to enable effective knowledge management, innovation, and strategic decision-making. Furthermore, a leader should understand and promote all types of knowledge and their specific dynamics.

Aristotle [22] describes in *Book VI –Virtues of thought* three types of knowledge: episteme, techne, and phronesis. Episteme is considered scientific knowledge that lasts forever and is teachable. Techne is craft knowledge that is related to production. Phronesis is related to prudence or practical wisdom. It is a "state grasping the truth, involving reason, concerned with action about things that are good or bad for a human being" [22], p. 89. According to Russell [23], Plato and other philosophers considered that knowledge cannot be derived from perception. It is a result of reflection and learning. Descartes [24] is looking for certainty in knowledge creation and reaches the conclusion that thought is the only reliable and certain attribute of human existence: "I am, I exist, that is certain" [24], p. 141. Polanyi [25] introduced the concept of the tacit dimension of knowing by recognizing the fundamental role of practical knowledge acquired through the direct experience of the human body. Based on the work of Polany [25] and the Japanese philosophy of oneness of mind and body, Nonaka and Takeuchi [26] developed the ontology of tacit and explicit knowledge with direct application to knowledge management. Tacit knowledge represents the results of direct experience of the human body in relation to its environment and it can be expressed only through the body language. Tacit knowledge is a result of human perception and learning by doing. It is like the hidden part of an iceberg. Explicit knowledge can be expressed using natural or symbolic languages and it is like the visible part of the iceberg. It is the rational knowledge that can be related to Aristotle's episteme, while tacit knowledge can be related to techne.

Lakoff and Johnson [27] explain that the human mind uses metaphors to define abstract concepts which do not have any material support. Andriessen [28] analyses several categories of metaphors used to define the concept of knowledge within the framework of knowledge management, from physical objects to love. The most frequently used metaphors are knowledge as an iceberg and knowledge as a flow [26,28,29]. However, all these metaphors suffer from the tangible and linear properties of the objects considered in the source domain. In order to overcome these limitations in defining and interpreting

knowledge within the framework of knowledge management systems, Bratianu [30] introduced the new metaphor of knowledge as energy. Based on this metaphor, Bratianu and Bejinaru [31] developed the theory of knowledge fields.

According to the theory of knowledge fields [30,31], there are three important forms of knowledge: rational knowledge, emotional knowledge, and spiritual knowledge. Rational knowledge has an explicit trait, and it can be expressed through natural language or symbols. Rational knowledge is the backbone of our educational system and working life. Emotional knowledge represents the emotional states generated by the human body in its interaction with the external environment, as shown by cognitive science [32–35]. Emotional knowledge is important in understanding consumers' behavior and decision-making processes [33,35,36]. Lastly, spiritual knowledge aggregates the entire spectrum of values, beliefs, and states of mind that are being experienced within an organization [37,38].

Understanding the evolution of human social behavior, namely how human feelings have developed over time, is considered a great neurological strategy that helps leaders understand the main drivers of human actions and better connect with their teams and organizations. Integrating this knowledge into their skillset enables them to influence social interactions more effectively and put the focus on emphasizing the role of feelings when it comes to decision-making and motivation [39]. Therefore, it is valuable to look at neuroleadership as an integrator of not only emotional, rational, and spiritual knowledge, but also with its epicenter in cognitive knowledge.

Integrating cognitive knowledge into the triad of rational, emotional, and spiritual knowledge offers a comprehensive understanding of human cognition and behavior. Cognitive knowledge involves the understanding of mental processes such as perception, attention, memory, and decision-making [26,40]. By integrating cognitive knowledge into leadership practices, leaders can level up their skillset by learning how individuals process information, make decisions, and respond to various stimuli, including how people act and react when they are triggered. This understanding can help them customize and tailor their leadership approaches, communication strategies, and organizational processes to optimize cognitive functioning and enhance individual and team performance. When a leader is more connected to a person by understanding how emotions work, how triggers affect the prefrontal cortex, why people become angry sometimes or how fight, flight, freeze responses are activated, he will become more prepared and equipped to deal with difficult situations and make better decisions. Moreover, integrating cognitive knowledge into the leadership triad can provide leaders with a deeper understanding of how individuals learn, adapt, and innovate, thereby enabling them to create contexts that facilitate and promote lifelong learning, knowledge creation, and adaptive responses to dynamic organizational challenges [41].

4. Development of Neuroleadership

The concept of neuroleadership was first introduced in the late 1990s, driven by a significant academic interest in understanding how to incorporate insights from neuroscience into leadership practices. Dr. David Rock, considered one of the first pioneers of neuroleadership, began exploring the potential for neuroscience to contribute to leadership development practices and strategies. The initial focus was on understanding how the brain processes information, makes decisions, and influences people's behavior. He later founded the NeuroLeadership Institute in 2007, which is recognized as one of the world's leading organizations in studying neuroleadership development and its applications, and which helped in advancing the concept in both academic and business worlds. Neuroleadership emphasizes that the human brain's functions influence behavioral responses, decision-making, and social connections. The aim of neuroleadership is to make leaders more aware of human behavior and equip them with instruments to understand why someone acts or reacts in a certain way and how they can manage that situation. It also involves a significant level of self-awareness. Although it is not a completely novel perspective, provided its

history, the concept of neuroleadership continues to evolve and shape the understanding of effective leadership, especially in today's times of high levels of change and uncertainty.

Neuroleadership is a multidisciplinary field that integrates neuroscience, psychology, and leadership studies to understand the neural processes underlying effective leadership. The concept of neuroleadership recognizes that the human brain is wired for survival, and its functions influence behavioral responses, decision-making, and social interactions. Neuroleadership seeks to uncover the neural mechanisms associated with leadership capabilities, such as decision-making, emotional regulation, and social cognition. This emerging field explores how brain activities and cognitive processes contribute to effective leadership. As David Rock quotes, "*Brain research can help people understand how other bodies of knowledge fit together*" [42] (p. 29).

