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The Entrepreneurial Side of the Mind: A Bibliometric Analysis of Neuroentrepreneurship Literature

Zihnin Girişimci Yönü: Nörogirişimcilik Literatürünün Bibliyometrik Analizi

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Abstract

Aim: This study seeks to clarify the concept of neuroentrepreneurship, positioned at the intersection of entrepreneurship and neuroscience, and to examine this field through a bibliometric analysis. Neuroentrepreneurship, first introduced into the literature in 2006, seeks to investigate entrepreneurial behavior and decision-making processes from a neuroscientific perspective.

Method: The study conducted a search using the keyword "neuroentrepreneur**" in the Web of Science (WoS) and SCOPUS databases. The resulting publications were systematically analyzed according to their distribution by year, journal, country of origin, citation frequency, and key concepts. Furthermore, scientific mapping was conducted using VOSviewer software, and content analysis was employed to identify the methodologies and prominent themes of the publications.

Results: As a result of the keyword searches, 15 publications were identified in the WoS database and 25 in the Scopus database. This suggests that the analysis focused on a limited number of publications, but the number of publications has increased over the years. Furthermore, it was determined that certain countries and journals are leading the field, and their citation rates reflect this. Most strikingly, the United States holds the highest publication count in both indexes. Furthermore, the content analysis indicates that neuroentrepreneurship studies primarily focus on concepts related to “entrepreneurial behavior”, “decision-making processes”, and “neuroscientific measurement methods”.

Conclusion: The study revealed that neuroentrepreneurship remains an infant field of scholarly inquiry. It has been concluded that this field, due to its structure suitable for interdisciplinary approaches, offers significant opportunities for new research that will deepen the interaction between entrepreneurship and neuroscience.

Keywords

Entrepreneurship, Neuroscience, Neuroentrepreneurship, Neuroimaging techniques, Bibliometric analysis

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Öz

Amaç: Bu çalışma, girişimcilik ve nörobilimin kesişim noktası olan nörogirişimcilik kavramını açıklamayı ve bu alanı bibliyometrik analiz yöntemiyle incelemeyi amaçlamaktadır. Nörogirişimcilik, 2006 yılından itibaren literatürde yer almakta olup, girişimcilik davranışını ve karar alma süreçlerini nörobilim perspektifinden analiz etmeyi amaçlamaktadır.

Yöntem: Çalışmada Web of Science (WoS) ve SCOPUS veri tabanlarında "neuroentrepreneur**" terimi anahtar kelime olarak kullanılarak arama yapılmıştır. Elde edilen yayınların yıllara göre dağılımı, yayımlandıkları dergiler, ülkelerin konumu, atıf oranları ve anahtar kavramlar analiz edilmiştir. Ayrıca VOSviewer yazılımı aracılığıyla bilimsel haritalama yapılmış, içerik analizi yöntemiyle de yayınların kullandıkları metodolojiler ve öne çıkan temalar belirlenmiştir.

Bulgular: Anahtar kelimeyle yapılan taramalar sonucunda, WoS veri tabanında 15, SCOPUS veri tabanında ise 25 yayın bulundu. Bu durum analizin sınırlı sayıda yayınla olduğunu, ancak yıllar içinde yayın sayısının arttığını göstermektedir. Ayrıca, belirli ülke ve dergilerin alanda öncü olduğu ve atıf oranlarının alana olan ilgiyi yansıttığı belirlenmiştir. En dikkat çekici sonuç ise Amerika'nın her iki dizinde de en çok yayına sahip ülke konumunda olmasıdır. Ek olarak içerik analizinin sonuçları da nörogirişimcilik çalışmalarının "girişimci davranış", "karar alma süreçleri" ve "nörobilimsel ölçüm yöntemleri"yle ilgili kavramlarını odağa aldığını göstermektedir.

Sonuç: Çalışmanın sonucunda, nörogirişimcilik alanının henüz emekleme aşamasında olan bir araştırma sahası olduğu ortaya konulmuştur. Disiplinlerarası yaklaşımlara elverişli yapısı nedeniyle bu alanın, girişimcilik ve nörobilim etkileşimini derinleştirecek yeni araştırmalar için dikkate değer fırsatlar sunduğu sonucuna ulaşılmıştır.

Anahtar Kelimeler

Girişimcilik, Nörobilim, Nörogirişimcilik, Nörogörüntüleme teknikleri, Bibliyometrik analiz

Introduction

Global economic development trends are undergoing rapid changes. Therefore, businesses and startups entering the business world are gaining prominence. Entrepreneurship is a dynamic field that plays a key role in the modern economy and innovation processes. In recent years, new and innovative approaches have emerged in this field. One of these approaches, neuroentrepreneurship, is an interdisciplinary field of study that examines entrepreneurial behavior and decision-making processes from a neuroscience perspective. Neuroentrepreneurship, first introduced to the literature in 2006 (Ballı & Aycı, 2021), is situated at the intersection of business and neuroscience, adding a new dimension to our understanding of entrepreneurship. Nevertheless, research in the field of neuroentrepreneurship remains limited, underscoring the need for a comprehensive investigation of the field's potential. Neuroscience studies, therefore, encompass areas such as the functioning of the nervous system and cognitive processes, while contributing to the field of entrepreneurship by providing a deeper understanding of entrepreneurial behavior and decision-making processes.

This study applies bibliometric and content analysis methods to better understand the evolution of the concept of neuroentrepreneurship and its position within the existing literature. Through bibliometric analysis, scientific studies on neuroentrepreneurship are examined, and their evolution over time, key themes, and collaborations between authors are presented using visual mapping techniques. Content analysis is also used to elaborate on the conceptual and methodological background of neuroentrepreneurship studies. This approach aims to provide a comprehensive perspective on the current state of knowledge and future research directions in the field of neuroentrepreneurship.