Rock's starting point is a well-known concept, directly correlated with neuroleadership practices—the status, certainty, autonomy, relatedness, and fairness (SCARF) model. Rock developed this model in 2008, and he aimed to shed light on two long-debated concepts in neuroscience: the natural inclination of humans to move towards reward and to avoid threat. When individuals maximize reward through their actions, dopamine is released, generating a sense of well-being. On the other hand, when the mind perceives a threat, the primal survival instinct of the human brain is instantly activated, releasing cortisol and adrenaline, hormones foundational to stress and anxiety [42]. Rock advised leaders to be mindful of the SCARF model when leading people through uncertainty and change because it is considered a powerful instrument in understanding human behavior, helping leaders manage people's reactions, and ensuring a safe, performant, and motivating environment.

Rock identified five dimensions that can be taken into account when addressing human motivation and improving collaboration. Status is the dimension which acknowledges the human inclination for social hierarchies. Leaders need to learn how their actions and decisions may impact individuals' perceived status within a group, which can negatively or positively influence their reactions and overall motivation. Certainty is rooted in the brain's preference for predictability and natural avoidance of change, because for the human brain, change is dangerous due to the fact that it might imply potential threats, putting at risk the brain's survival. Leaders are encouraged to provide clear expectations, relevant information, and a sense of stability to support their teams. By doing this, they promote a psychologically safe environment, which is considered essential for teams to work and perform [43]. Autonomy implies recognizing the human desire to be in control of their environment. Leaders are encouraged to cultivate a positive environment by allowing people to explore, and give them autonomy while minimizing micromanagement. Relatedness is correlated with the human's inherent social nature, provided that the brain is wired to create interpersonal connections to feel safe, appreciated, and loved. Leaders need to foster positive social interactions and constantly instill a sense of belonging within the team. Fairness is related to the fact that people are prone to become stressed or annoyed when they feel discriminated against. Therefore, leaders must create a fair and equal work environment, ensuring everyone has the same opportunities, and acting according to pre-communicated expectations.

Continuing his work on creating and researching this new field of neuroleadership, Rock and Ringleb put together a four-domain framework which aimed to incorporate the components of neuroleadership [44]. These domains provide a structured understanding of how the brain functions in the context of leadership behaviors and decision-making. The first domain, decision-making, highlights the cognitive processes and neural mechanisms involved in conducting an effective and productive decision-making process. Regulating emotions explores the neuroscience of emotional regulation and how leaders can practice self-regulation as a method of managing their emotions and becoming more aware of others' emotions. It also shows the impact of mindfulness, reappraisal training on cognitive performance. The third domain, collaborating with others, focuses on the social aspects of leadership, highlighting how the brain processes social interactions and influences collaboration. Lastly, facilitating change examines the neurological implications of change

management, offering insights into how leaders can navigate and facilitate successful organizational change. It also involves the effectiveness of different types of feedback techniques on performance. Together, these four domains are the pillars of a novel framework that empowers leaders with a neuroscientific perspective on how to enhance their decision-making, emotional intelligence, collaborative skills, and change management capabilities.

Silvia Damiano's i4 Neuroleader Model, which aims to incorporate neuroscientific principles into leadership, examined four dimensions: performance, collaboration, innovation, and agility [45]. The performance aspect of the model investigates the neurological basis that impacts the attention, focus, and cognitive resources necessary for individual and team performance. In terms of collaboration, the dimension outlines how the brain influences collaborative behaviors by emphasizing effective communication and trust-building. The innovation section explores the cognitive processes behind creative thinking and adaptability. The agility dimension looks at neuroscientific insights into adaptability and resilience when dealing with change, uncertainty, and stress. This approach in neuroleadership highlights the evolution of traditional leadership incorporating a deeper understanding of the brain and its impact [45].

The i4 Neuroleader Model is particularly relevant in the context of the fast-changing global economy, from the Industrial Age through the Information Age and into the Imagination Age. In the Industrial Age, characterized by mechanistic structures and hierarchical organizations, leadership used to mainly focus on command and control. Leaders needed to understand how attention, focus, and cognitive resources work in order to help individual optimize these resources and improve team performance within rigid structures [46].

As industries transitioned into the Information Age, where knowledge and information became central, the i4 Neuroleader Model gains relevance in the collaboration dimension. In this era, effective leadership requires understanding the brain's role in promoting collaborative behaviors, fostering transparent communication, and building trust within the organization. With one step into the Imagination Age, marked by a shift towards creativity and adaptability, the i4 model is particularly important through its applications of innovation and agility. Neuroscientific insights into cognitive processes explaining creative thinking and adaptability are helpful for leaders when it comes to leading others through change and uncertainty [47].

In order to look at the elements that have contributed to setting up the base for neuroleadership, it is important to examine the mirror neuron system theory. This discovery was made popular by Rizzolatti and Craighero [48], and they revealed that mirror neurons are a class of premotor cortical cells that are activated during both action execution and observation. This theory may be considered an important mechanism for social learning and imitation, suggesting that observing the behaviors of others might unconsciously activate similar neural representations within the observer. Therefore, from a leadership perspective, this implies a great potential for leaders to influence individual and team behavior organically and naturally through their own actions and examples. In other words, leaders who live by healthy values and portray desired skills, such as conversational intelligence or emotional regulation, may trigger the mirror neuron system in their team members, which then results in the unconscious adoption of these same behaviors. This phenomenon can foster a more cohesive and performant team, taking into consideration that the individuals begin to naturally mirror the leader's approach. Consequently, neuroleadership highlights the importance of leaders' self-awareness, knowing that their behaviors may have a significant influence on people's and teams' development. In addition, mirror neurons were found to be very important when it comes to the human ability to learn new skills, integrate new knowledge, connect with others, and build social connections [49]

Looking at how people act and react, the reward or punishment responsivity and motivation is another valuable concept for understanding how neuroleadership can improve the quality of leadership and decision-making and may result in enhanced team effectiveness and better organizational performance [50]. To highlight the implications, it is valuable to understand some neurobiological parts of the human brain: the role of the

amygdala, which is a brain region that has an essential impact on how humans experience and process emotions [51]. When someone feels fear, isolation, or a strong emotion generated by a social threat, the amygdala is activated, and people feel the urge to act to avoid the punishment and secure their safety, even if it is only psychological. Apart from the release of cortisol and adrenaline, when the amygdala is activated, the prefrontal cortex cannot function as it normally does, limiting the rational and cognitive behaviors, and this may negatively impact open communication and creative problem-solving. Conversely, leaders who are able to create a safe space for different perspectives, opinions, or beliefs and can encourage healthy debate can help their team members stay in an active zone of the prefrontal cortex, which is responsible for rational thinking [52]. Therefore, leaders who are able to guide people through understanding the cognitive biases and their implications on the prefrontal cortex can support team members in making better decisions and sharing ideas more openly.

5. Leader vs. Neuroleader

In today's rapidly evolving business landscape, marked by technological advances and global relations, there is an urgent need to enhance leadership practices to effectively navigate the complexities and challenges faced by organizations. Traditional leadership models, while valuable, may fall short in addressing the intricacies of the modern workplace. The pace of change, coupled with diverse and dynamic team structures, requires a more nuanced understanding of leadership that goes beyond conventional approaches. This imperative arises from the recognition that leadership is not solely about authority and decision-making but is connected to the understanding of human behavior, motivation, and the cognitive processes [53].

It is important to mention that both neuroleadership and traditional leadership share similarities and common ground in areas such as decision-making, problem-solving, driving change, and collaboration. In relation to decision-making, both leadership styles prioritize the importance of leaders having sound judgment. Neuroleadership leverages knowledge about how the brain makes decisions, taking into account cognitive biases, and it promotes a deep understanding of how these biases work in order to improve the decision-making process. Conversely, conventional leadership models such as the path–goal theory encourage leaders to remove obstacles in decision-making to support followers in accomplishing their goals [44].

While both neuroleadership and traditional leadership share key similarities, the main difference lies in their intrinsic nature. Traditional leadership models, including trait, behavioral, contingency, and path–goal theories, focus their concepts on observational and behavioral studies. On the other hand, neuroleadership finds its place at the intersection of leadership, neuroscience, and psychology. It provides a novel perspective by revealing how the brain functions and how psychological processes influence leadership behaviors and outcomes.

Defining the neuroleadership framework is essential for understanding the neural basis of leadership behaviors and decision-making processes. The work of Zwaan et al. from 2019 and Ruiz-Rodríguez et al. in 2023 emphasizes the potential of neuroleadership to improve leadership practices, change management efforts, innovation, creativity, and employee engagement [54,55]. Additionally, the study by Sutherland et al. highlights the importance of understanding leadership studies through storytelling and narrative approaches, underscoring the need to integrate neuroscientific findings into leadership development programs [56].

Neuroleadership comes with several new aspects in the leadership approach. First, it provides a more complex, detailed, and complete understanding of how leaders process data to transform the data into information, knowledge and then make decisions [52]. Traditional leadership often focuses on external factors influencing a decision, while neuroleadership investigates the internal cognitive processes that contribute to decision-making.

Essentially, it examines the neurological basis of how leaders think and react, adding a new dimension to problem-solving competencies [44].

Neuroleadership places an essential focus on the intangible connection between emotions and leadership. Traditional models put emphasis on rational action, visible behaviors, and traits. On the contrary, neuroleadership uncovers the hidden emotional implications of leadership behaviors, providing new insights into emotional intelligence and its impact on leadership efficacy and connecting it with the power of emotional regulation [57,58].

Transformational leadership is a dynamic leadership practice that emphasizes inspiring and empowering people to achieve great results. At its core, transformational leadership integrates both rational and emotional knowledge, recognizing the importance of blending logic with emotions, empathy, and understanding. While transformational leaders motivate people by instilling an inspiring vision, they also prioritize emotional intelligence and interpersonal relationships. This holistic approach aligns with the principles of neuroleadership, which highlights the significance of emotional regulation and the importance of understanding people's behavior. Thus, transformational leadership is well connected to neuroleadership, as it takes into account some of the most important aspects of the latter, such as inspirational motivation and individualized consideration—namely, embracing the belief that everyone has their own needs, feelings, and fears that move them. In other words, neuroleadership and transformational leadership share the same essence: inspiring and motivating followers to achieve beyond their perceived potential. Consequently, transformational leadership can act as a bridge between traditional models and neuroleadership by guiding leaders to connect with their core needs, building trust, and driving motivation.

Neuroleadership highlights and explains the cognitive processes involved in change and resistance within the brain. It equips leaders with a deeper understanding of how cognitive resistance to change can arise, allowing for more effective management of such resistance. While traditional leadership approaches focus on the mandatory steps to implement change, neuroleadership invites managers and leaders to discover the neural mechanisms behind these steps, creating an environment that facilitates change and empowers individuals to become drivers of such transformation.

To have a better understanding of the implications of neuroleadership, it is worth examining the common ground and the differences between this concept and neuromanagement. Neuroleadership and neuromanagement are essentially related fields in the organizational psychology paradigm, which find their roots in the way people aim to integrate the implications of neuroscience and how the human brain works in order to enhance these practices [59]. On the one hand, neuroleadership focuses on understanding the neural processes behind leadership theories, while neuromanagement is more connected to the overall management practices within an organization. On the other hand, while neuroleadership puts an emphasis on individual behaviors, neuromanagement aims to apply neuroscience principles across various organizational lines, structures, and procedures. The two concepts are complementary, and by integrating insights from both fields, organizations can gain the advantage of building more comprehensive and relevant strategies to foster innovation, collaboration, and continuous improvement [60]

For organizations and their people to thrive now, all of these leadership characteristics should be combined into a more connected leadership style—neuroleadership—which has its foundation in traditional leadership.

Table 2 showcases a comparison matrix between the traditional leader and neuroleader competences.

At the border between a traditional leader and a neuroleader sits transformational leadership, which may fill in the gap between the common ground and the main differences between the older and the more novel leadership practices. Transformational leadership takes into account what inspires and motivates humans to contribute to a larger goal, being a promoter of intrinsic motivation. Transformational leadership may be perceived as a healthy mix of rational and emotional knowledge, together with a balanced focus on external and

internal factors when making a decision. Nevertheless, it lacks the understanding of how the human brain works and how the behavioral approach to individuals may help leaders become better professionals.

Table 2. Leader vs. neuroleader competencies comparison; authors' own work.