In the conclusion section of the study, comments on the findings, discussions on the shortcomings in the field, and various suggestions to improve the studies, both theoretically and practically, for the development of the field of neuroentrepreneurship are included.

Literature Review

Neuroscience

Neuroscience is the branch of science that studies the nervous system, a highly complex biological structure. The field of neuroscience, encompassing the disciplines of neurons, neuronal circuits, anatomy, biochemistry, molecular biology, physiology, pharmacology, and psychology, has developed significantly in recent years (Vogt, 2015). Neuroscience, an interdisciplinary field, seeks to understand brain activity during a specific task, consciousness, perception, memory, and learning, and the relationship of these processes to human behavior and physiology. The nervous system, the focus of this discipline, encompasses the central nervous system—comprising the brain and spinal

cord—and the peripheral nervous system, made up of nerves located outside the brain and spinal cord. While the nervous system encompasses both central and peripheral components, human neuroscience has focused particularly on cognitive processes in the brain (Sousa et al., 2017: 227). In this context, understanding how processes such as perception, attention, and memory function is one of the key areas of research that neuroscientists conduct using various neuroimaging methods.

Neuroscience employs various methods to investigate cognitive processes within the brain, including perception, attention, and memory. The most common of these is neuroimaging. Neuroimaging methods and the tools used in this context are evaluated neurocognitively, taking into account their hormonal and chemical effects on the body (Posner & DiGirolamo, 2000; Beltz & Moser, 2020). In this regard, neuroimaging techniques that measure the state of the cognitive process behind entrepreneurial mindset, thought (idea), decision-making behaviors in the brain and observe the brain activity between decision-making, emotion, and different neurological features (Lawrence et al., 2008; Custodio, 2010) include (a) electroencephalography (EEG), (b) magnetoencephalography (MEG), (c) functional magnetic resonance imaging (fMRI), (d) positron emission tomography (PET), and (e) functional near-infrared spectroscopy (fNIRS).

- EEG is a non-invasive method that measures the electrical activity of a large number of neurons in the brain via electrodes placed on the scalp (Light et al., 2010). During an EEG, event-related potentials (ERPs) are elicited by stimuli such as pictures or words presented to the participant (Beres, 2017: 248-250). ERPs have waveforms that correspond to different cognitive processes. For example, one of the most common is the P300 waveform, which occurs approximately 300 milliseconds after the stimulus is presented (Dietrich & Kanso, 2010: 824) and is associated with various cognitive performance indicators, such as attention to a specific stimulus (Sur & Sinha, 2009), categorization of presented visual stimuli, and working memory (Woodman, 2010).
- MEG: Unlike EEG, which is recorded from electrodes placed on the skull, the MEG device allows the measurement of neuronal activity during cognitive processes without contact with the participant's skull, thanks to a helmet containing sensors (Ahlfors & Mody, 2016; Singh, 2014). MEG can reveal the interconnectedness of different brain regions related to cognitive functions (Mandal et al., 2018).
- fMRI is a method that measures blood oxygen levels while various stimuli are presented to participants to measure cognitive functions, revealing the brain regions that are activated (Glover, 2011). This method, called blood oxygenation level-dependent (BOLD) fMRI, measures the changes that occur when blood flow is directed to areas in need of oxygen, as neurons active during a particular cognitive function require more oxygen (Nir et al., 2008).
- PET is an imaging method that measures changes in blood flow and metabolism during a certain cognitive activity, thanks to a radioactive substance injected into the participant's blood (Kable, 2011).
- fNIRS measures activation in the cerebral regions of the brain by directing a beam of light to the skull through patches placed on the participants' heads (Cui et al., 2015).

Entrepreneurship

Entrepreneurship is positioned as a fundamental tool for national development (Acs & Audretsch, 2003: 4). This perspective has become increasingly prominent in modern times. There are various reasons for the rise of entrepreneurship. While the development of scientific research has brought entrepreneurship to the forefront, it can also be argued that increasing economic inequalities among nations have led to the development of entrepreneurial activities (Aldrich, 2005). For centuries, entrepreneurial activities in societies with distinct economic and social characteristics, as well as the fluctuations in these activities, have been examined. Assessing the contribution of enterprises to economic development requires consideration of both societal dynamics and culture. Hofstede explores the relationship between societal dynamics and businesses within the framework of cultural dimensions. Numerous studies have investigated the relationship between cultural dimensions and entrepreneurial trends in a country from different perspectives (Contiu et al., 2012). Furthermore, small businesses or enterprises, which form the dynamics of society, adapt more easily to changing circumstances. Many different types of entrepreneurship adapt and support the face of crises and environmental problems (Doh et al., 2019). Furthermore, many innovative practices emerge from firms.

Entrepreneurship, which holds a significant place in life, has been defined by various fields of study. In this context, definitions from some prominent scholars stand out. According to French economist Jean-Baptiste Say, entrepreneurship is the acceptance of risk factors and the organization and management of the factors of production (natural resources,

labor, capital, and entrepreneurship). Therefore, risk is a crucial element to be accepted in entrepreneurship. The importance of risk was highlighted in 1755 by Cantillon in his book "Essai sur la nature du commerce en général" -An Essay on the Nature of General Commerce- (Hisrich & Peters, 1995). Another definition defines entrepreneurship as a way of thinking and a planned behavior that emphasizes the importance of opportunities (Güney, 2008).

There is no clear, agreed-upon definition of entrepreneurship. However, it can be said that there are more widely accepted and cited definitions within the framework of different scientific disciplines. One definition of entrepreneurship in this context belongs to Shane and Venkataraman (2000). According to this study, entrepreneurship is defined as "how, by whom, and with what effects opportunities to create future goods and services are discovered, evaluated, and exploited" (Ratten, 2023).