Group	Competence	Leader	Neuroleader
Intellectual (IQ)	1. Bold decision-making	X	X
	2. Creative problem-solving	X	X
	3. Driving change	X	X
Managerial (MQ)	4. Conversational intelligence		X
	5. Cognitive flexibility		X
	6. Coaching	X	X
Emotional (EQ)	7. Growth mindset as an enabler for neuroplasticity		X
	8. Emotional regulation		X
	9. Mindfulness		X

Driving change serves as a fundamental determinant within the field of neuroleadership, illuminating the intricate interplay between neuroscience and leadership when organizations undergo transformative processes. In today's dynamic business landscape, leaders often find themselves in the driver's seat of change initiatives, making the exploration of neuroleadership's insights particularly pertinent. Neuroleadership empowers leaders to understand how the brain processes change and how people may perceive it, thereby equipping them to promote it and navigate the complexities of change with greater efficacy and success [61].

Leaders often find themselves in positions where bold decisions are required to steer organizations through uncertainty and complex challenges. Neuroleadership helps leaders develop skills which are connected to a significant comprehension of the neural mechanisms that explain decision-making, providing helpful insights into the intricate processes occurring within the human brain during such critical moments [62]. Figure 1 sets out the components that set the foundation of neuroleadership as an instrument to enhance traditional leadership practices.

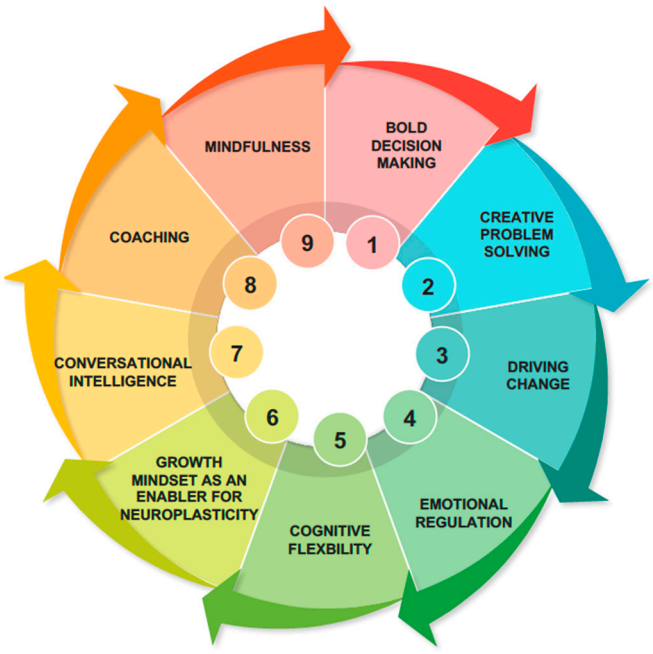


Figure 1. Neuroleadership principles wheel; authors' own work.

A deeper exploration of the neuroleadership perspective underscores its focus on decision-making with special attention to recognizing cognitive biases and mental shortcuts that affect judgment. Making bold decisions involves taking calculated risks and challenging linear thinking. Neuroleaders understand that the brain tends to rely on certain mental shortcuts that can lead to improper or less-valued outcomes. For instance, the "confirmation bias" can cause leaders to seek information that supports their pre-existing beliefs, potentially leading to decisions that ignore other relevant data. Similarly, the "availability heuristic" can lead to decisions based on recent or vivid information, even if it does not represent the complete picture [63].

The process of problem-solving begins with the brain's capacity to recognize and process issues. When a problem is identified, the anterior cingulate cortex (ACC) is activated, playing a crucial role in detecting conflicts and errors [64]. Simultaneously, the prefrontal cortex (PFC), responsible for executive functions like attention and working memory, is engaged in focusing attention on the problem at hand. These early cognitive processes form the foundation of effective problem-solving, highlighting the significance of the brain's initial response.

Once a problem is recognized, the brain initiates information gathering and integration. The hippocampus, a vital brain structure for memory and learning, facilitates the retrieval of relevant data and their integration with current observations. The hippocampus's ability to access stored information and link it with real-time data is essential for effective problem-solving [65]. This stage highlights the brain's capacity to synthesize a vast array of information, a process which is highly connected to designing and implementing comprehensive solutions.

Emotional regulation renders itself as an important competence that leaders may adopt in order to perform and lead in today's world of uncertainty. It refers to the ability to recognize, understand, and manage one's own emotions effectively, as well as influencing the emotions of others in a constructive manner [66]. When connected to leadership, emotional regulation represents an important pillar as it impacts not only individual well-being but also team dynamics, decision-making, and overall organizational and team culture. Understanding and practicing emotional regulation is part of the neuroleadership framework taking into consideration its behavioral nature, emphasizing the importance of being aware of how emotions can impact the way people work together, stress, and well-being [67].

Coaching skills in leadership encompass a set of competencies that leaders employ to facilitate the growth, development, and optimal performance of their team members. These skills involve active listening, the use of open-ended questioning, giving constructive feedback, and offering individual guidance and support. Coaching in leadership creates an environment that encourages the exploration of team members' strengths, weaknesses, and their potential, culminating in the enhancement of their skills together with meeting their objectives. Effective questioning techniques are an aspect of coaching that resonates with neuroleadership principles. Asking the right questions encourages team members to explore their thoughts, beliefs, and potential solutions [68]. Consequently, neuroscience research highlights the significance of well-designed questions in stimulating cognitive engagement and promoting learning.

Cognitive flexibility, a cognitive skill, refers to the ability to adapt and switch between different cognitive strategies or mental processes in response to changing situations or tasks. It involves the capacity to shift one's thinking patterns, generate alternative solutions, and adjust one's mental approach when dealing with new or complex challenges. Cognitive flexibility is founded on the brain's capacity to reconfigure neural networks and pathways to accommodate different cognitive demands, connecting it with neuroplasticity (the brain's ability to develop new neural pathways). In the context of neuroleadership, cognitive flexibility serves as a valuable component, facilitating leaders' capacity to navigate dynamic and uncertain scenarios, lead people through change, and quickly adapt when making decisions for the benefit of their teams and organizations [69–71].

Conversational intelligence (C-IQ) is a concept that explains the nature of conversations and their impact on individuals and organizations [72]. It comprises three distinct levels, each representing a level of conversational effectiveness and influence. It is important to mention that trust undergoes a transformative evolution across the three levels of conversational intelligence. At Level I, trust is primarily transactional, it relies on fact-based information, and the conversation often lacks emotional depth or personal connection. Transitioning to Level II, trust becomes more nuanced, focusing on the intentions and motivations of conversational partners within positional conversations. Here, trust is at the intersection of the conversational partners' interests and may be conditional. Finally, at Level III, trust goes beyond facts or intentions. This highest level reflects a profound belief in authentic care, mutual goals, and willingness to cooperate. Thus, the evolution of trust across C-IQ levels mirrors a progression from transactional to relational, with trust becoming more profound as conversations are more in-depth.

Leaders who excel at Level III conversational intelligence are great at fostering collaboration, innovation, and meaningful connections among team members, ultimately contributing to positive organizational outcomes and promoting a space of co-creation.

A growth mindset, as defined by psychologist Carol Dweck, is a foundational concept for the entire cognitive psychology field [73]. It represents a belief system in which people perceive their abilities and intelligence as qualities that can be developed and enhanced through dedication, effort, and learning throughout their whole lives.

Connected to having a growth mindset, neuroplasticity is the brain's capacity to reorganize and adapt itself by forming new neural connections and pathways [74]. It allows the brain to learn, unlearn, and relearn, even into adulthood. Neuroplasticity is promoted and harnessed by a growth mindset because the belief in the ability to develop skills and intelligence encourages individuals to engage in activities that challenge their existing neural networks.

Neuroleadership, as a field that seeks to integrate insights from neuroscience into leadership practices, is inherently connected to the concepts of a growth mindset and neuroplasticity [75]. Leaders who adopt a growth mindset are more likely to foster a culture of continuous learning within their teams and organizations. They encourage their team members to take on new challenges, learn from failures, and embrace change as an opportunity for growth. This, in turn, aligns with the principles of neuroplasticity, as it promotes the brain's capacity to adapt and grow in response to these learning experiences.

Neuroleadership may be perceived as a true example of interdisciplinary and integrated powerful knowledge (IIPK), which is the outcome of bringing together insights from various disciplines to tackle difficult obstacles and challenges. Neuroleadership was framed and designed in order to respond to novel workplace challenges and rapid changes, and it merges insights from neuroscience with leadership principles, providing a comprehensive understanding of human behavior. Developing such knowledge is essential for organizations to drive innovation and preserve their competitive advantage Through the co-creation of IIPK, informed decision-making is promoted, leading to more effective and sustainable solutions [76].

Neuroleadership is a transformational type of leadership, implying that it can significantly contribute to a company's success or growth by encouraging proactive behavior and inspiring people to achieve extraordinary outcomes. It nurtures employee motivation, performance, and morale through mechanisms such as fostering a sense of identity, serving as a role model, and aligning work and tasks with individual strengths and weaknesses [77].

Nevertheless, even though it seems like neuroleadership can be the answer to most of the challenges leaders currently face, it is important to acknowledge some new perspectives on what leadership may actually imply. Kelly (2004) challenges the view of leadership as a fixed set of positive attributes possessed by individuals, and he proposes instead a "negative ontology" of leadership, suggesting that leadership emerges not from the presence of specific qualities, but from the absence of something crucial. He calls this aspect a "lack" that could be, for example, a lack of clarity, a lack of direction, or a lack of expertise. In

the face of such absences, people may turn to others to provide guidance or solutions, creating the space for leadership to rise. Therefore, leadership is seen as a dynamic process that depends on the context and connection between leaders and followers rather than a fixed set of characteristics that individuals possess. This implies that there is no such thing as a single leadership theory, but leadership is a collection of best practices from multiple theories, which may or may not be put in practice depending on the situation [78]. Therefore, neuroleadership must take this point into account and render itself as a dynamic set of skills, gravitating around understanding the human brain and how people behave.

From a social point of view, this new leadership approach has the potential to significantly impact how leaders understand and handle organizational management and strategy execution. One important social impact of neuroleadership is its inherent nature of fostering more effective and empathetic leadership practices, thus improving the quality of the relationships within teams and organizations and promoting a sense of belonging. The understanding of human behavior enables leaders to empathize with their team members' perspectives, promote cognitive flexibility, and ensure a psychologically safe environment. Consequently, organizations may experience improved employee satisfaction, lower stress levels, and better collaboration, which contribute to a healthier and more positive organizational culture.

Moreover, neuroleadership has the potential to address very important and longstanding issues of diversity, equity, and inclusion not only within workplaces but also within society. By highlighting the unconscious biases, cognitive processes, and social dynamics that influence the decision-making process and employee behavior in organizations, neuroleadership research can contribute to developing strategies for promoting diversity and fostering inclusive environments. Leaders who possess knowledge about the neurological processes that create prejudice and discrimination can better implement instruments and initiatives in order to mitigate the impact and promote fairness in decision-making processes. Therefore, the social impact of neuroleadership lies in its potential to create more connected, inclusive, and socially responsible leadership practices that promote, drive, and sustain positive change within organizations and society.

Even though neuroleadership is gaining more and more popularity and implies a series of important advantages, it is important to also state its limitations. One of the most significant concerns is oversimplifying complex brain functions and behaviors and being unable to convey the entire complexity of the human brain, which is much more than a few regions and neural mechanisms. The current research on the human brain still has some important gaps, making it difficult to really understand how it works and how it adapts, not to mention the simplification then required to integrate it with leadership. Therefore applying this still-evolving science of the human brain to leadership practices, if not performed properly and with awareness, may lead to the creation of overly simplistic models that fail to capture the nuances of human behavior [79].

When it comes to applying the neuroleadership instruments in practice, organizations may face resistance because this is a time-consuming process, which disrupts the normal operations until it is fully functional. Also, teaching leaders to be neuroleaders requires significant time and important resources, which may not be feasible for all organizations. Additionally, the effectiveness of neuroleadership techniques depends on the specific needs and contexts of each organization, together with the specific dynamics of the teams and individuals. Consequently, it is difficult to look at the neuroleadership as a one-size-fits-all solution, and organizations should be open to customizing it based on their needs and challenges.

6. Practical Implications of Neuroleadership

Neuroleadership can play a fundamental role in helping organizations develop better learning and development strategies and programs for leaders, in order to equip them with knowledge and competencies that can be used to respond to today's challenges. Organizations can grow their neuroleadership capabilities and find the right balance

between traditional practices and neuroleadership, developing their knowledge base, and transforming it into a competitive advantage. Organizations are changing rapidly because of the emergence of generative artificial intelligence (AI), and they need leaders who can embrace and promote the change and help people navigate the uncertainty and even fear generated by AI. People need to be encouraged and supported to integrate AI into their day-to-day work, and neuroleaders can play a crucial role in supporting the organizations implementing this change in the workplace.