The question of who is an entrepreneur brings to the forefront the concept of the entrepreneur, a crucial element of entrepreneurship. This is because an entrepreneur is someone who brings together other factors of production and possesses the ability to manage and organize them. Furthermore, an entrepreneur is someone who, in line with their abilities, recognizes opportunities and assumes risks accordingly. In this context, an entrepreneur is an individual whose personal characteristics are influenced by economic, social, and psychological factors throughout life and who stands out. In this context, the role of the entrepreneur comes to the fore, and their theoretical contribution to entrepreneurship is examined within the scope of entrepreneurship typologies and entrepreneurship theories (Özkul & Dulupçu, 2007).

Different disciplines ask different questions when defining entrepreneurship and the entrepreneur. While economics examines the impact of entrepreneurship and the role of the entrepreneur in economic reality, psychology focuses on the personal characteristics and behaviors of people—those who choose to pursue entrepreneurship. Furthermore, the perspectives of disciplines such as sociology and anthropology on entrepreneurship form the framework for entrepreneurship theories in the literature. Cantillon's entrepreneurship theory focuses on the entrepreneur. This theory, and the framework of many other theories, has been shaped by the perspectives of different scholars over time. At the same time, new fields and syntheses have emerged and continue to evolve with the development of the scientific world (Rocha, 2012). This situation has led scholars to argue that the axis of entrepreneurship has shifted. For example, Oğuz (2005) presented the changing face of entrepreneurship and expressed Baumol's view that entrepreneurship has moved away from the field of economics. This shift, coupled with changes in markets, the development of the scientific world, and the increased prominence of multidisciplinary studies, has paved the way for the emergence of new types of entrepreneurship. In this context, the integration of the discipline of neuroscience, which has recently gained greater prominence, into the fields of management and economics has enabled the emergence of many new concepts. The concept of "neuroentrepreneurship" has emerged in this context and shaped the study.

Neuroentrepreneurship

With the development of neuroscience, economics and business disciplines have begun to integrate with the field. In this context, concepts such as neuromarketing, neuromanagement, and neuroentrepreneurship have emerged (Ballı & Aycı, 2021). Neuroentrepreneurship, a new form of entrepreneurship emerging, has limited research in the literature. Furthermore, despite its ongoing development, knowledge about it is also limited. An examination of the concept's background reveals that it was first discussed in 2006, but interest in the topic has increased since 2012. Therefore, neuroentrepreneurship is a new and evolving concept. Furthermore, the novel nature of the concept is further illustrated by the fact that many studies in the existing literature do not include neuroentrepreneurship among the types of entrepreneurship. For example, Ratten's (2023) study includes new entrepreneurship concepts such as COVID-19 entrepreneurship, but does not include neuroentrepreneurship.

Neuroentrepreneurship, a new concept, focuses on the decision-making processes and behaviors of entrepreneurs. For example, the relationship between entrepreneurial behavior and the hormone dopamine is one of the key topics addressed in this context (Ballı & Aycı, 2021: 190). Neuroentrepreneurship is a new, multidisciplinary form of entrepreneurship that believes that understanding entrepreneurial intentions within the context of behavior and mental processes can be achieved through a better understanding of the human brain. However, the literature still lacks a definitive consensus on the definition of neuroentrepreneurship. To address this gap, Juárez-Varón et al. (2024) examined the themes and definitions of neuroentrepreneurship studies and defined it as "a branch of research that analyzes the neurological processes involved in entrepreneurial decision-making processes using neuroscience methods to better understand entrepreneurial behavior" (Juárez-Varón et al., 2024).

Krueger and Day (2010) noted that neuroscience methods can be used to understand entrepreneurship. Understanding entrepreneurship by delving into the nature of the entrepreneur and identifying what motivates an individual to engage in entrepreneurial behavior will also enable us to understand and train future entrepreneurs. This notion also shapes academics' perspectives on the field. Some scholars suggest expanding neuroscience methods to investigate the "entrepreneurial mindset" (Moore et al., 2019). Although neuroscience techniques have recently been studied in the context of entrepreneurship, the desired results have not yet been achieved. A general overview of these studies reveals that the entrepreneurial mindset involves acting and behaving under uncertainty, and neuroentrepreneurship, by deciphering the entrepreneurial mindset, contributes to the development of both entrepreneurship and social life (Haynie et al., 2010). In short, neuroentrepreneurship is an approach that observes the underlying mechanisms of the mind that determine and influence entrepreneurial behavior.

This new concept can be evaluated more closely by exploring the developmental trajectory and motivation behind the neuroentrepreneurship approach. However, it should be noted that while research has been conducted for many years on entrepreneurs' entrepreneurial orientations based on their environment, economic climate, and risk levels, this has been met with limited evaluation. In this context, what different factors might underlie the emergence of entrepreneurship? Sanyang and Huang (2010) state that individuals with entrepreneurial traits implement their ideas under all circumstances. What drives this motivation? The motivation to exhibit entrepreneurial behavior despite external factors can be considered an intrinsic source of motivation. Studies in the literature indicate that individuals with different personality traits and backgrounds ultimately tend toward entrepreneurship (Hatten, 2012). Accordingly, it has been argued that individuals exhibiting entrepreneurial behavior cannot be analyzed solely through personality tests, as this approach yields conflicting results. Instead, a focus on other individual characteristics has begun to emerge. Cognitive science has attempted to explain these other characteristics. In this context, it has been argued that the mental processes involved in the entrepreneur's acquisition, processing, and use of information are important in determining entrepreneurial behavior (Sánchez et al., 2011). Accordingly, entrepreneurs exhibit distinct cognitive characteristics, such as an innovative approach, intuitive decision-making skills, domain-specific expertise, self-confidence in recognizing opportunities, a predisposition to take risks, and the ability to retrospectively analyze the outcomes of a venture. In this context, according to the cognitive paradigm, self-efficacy beliefs, particularly regarding overcoming unplanned obstacles, are the most important factor distinguishing entrepreneurs from non-entrepreneurs.

Neuroentrepreneurship, also known as brain-based entrepreneurship (Perez-Centeno, 2017), explores the brain functions and hormones that influence an entrepreneur's decision-making. For example, a study examining the brain differences between entrepreneurs and managers was conducted (Lawrence et al., 2008). The study reveals which brain lobes entrepreneurs and managers use when making risky decisions, as well as their cognitive state during this process. Similarly, another experimental study (Nicolaou et al., 2018) concluded that hormones such as testosterone and cortisol increase people's tendency to become entrepreneurs. Additionally, observations and analyses of the brains of aspiring entrepreneurs, such as the study conducted by Zaro et al. (2016) using EEG electrodes, have shown differences in cognitive activity and neural structures. Based on the results of these studies, it can be argued that examining entrepreneurial intentions and entrepreneurs' perception of opportunity using neuroscience methods and subfields will contribute to the development of entrepreneurs.

On the other hand, within the context of neuroentrepreneurship, one of the issues addressed by the cognitive neuroscience approach is how processes such as memory, attention, and perception influence entrepreneurship. In this context, the field of entrepreneurial cognition, which has developed its focus, is one of the most common terms used in the field of neuroentrepreneurship. To guide neuroscience and entrepreneurship studies, Massaro et al. (2023) discuss various cognitive functions that can be targeted in entrepreneurship research and the brain regions in the prefrontal and medial temporal lobes that should be examined when studying them. Accordingly, in the field of cognitive neuroscience, neuronal activity during entrepreneurial cognition is understood by examining cognitive differences such as error-oriented cognitions, opportunity evaluation, attention, emotions, personality trait differences, the ability to multitask with working memory, counterfactual thinking style, decision-making processes, and psychological resilience in entrepreneurial and non-entrepreneurial individuals using various neuroimaging methods.

Entrepreneurs' decision-making and behavior can be assessed by considering various sub-branches of neuroscience. Besides cognitive neuroscience, other sub-branches of neuroscience that have been included in the scope of research on entrepreneurship include affective neuroscience, behavioral neuroscience, cultural neuroscience, computational neuroscience, neuroinformatics, systems neuroscience, and social neuroscience. Conducting a multidisciplinary study

across a broad network allows for in-depth analysis of entrepreneurs' decision-making, attitudes, and behaviors throughout the process (Toga & Thompson, 2005; Nicolaou & Shane, 2014).

Neuroentrepreneurship is an approach that focuses directly on the entrepreneur in the development of the field of entrepreneurship. It attempts to conduct research using diverse analyses, drawing on areas where neuroscience is developing. As it draws on different disciplines, this approach should explore existing knowledge in the literature and identify gaps through analysis. In this context, by examining studies addressing neuroentrepreneurship in the literature, the focus can be clearly identified. However, there are criticisms that neuroentrepreneurship studies remain within a theoretical framework (Aydın, 2021) and that the research conducted in the field is limited. This suggests that the concept still represents a significant gap in the literature. To define the concept of neuroentrepreneurship and understand its contributions, gaps in the field can be identified by reviewing the literature. This perspective can reveal the focus and theoretical background of neuroentrepreneurship, as well as the direction of future research.

Research Methodology

In this study, the bibliometric analysis technique, which is discussed as a qualitative or quantitative research method based on secondary data, was used (Passas, 2024). Developed by Pritchard (1969), the bibliometric analysis method applies mathematical and statistical methods to publications. Bibliometric analysis contributes to the literature by using a range of quantitative methods to measure, monitor, and analyze academic literature, offering benefits such as examining current changes and developments in science and evaluating results with an academic foundation (Martinez et al., 2015; Roemer & Borchardt, 2015).

To provide a macroscopic perspective on the concept of neuroentrepreneurship through bibliometric analysis, widely used databases were considered. Databases such as WoS, Scopus, Google Scholar, PubMed, and MEDLINE are the most preferred. (Chen, 2017; Cobo et al., 2015). Thomson Reuters' citation indexes, Web of Science, and Elsevier's Scopus, provide detailed information about the research they host. Furthermore, these databases (Mingers & Leydesdorff, 2015; Moed, 2009), which are preferred for their coverage of studies from multiple disciplines and their indexing of internationally peer-reviewed journals, were chosen for this study. The data for this study were searched in the WoS and SCOPUS databases on August 3, 2025, including all key concepts that could define the concept of neuroentrepreneurship. No additional search restrictions were imposed on data obtained using the keywords ("neuroentrepreneur*"), ("neuro entrepreneur*"), or ("neuro-entrepreneur*").

In order to limit the data obtained based on bibliometric analysis and to obtain important findings regarding the concept, certain research questions were designed in this study.

RQ1. What is the distribution of publications related to the concept of neuroentrepreneurship over the years?

RQ2. Which journals publish in the field of neuroentrepreneurship?

RQ3. Which countries are most prominent in neuroentrepreneurship-related publications?

RQ4. Which authors have published the most on neuroentrepreneurship?

RQ5. In which areas are neuroentrepreneurship studies most frequently conducted?

RQ6. What is the distribution of citations to neuroentrepreneurship studies across years?

RQ7. What are the most cited articles on neuroentrepreneurship?

RQ8. What are the key concepts associated with neuroentrepreneurship?

While seeking answers to the research questions, each question was comparatively examined for differences across databases. The studies collected from databases for bibliometric analysis were also subjected to content analysis, particularly to examine their qualitative aspects. The content analysis technique, which is among the qualitative research methods, enables the classification of information in materials through coding, categorization, etc., and the creation of measurable information (Fiske, 1996; Gökçe, 2006). In this study, the studies were grouped under themes using a deductive method based on research methods and analysis tools. Data obtained through purposive sampling were categorized into four categories to provide a systematic structure based on the category-building process of content analysis. The research questions developed in line with these categories are as follows:

RQ9. Which of the articles included in the study used qualitative and which used quantitative research methods?

RQ10. What are the key concepts most frequently discussed in the neuroentrepreneurship studies included in the study?