In addition, by integrating neuroleadership insights into decision-making processes, leaders can improve organizational performance, because they can make better decisions by being aware of the cognitive biases and the reward–punishment mechanism. Understanding cognitive biases and neural mechanisms can make a substantial contribution when it comes to mitigating the risks of important decisions, therefore optimizing strategic choices.

Lastly, promoting practices and strategies, such as emotional regulation or building an environment with a high degree of psychological safety, empowers teams to respond to challenges collectively, increases their resilience, and makes them feel comfortable coming up with new ideas and perspectives, which encourages an innovative culture. Also, through practices such as mindfulness and cognitive reframing, neuroleadership empowers people to reframe AI not as a threat to job security, but as a catalyst for innovation and professional growth. By using neuroscience principles, leaders can nurture an organizational culture that is focused on continuous learning, paving the way for embracing change and disruptive ideas, making neuroleadership not only a business integrator but also a key pillar for the future.

The neuroleadership framework can also be applied outside the business environment, for example in medicine. By leveraging knowledge of how the brain processes stress, reward, and decision-making, healthcare leaders may define better strategies that can enhance medical staff well-being, which is considered one of the most important challenges in medical institutions. For example, promoting autonomy in tasks and fostering equality, which are both elements of understanding how the brain reward system works, can activate reward pathways and decrease stress hormones, ultimately leading to a more engaged and resilient workforce and reducing burnout. In addition, neuroleadership can contribute to more informed decision-making within medical organizations. Neuroleaders know how to promote a psychologically safe environment, in which team members feel safe and comfortable sharing ideas without fear of judgment. By doing this, the exploration of diverse perspectives is encouraged, and this collaborative approach can lead to better decisions that positively impact patient care.

7. Conclusions and Prospects

In conclusion, the intersection of traditional leadership and neuroleadership comes as a helpful instrument for leaders navigating the complexities of the modern world. It is essential to mention that neuroleadership does not seek to abandon conventional leadership practices but rather offers a fresh lens through which leaders can comprehend and nurture human behavior. This emerging field enables leaders to explore more in-depth neuroscientific implications of decision-making, motivation, and collaboration, providing a comprehensive understanding of the cognitive processes that drive individual and team performance. Neuroleadership may play an important role when it comes to understanding the dynamics between the three fields of knowledge: rational knowledge, emotional knowledge, and spiritual knowledge. Each type of knowledge can be transformed into any other type of knowledge, hence contributing in a balanced way to the decision-making processes and building the motivation framework. Neuroleaders understand the brain dynamics and make much better use of its power in imagining new possible scenarios for the company and for the well-being of its employees.

Neuroleadership's contribution lies in its potential to empower leaders with actionable insights correlated with cognitive science. By incorporating neuroscientific principles into leadership strategies, leaders and managers can cultivate an organizational culture that

aligns better with how people function, allowing for more authentic connections within a team. This approach allows leaders to tailor their leading style, fostering environments that inspire creativity, resilience, and innovation. Neuroleadership may be perceived as a guide, helping leaders transform cognitive knowledge into a competitive advantage in the knowledge economy.

Author Contributions: Conceptualization, C.B.; methodology, R.-M.S.; project administration, R.-M.S.; resources, C.B.; supervision, C.B.; visualization, R.-M.S.; writing—original draft, R.-M.S.; writing—review and editing, C.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Acknowledgments: Chat GPT-3, built by the Open AI organization, was employed during the selection of the most relevant research papers to be examined during the literature review. The tool was used to identify helpful papers from the body of literature and summarize the main ideas.

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Gitelman, L.D.; Chebotareva, G.S.; Kozhevnikov, M.V. Strategic intelligence of an organization amid uncertainty. *Int. J. Energy Prod. Manag.* **2021**, *6*, 294–305. [CrossRef]
2. Chen, A.; Fabozzi, F.; Huang, D. Optimal corporate strategy under uncertainty. *Appl. Econ.* **2013**, *45*, 2877–2882. [CrossRef]
3. Bratianu, C. *Knowledge Strategies*, 1st ed.; Cambridge University Press: Cambridge, UK, 2022.
4. Van Vugt, M. Evolutionary origins of leadership and followership. *Pers. Soc. Psychol. Rev.* **2006**, *10*, 354–371. [CrossRef] [PubMed]
5. Mugisha, D. How Prepared Are Employers for Generation Z? Available online: https://www.pwc.com/ug/en/press-room/how-prepared-are-employers-for-generation-z-.html (accessed on 14 January 2024).
6. Alcañiz, M.; Parra, E.; Giglioli, I.A.C. Virtual reality as an emerging methodology for leadership assessment and training. *Front. Psychol.* **2013**, *9*, 1658. [CrossRef]
7. Massaro, S. Neurofeedback in the workplace: From neurorehabilitation hope to neuroleadership hype? *Int. J. Rehabil. Res.* **2015**, *38*, 276–278. [CrossRef]
8. Pittman, A. Leadership rebooted: Cultivating trust with the brain in mind. *Hum. Serv. Organ. Manag. Leadersh. Gov.* **2020**, *44*, 127–143. [CrossRef]
9. Van Vugt, M.; Ronay, R. The evolutionary psychology of leadership: Theory, review, and roadmap. *Org. Psychol. Rev.* **2013**, *4*, 74–95. [CrossRef]
10. Trethewey, A.; Goodall, H.L., Jr. Leadership reconsidered as historical subject: Sketches from the Cold War to Post-9/11. *Leadership* **2007**, *3*, 457–477. [CrossRef]
11. Al-Suwaihel, O.K. Female Leaders Perspectives. The Influence of Culture on Their Leadership. *Contemp. Issues Educ. Res.* **2010**, *3*, 29–40. [CrossRef]
12. Zak Paul, J. The neuroscience of trust. *Harv. Bus. Rev.* **2017**, *95*, 84–90.
13. Goleman, D.; Boyatzis, R.; McKee, A. The emotional reality of teams. *Emot. Real. Teams* **2002**, *21*, 55–65. [CrossRef]
14. Trinidad, C.; Normore, A.H. Leadership and gender: A dangerous liaison? *Leadersh. Org. Dev. J.* **2005**, *26*, 574–590. [CrossRef]
15. Malloy, E.; Kavussanu, M. A comparison of authentic and transformational leadership in sport. *J. Appl. Soc. Psychol.* **2021**, *51*, 636–646. [CrossRef]
16. Fiaz, M.; Su, Q.; Ikram, A.; Saqib, A. Leadership styles and employees 'motivation: Perspective from an emerging economy. *J. Dev. Areas* **2017**, *51*, 143–156. [CrossRef]
17. Dalkir, K. *Knowledge Management in Theory and Practice*, 1st ed.; Routledge: London, UK, 2013.
18. Hauptman, O.; Neuringer, J. The knowledge-creating company: How Japanese companies create the dynamics of innovation. *Technol. Forecast. Soc. Chang.* **1997**, *1*, 99–101. [CrossRef]
19. Dulewicz, V.; Higgs, M. Leadership at the top: The need for emotional intelligence in organizations. *Int. J. Organ. Anal.* **2003**, *11*, 193–210. [CrossRef]
20. Bolisani, E.; Bratianu, C. *Emergent Knowledge Strategies: Strategic Thinking in Knowledge Management*; Springer: Cham, Switzerland, 2018.
21. Bratianu, C. Knowledge dynamics: Exploring its meanings and interpretations. *Manag. Dyn. Knowl. Econ.* **2023**, *11*, 100–111. [CrossRef]
22. Aristotle. *Nicomachean Ethics*, 2nd ed.; Hackett Publishing Company: Indianapolis, IN, USA, 1999.
23. Russell, B. *A History of Western Philosophy*; Simon and Schuster: New York, NY, USA, 1972.
24. Descartes, R. *Key Philosophical Writings*; Wordsworth Editions Ltd.: Hertfordshire, UK, 1997.
25. Polanyi, M. *The Tacit Dimension*; Peter Smith: Gloucester, UK, 1983.