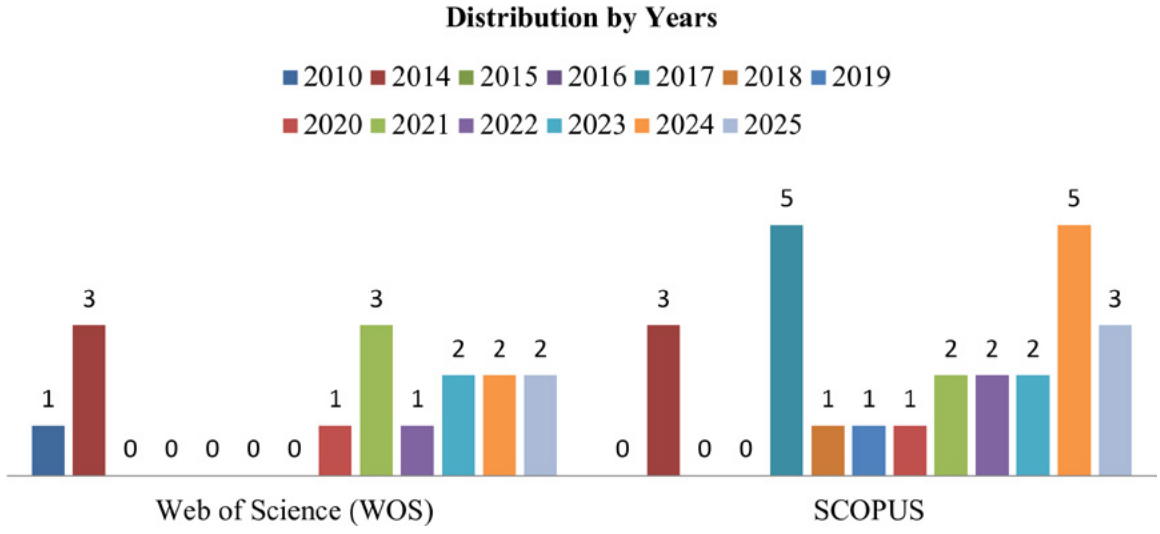
In the content analysis section, the similarities and differences in terms of content of the studies are presented according to the categories above.

A scientific mapping approach was adopted to map analyses based on research questions. Scientific mapping examines the conceptual aspects of research (Martinez et al., 2015) and reveals how disciplines, areas of expertise, individual articles, and authors are related to each other (Small, 1999). The software program VOSviewer (version 1.6.17) was used to visualize and map the obtained data. VOSviewer is a program for creating, visualizing, and exploring maps based on all types of network data (Van Eck & Waltman, 2021). Unlike other mapping programs (Bibexcel, CiteSpace, CopalRed, IN-SPIRE, CRExplorer, Network Workbench Tool, Science of Science Tool, VantagePoint, SciMAt, etc.), VOSviewer was chosen in this study to create word clouds representing the main themes of bibliographic clusters.

Findings

As part of the research, studies on neuroentrepreneurship were searched in the WOS Core Collection and Scopus databases, and the necessary filters were performed to determine the scope of the study. This resulted in 15 studies within the WOS and 25 within the SCOPUS. All data obtained in response to the research questions were analyzed in detail by author, year, subject, and other metrics.

Fifteen studies retrieved from the Web of Science database were examined, and it was observed that these studies were published in the WOS index between 2010 and 2025, and in the SCOPUS index between 2014 and 2025. Graph 1 shows the distribution of analyzed publications by year. According to SCOPUS, the most studies (5) were published in 2017 and 2024.



Graph 1: Distribution of neuroentrepreneurship studies by year

Table 1 shows the sources and the number of publications related to neuroentrepreneurship published by the database. It can be seen that both databases contain studies scanned from the same sources. Within the WoS, the journals "Entrepreneurship and Regional Development," "International Entrepreneurship and Management Journal," and "Journal of Management Inquiry" stand out with two studies. Within the SCOPUS, the Handbook of Research Methodologies and Design in Neuroentrepreneurship stands out with five studies. In this context, it can be said that the book/book section also emerges as a significant resource.

Table 1: Distribution of neuroentrepreneurship studies by publication

Web of Science (WoS)		**SCOPUS**	
Publication Title	**Number of Studies**	**Publication Title**	**Number of Studies**
"Entrepreneurship and Regional Development"	2	"Handbook of Research Methodologies and Design in Neuroentrepreneurship"	5
"International Entrepreneurship and Management Journal"	2	"Journal Of Management Inquiry"	2
"Journal of Management Inquiry"	2	"International Entrepreneurship and Management Journal"	2

Table 1. Continued

Web of Science (WoS)		SCOPUS	
Publication Title	**Number of Studies**	**Publication Title**	**Number of Studies**
"Annals in Entrepreneurship Education"	1	"Entrepreneurship and Regional Development"	2
"Annals of Entrepreneurship Education and Pedagogy 2014"	1	"Contemporary Issues in Entrepreneurship Research"	2
"Frontiers in Psychology"	1	"Procedia Computer Science"	1
"Entrepreneurship Theory and Practice"	1	"Journal of Innovation and Knowledge"	1
"Frontiers in Neuroscience"	1	"Journal Of Entrepreneurship In Emerging Economies"	1
"Handbook of Entrepreneurship Research"	1	"Journal of Business Venturing Insights"	1
"International Handbook Series on Entrepreneurshıp"	1	"Frontiers in Psychology"	1
"Journal of Entrepreneurshıp in Emerging Economies"	1	"Frontiers in Neuroscience"	1
"Journal of Mehmet Akif Ersoy University Economics and Administrative Sciences Faculty"	1	"Foundational Research in Entrepreneurship Studies Insightful Contributions and Future Pathways"	1
"Entrepreneurship Theory and Practice"	1	"Entrepreneurship Theory and Practice"	1
"Turismo Estudos E Praticas"	1	"Annals of Entrepreneurship Educational and Pedagogy 2014"	1
		"AJOB Neuroscience"	1
		"A World Scientific Encyclopedia of Business Storytelling"	1
		"Annals of Entrepreneurship Education and Pedagogy 2025"	1

When the countries where the studies originated are listed, the countries with the most publications in the WoS database are the United States (7) and Spain (3). Among the studies published in the SCOPUS database, the countries with the most publications are the United States (11) and India (4). Furthermore, when comparing both databases, the USA, Spain, and England are the priority countries in terms of the number of publications. Table 2 provides a more detailed breakdown of the countries and publication numbers of the studies.

Table 2: Distribution of neuroentrepreneurship studies by country

Web of Science (WoS)		SCOPUS	
Country	**Number of Studies**	**Country**	**Number of Studies**
United States	7	United States	11
Spain	3	India	4
China	2	United Kingdom	3
England	2	Spain	3
India	2	Germany	2
Australia	1	France	2
Belgium	1	Canada	2
Canada	1	Australia	2
Cyprus	1	Belgium	1
France	1	Saudi Arabia	1
Germany	1	China	1
Iran	1	Cyprus	1
Turkiye	1	Netherlands	1

Table 2. Continued

Web of Science (WoS)		SCOPUS	
Country	**Number of Studies**	**Country**	**Number of Studies**
Italy	1	New Zealand	1
		Poland	1
		Russian Federation	1
		Italy	1

Authors are working on neuroentrepreneurship in various countries worldwide, either individually or collaboratively. According to data from the WoS database, 50 authors are working on neuroentrepreneurship, and according to data from the SCOPUS database, 60 authors are working on neuroentrepreneurship. The authors with the most studies are listed in Table 3, respectively. Three (3) studies by Juárez-Varón, D. were found and searched in both indexes.

Table 3: Distribution of neuroentrepreneurship studies by author

Web of Science (WoS)		SCOPUS	
Author	**Number of Studies**	**Author**	**Number of Studies**
Juárez-Varón, D.	3	Juárez-Varón, D.	3
Mengual-recuerda A	2	Day, M.	3
Zuluaga JCS	2	Boardman, M.C.	3
		Zuluaga, J.C.S.	2
		Moss, A.U.	2
		Krueger, N.	2
		Mengual-Recuerda, A	2

According to database data, the disciplines in which published studies are located vary. The field of "Business" appears to be prominent in studies on neuroentrepreneurship. Although "Psychology" is associated with varying numbers of studies in different databases, it ranks third in both. Table 4 shows that research areas are divided into six in the Web of Science (WoS) and seven in SCOPUS. Furthermore, psychology and neuroscience are secondary in this research area, suggesting a weaker understanding of entrepreneurship within neuroscience.

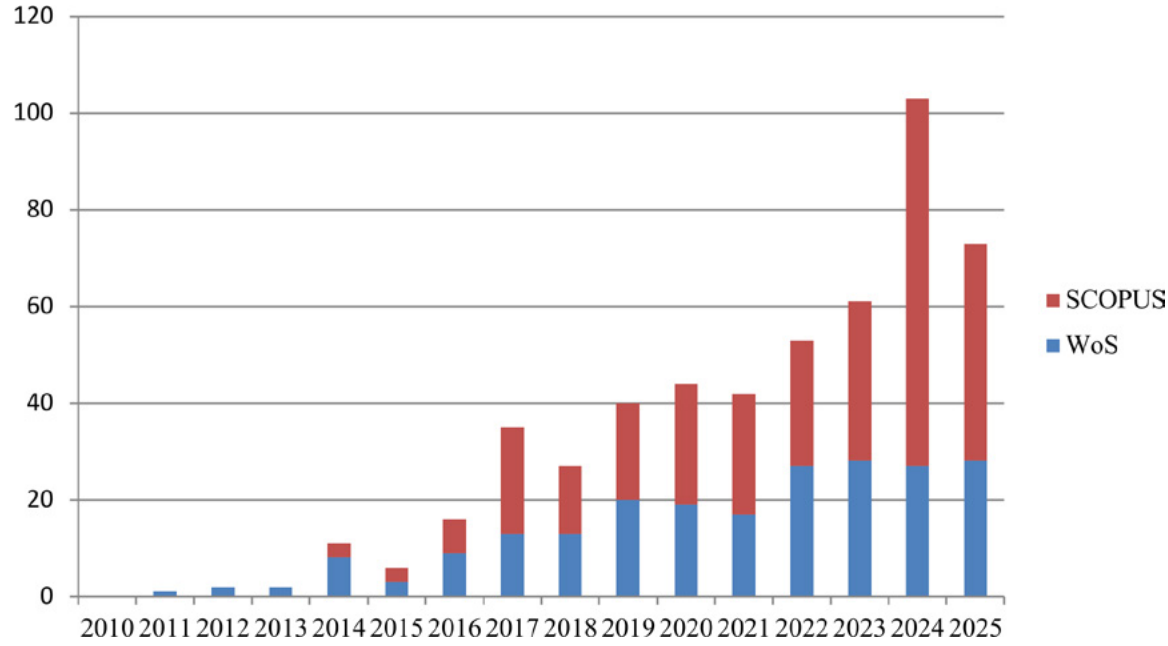
Table 4: Research areas

Web of Science (WoS)		SCOPUS	
Research Area	**Number of Studies**	**Research Area**	**Number of Studies**
Business Economics	12	Business, Management and Accounting	21
Development Studies	2	Economics, Econometrics and Finance	13
Psychology	1	Psychology	6
Educational Research	1	Neuroscience	2
Neurosciences, Neurology	1	Computer Science	1
Social Sciences Other Topics	1	Social Sciences	1
		Arts and Humanities	1

An analysis of citations to neuroentrepreneurship studies based on the WOS and SCOPUS databases is presented in Graph 2. According to the WoS database, the total number of citations is 217, and according to the SCOPUS database, the total number of citations is 299. The highest number of citations (27) in the WoS database occurred in 2023 and 2025 (until August), while the highest number of citations (76) in the SCOPUS database occurred in 2024. Based on the citation numbers in Chart 2, it can be said that interest in the field has increased in recent years.