26. Nonaka, I.; Takeuchi, H. *The Knowledge Creating Company: How Japanese Companies Create the Dynamics of Innovation*, 1st ed.; Oxford University Press: Oxford, UK, 1995.
27. Lakoff, G.; Johnson, M. *Philosophy in the Flesh: The Embodied Mind and Its Challenge to the Western Thought*; Basic Books: New York, NY, USA, 1999.
28. Andriessen, D. Stuff or love? How metaphors direct our efforts to manage knowledge in organizations. *Knowl. Manag. Res. Pract.* **2008**, *6*, 5–12. [CrossRef]
29. Nissen, M.E. *Harnessing Knowledge Dynamics: Principled Organizational Knowing & Learning*; IRM Press: London, UK, 2006.
30. Bratianu, C. Changing paradigm for knowledge metaphors from dynamics to thermodynamics. *Syst. Res. Behav. Sci.* **2011**, *28*, 160–169. [CrossRef]
31. Bratianu, C.; Bejinaru, R. The theory of knowledge fields: A thermodynamics approach. *Systems* **2019**, *7*, 20. [CrossRef]
32. Damasio, A. *Self Comes to Mind: Constructing the Conscious Brain*, 1st ed.; Pantheon: London, UK, 2010.
33. Kahnemann, D. *Thinking, Fast and Slow*, 1st ed.; Farrar, Straus and Giroux: New York, NY, USA, 2011.
34. LeDoux, J. *The Emotional Brain: The Mysterious Underpinnings of Emotional Life*, 1st ed.; Simon & Schuster: London, UK, 1998.
35. Hill, D. *Emotionomics: Leveraging Emotions for Business Success*, Revised ed.; Kogan Page: London, UK, 2008.
36. Bratianu, C.; Vătămănescu, E.M.; Anagnoste, S.; Dominici, G. Untangling knowledge fields and knowledge dynamics within the decision-making process. *Manag. Decis.* **2020**, *59*, 306–323. [CrossRef]
37. Giacalone, R.A.; Jurkiewicz, C.L. (Eds.) *Handbook of Working Spirituality and Organizational Performance*, 2nd ed.; M.E. Sharpe: New York, NY, USA, 2010.
38. Zohar, D.; Marshall, I. *Spiritual Capital: Wealth We Can Live by*; Berrett-Koehler: San Francisco, CA, USA, 2004.
39. Grinde, B. The Evolution of Human Social Behavior. *Encyclopedia* **2024**, *4*, 430–443. [CrossRef]
40. Nonaka, I.; Takeuchi, H. *The Wise Company: How Companies Create Continuous Innovation*; Oxford University Press: Oxford, UK, 2019.
41. Pech, R. Developing a leadership knowledge architecture: A cognitive approach. *Leadersh. Org. Dev. J.* **2003**, *24*, 32–42. [CrossRef]
42. Rock, D. The Neuroscience of Leadership. Ph.D. Thesis, Middlesex University, London, UK, 2010.
43. Graen, G.; Canedo, J.C.; Grace, M. Team coaching can enhance psychological safety and drive organizational effectiveness. *Org. Dyn.* **2019**, *49*, 100697. [CrossRef]
44. Ringleb, A.H.; Rock, D. The emerging field of NeuroLeadership. *NeuroLeadership J.* **2008**, *1*, 3–19.
45. Damiano, S. *Leadership Is Upside Down: The i4 Neuroleader Compendium*, 1st ed.; About my Brain Institute: New Haven, CT, USA, 2021.
46. Damiano, S. From Manager to Neurocoach: Shaping the Future of Effective Leadership. Available online: https://www.linkedin.com/pulse/from-manager-neurocoach-shaping-future-effective-leadership/ (accessed on 20 January 2024).
47. Sonderegger, L.B. Neuroscience for innovation leaders: Applying brain science to drive innovation. In *Innovation Leadership in Practice: How Leaders Turn Ideas into Value in a Changing World*; Emerald Publishing Limited: Bradford, UK, 2023; pp. 27–43.
48. Rizzolatti, G.; Laila, C. The mirror-neuron system. *Annu. Rev. Neurosci.* **2004**, *27*, 169–192. [CrossRef] [PubMed]
49. Iacoboni, M.; McHaney, R.W. Applying empathy and mirror neuron concepts to NeuroLeadership. *NeuroLeadership* **2009**, *2*, 35–41.
50. Van den Bos, K.; Allan Lind, E. Uncertainty management by means of fairness judgments. *Adv. Exp. Soc. Psychol.* **2002**, *34*, 1–60.
51. Lindquist, K.A.; Wager, T.D.; Kober, H.; Bliss-Moreau, E.; Barrett, L.F. The brain basis of emotion: A meta-analytic review. *Behav. Brain Sci.* **2012**, *35*, 121–143. [CrossRef]
52. Christoff, K.; Irving, Z.C.; Fox, K.C.R.; Spreng, R.N.; Andrews-Hanna, J.R. Mind-wandering as spontaneous thought: A dynamic framework. *Nat. Rev. Neurosci.* **2016**, *17*, 718–731. [CrossRef]
53. Hallo, L.; Nguyen, T.; Gorod, A.; Tran, P. Effectiveness of leadership decision-making in complex systems. *Systems* **2020**, *8*, 5. [CrossRef]
54. Zwaan, L.A.; Aiken, D.; Viljoen, R. The role of neuroleadership in work engagement. *SA J. Hum. Resour. Manag.* **2019**, *17*, 1–9. [CrossRef]
55. Lucendo-Monedero, Á.L.; Ruiz-Rodríguez, F.; González-Relaño, R. The information society and socio-economic sustainability in European regions. Spatio-temporal changes between 2011 and 2020. *Technol. Soc.* **2023**, *75*, 102337. [CrossRef]
56. Sutherland, H.; Figari, F. EUROMOD: The European Union tax-benefit microsimulation model. *Int. J. Microstimulation* **2013**, *6*, 4–26. [CrossRef]
57. Baron, R.A. Psychological perspectives on entrepreneurship: Cognitive and social factors in entrepreneurs' success. *Curr. Dir. Psychol. Sci.* **2000**, *9*, 15–18. [CrossRef]
58. Goleman, D.; Boyatzis, R.E.; McKee, A. *Primal Leadership: Unleashing the Power of Emotional Intelligence*, 1st ed.; Harvard Business Press: Cambridge, MA, USA, 2013.
59. AliParincu, M.T.; Capatina, A.; Varon, D.J.; Bennet, P.F.; Recuerda, A.M. Neuromanagement: The scientific approach to contemporary management. *Proc. Int. Conf. Bus. Excell.* **2020**, *14*, 1046–1056.
60. Kuncoro, F.W.; Ismail, I. The Role of Neuromanagement and Motivation in Improving Organizational Performance. *Indones. J. Contemp. Multidiscip. Res.* **2023**, *2*, 909–924. [CrossRef]
61. Grunwald, L.A. *Neuroleadership in Change Management*, 1st ed.; Springer: Berlin/Heidelberg, Germany, 2021.
62. Pessoa, L. On the relationship between emotion and cognition. *Nat. Rev. Neurosci.* **2008**, *9*, 148–158. [CrossRef] [PubMed]