The five most cited studies by the database are listed in Table 5. According to the WoS database, the study titled "Looking Forward, Looking Backward: From Entrepreneurial Cognition to Neuroentrepreneurship" received the most citations (58), while according to the SCOPUS database, the study titled "Biology, Neuroscience, and Entrepreneurship" received the most citations (54). Beyond the broader citation coverage of SCOPUS, notable findings include the following: "Biology, Neuroscience, and Entrepreneurship," "It's All in Your Head: Why We Need Neuroentrepreneurship," and

"Neuroentrepreneurship: an integrative review and research agenda" can be considered key works in the literature. Furthermore, Krueger's multiple publications and the inclusion of his work in various databases further demonstrate his centrality to the neuroentrepreneurship literature.



Graph 2: Number of citations by year

Table 5: Most cited studies

Web of Science (WoS)			**SCOPUS**		
Title of Study	**Author(s)**	**Number of Citations**	**Title of Study**	**Author(s)**	**Number of Citations**
"Looking Forward, Looking Backward: From Entrepreneurial Cognition to Neuroentrepreneurship"	Krueger & Day	58	"Biology, Neuroscience, and Entrepreneurship"	Nicolaou & Shane	54
"Biology, Neuroscience, and Entrepreneurship"	Nicolaou & Shane	39	"It's All in Your Head: Why We Need Neuroentrepreneurship"	de Holan	47
"It's All in Your Head: Why We Need Neuroentrepreneurship"	de Holan	29	"Neuroentrepreneurship: What can entrepreneurship learn from neuroscience?"	Krueger & Welpe	39
"Neuroentrepreneurship: An integrative review and research agenda"	Sharma et al.,	27	"The entrepreneurial 'mindset': Entrepreneurial intentions from the entrepreneurial event to neuroentrepreneurship"	Kaffka & Krueger	36
"Entrepreneurial cognition and premature scaling of startups: a qualitative analysis of determinants of start-up failures"	Joseph et al.,	20	"Neuroentrepreneurship: an integrative review and research agenda"	Sharma et al.,	33

Data on neuroentrepreneurship, retrieved from WoS databases, were analyzed using the VOSviewer program. A mapping was created using 47 keywords from all studies, each with a corresponding keyword. Figure 1 shows 47 words in the network map, 8 clusters, and 153 connections between them. The most frequently occurring keywords were neuroentrepreneurship (7 occurrences, 31 links), entrepreneurship (6 occurrences, 31 links), nueroscience (5 occurrences, 23 links), decision-making (3 occurrences, 15 links), and entrepreneurial cognition (3 occurrences, 11 links), and key concepts such as fMRI were also included. The keywords also included "self-regulation attitude theory."

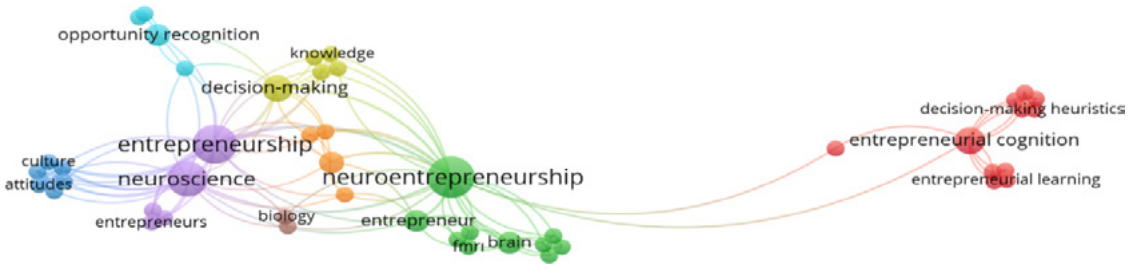


Figure 1: Keyword network map based on WoS data

Data on neuroentrepreneurship, retrieved from the SCOPUS database, were analyzed using the VOSviewer program. The resulting data revealed that 82 of the 89 keywords mentioned in all studies were interconnected, and mapping was performed accordingly. Figure 2 shows the network map of 82 words, 10 clusters, and 468 connections between the clusters. The most frequently occurring and connecting keywords were neuroentrepreneurship (11 occurrences, 55 links), entrepreneurship (8 occurrences, 62 links), nueroscience (6 occurrences, 51 links), entrepreneur (4 occurrences, 28 links), and decision-making (3 occurrences, 18 links). The fMRI method also appears as a key concept in the keywords of this database. The keywords also included "self-regulation attitude theory" and "dopamine theory of addiction."

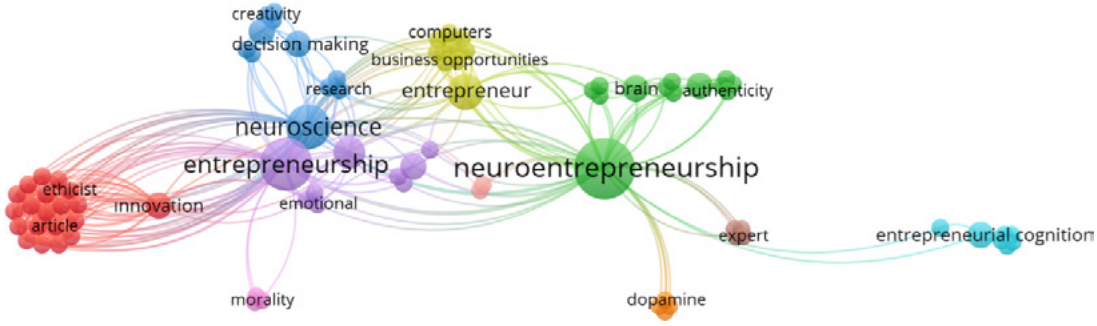


Figure 2: Keyword network map based on SCOPUS data

Content analysis of the studies that constitute the data for this research reveals information such as research methods and key concepts in neuroentrepreneurship studies. Each study also includes author and year information. Studies included in WoS and SCOPUS are distinguished. Table 7 examines a total of 29 studies published in WoS and SCOPUS. Further details include whether the studies employed qualitative, quantitative, or mixed methods. Additional information, such as interview method selection and bibliometric analysis, is also included. Sixteen of these studies utilized qualitative research, while one study employed mixed methods.