63. Berthet, V.; Autissier, D.; De Gardelle, V. *Measuring Individual Differences in Cognitive Biases: The Cognitive Bias Inventory*; Université de Lorraine: Nancy, France, 2021.
64. Bush, G.; Luu, P.; Posner, M.I. Cognitive and emotional influences in anterior cingulate cortex. *Trends Cogn. Sci.* **2000**, *4*, 215–222. [CrossRef]
65. Eichenbaum, H. The role of the hippocampus in navigation is memory. *J. Neuropsychol.* **2017**, *117*, 1785–1796. [CrossRef]
66. Grandey, A.A. Emotional regulation in the workplace: A new way to conceptualize emotional labor. *J. Occup. Health Psychol.* **2000**, *5*, 95. [CrossRef]
67. Scheibe, S.; Zacher, H. A lifespan perspective on emotion regulation, stress, and well-being in the workplace. In *The Role of Emotion and Emotion Regulation in Job Stress and Well Being*; Emerald Group Publishing Limited: Bingley, UK, 2013; pp. 163–193.
68. Passmore, J.; Peterson, D.; Freire, T. The psychology of coaching and mentoring. In *The Wiley-Blackwell Handbook of the Psychology of Coaching and Mentoring*; John Wiley & Sons, Ltd.: Hoboken, NJ, USA, 2013; pp. 1–11.
69. Köstereliоğlu, M.A. Self-leadership perception and emotional intelligence as the predictors of cognitive flexibility. *Probl. Edu. 21st Century* **2021**, *79*, 700–715. [CrossRef]
70. Gkintoni, E.; Halkiopoulos, C.; Antonopoulou, H. Neuroleadership an asset in educational settings: An overview. *Emerg. Sci. J.* **2022**, *6*, 893–904. [CrossRef]
71. Hurtado, P.S.; Mukherji, A. Developing a construct of the leader's cognitive flexibility—An interdisciplinary approach. *J. Comp. Stud.* **2015**, *23*, 3–13.
72. Glaser, J. *Conversational Intelligence: How Great Leaders Build Trust and Get Extraordinary Results*, 1st ed.; Routledge: New York, NY, USA, 2016.
73. Dweck, C. *Mindset: The New Psychology of Success*, 1st ed.; Ballantine Books: New York, NY, USA, 2007.
74. Sivalingam, S.; Thomas, P.; Karthikeyan, C. A conceptual study on application of neuro plasticity for leadership development: A leadership perspective. *Int. J. Manag. IT Eng.* **2017**, *7*, 103–133.
75. Rock, D.; Cox, C. SCARF in 2012: Updating the social neuroscience of collaborating with others. *NeuroLeadership J.* **2012**, *4*, 15–25.
76. Kurup, P.M.; Li, X.; Dong, Y.; Bhardwaj, M.; Yang, Y. Co-Creating Interdisciplinary Integrated Powerful Knowledge. *Encyclopedia* **2023**, *3*, 964–971. [CrossRef]
77. Choongo, P.; Chileshe, M.; Lesa, C.N.; Mwiya, B.; Taylor, T.K. Leadership Style and Firm Growth. Encyclopedia. Available online: https://encyclopedia.pub/entry/53097 (accessed on 8 April 2024).
78. Kelly, S. Towards a negative ontology of leadership. *Hum. Relat.* **2014**, *67*, 905–922. [CrossRef]
79. Kuhlmann, N.; Chelsie, A.K. Neuroleadership: Themes and limitations of an emerging interdisciplinary field. *Healthc. Manag. Forum* **2018**, *31*, 103–107. [CrossRef]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.