Table 7: Research method employed in the studies

Title of Study	Author(s)	Publication Year	Research Method	WoS	SCOPUS
"Biology, Neuroscience, and Entrepreneurship"	Nicolaou & Shane	2014	Qualitative-Examining the conceptual framework	+	+
"It's All in Your Head: Why We Need Neuroentrepreneurship"	De Holan	2014	Qualitative-Examining the conceptual framework	+	+
"Neuroentrepreneurship: An integrative review and research agenda"	Sharma et al.,	2021	Qualitative Methods-Content Analysis	+	+
"Assessing the Perceived Value of Neuroethics Questions and Policy to Neuro-Entrepreneurs"	Moss et al.,	2021	Mixed Methods	+	+

Table 7. Continued

Title of Study	Author(s)	Publication Year	Research Method	WoS	SCOPUS
"Integration of Neuroscience and Entrepreneurship: A Systematic Review and Bibliometric Analysis"	Liu et al.,	2022	Quantitative Methods-Bibliometric Analysis	+	+
"Advancing (Neuro)Entrepreneurship Cognition Research Through Resting-State fMRI: A Methodological Brief"	Ooms et al.,	2024	Quantitative Methods	+	+
"Looking Forward, Looking Backward: From Entrepreneurial Cognition to Neuroentrepreneurship"	Krueger & Day	2010	Quantitative Methods	+	-
"Neuroentrepreneurship: What can entrepreneurship learn from neuroscience?"	Krueger & Welpe	2014	Qualitative-Examining the conceptual framework	+	+
"Entrepreneurial cognition and premature scaling of startups: A qualitative analysis of determinants of start-up failures"	Joseph et al.,	2023	Qualitative Methods-Interviews	+	+
"Entrepreneurial Cognition and effect on Neuro entrepreneurship"	Heydari et al.,	2020	Qualitative-Examining the conceptual framework	+	-
"Comparing Brain Activity of Entrepreneurs and Non-Entrepreneurs During Creative Thinking and Opportunity Recognıtıon"	Dincer Aydin et al.,	2023	Quantitative Methods-Experiment	+	-
"Analysis of the influence of emotions on the decision-making of entrepreneurs using neurotechnologies"	Serna-Zuluaga et al.,	2024	Qualitative Methods-Interviews	+	+
"Neuroentrepreneurship: state of the art and future lines of work"	Juárez-Varón et al.,	2024	Quantitative Methods-Systematic review and bibliometric analysis	+	+
"Authentic Autism"	Saylors	2023	---	-	+
"Baby, I'm addicted! The pleasure-pain pathway that shifts entrepreneurial passion to entrepreneurial addiction: Pivotal role of dopamine"	Sinha	2022	Qualitative Methods	-	+
"Neuroentrepreneurship a new paradigm in the management science"	Korpysa	2020	Qualitative Methods	-	+
"The Ethical Imperative for Neuro-Entrepreneurs"	Moss & Amadio	2019	Qualitative Methods	-	+
"The entrepreneurial 'mindset': Entrepreneurial intentions from the entrepreneurial event to neuroentrepreneurship"	Kaffka & Krueger	2018	Qualitative-Examining the conceptual framework	-	+
"A few words about what neuroentrepreneurship can and cannot help us with"	Guillory et al.,	2017	----	-	+
"Human psychophysiological and genetic approaches in neuroentrepreneurship"	Colosio et al.,	2017	Quantitative Methods-Experiment	-	+

Table 7. Continued

Title of Study	Author(s)	Publication Year	Research Method	WoS	SCOPUS
"Entrepreneurial return on investment through a neuroentrepreneurship lens"	Day & Boardman	2017	Quantitative Methods	-	+
"Unpacking neuroentrepreneurship: Conducting entrepreneurship research with EEG Technologies"	De Holan & Couffe	2017	Qualitative Methods	-	+
"Handbook of research methodologies and design in neuroentrepreneurship"	Day et al.,	2017	----	-	+
"The neurosocial alchemy of entrepreneurial transformation: a deep dive into extended mirror neuron system and neuroplasticity"	Kaur	2025	Qualitative-Examining the conceptual framework	+	+
"Deeper knowledge of entrepreneurs in decision-making. Innovating through neuroentrepreneurship"	Zuluaga et al.,	2025	Quantitative Methods-Experiment	+	+
"Recasting entrepreneurship education as a neurolearning process"	Jones	2025	------	-	+
"Neuroentrepreneurship: Pierce the veil of creativity in workplace"	Sharma & Devy	2024	Qualitative-Examining the conceptual framework	-	+
"Creative and cultural industry entrepreneurship in the 21st century: Challenges by and for policymakers"	Hill et al.,	2024	Qualitative-Examining the conceptual framework	-	+

When the 29 studies were examined for key concepts, none were identified in 12 of them. It is observed that the key concept is generally absent from book chapter studies. Among the keywords listed in Table 8, the most frequently occurring are "Entrepreneurship" (11), "Entrepreneurial" (11), "Neuroscience" (9), and "Neuroentrepreneurship" (9), respectively.

Table 8: Keywords used in the studies

Title of Study	Author(s)	Publication Year	Keywords	WoS	SCOPUS
"Biology, Neuroscience, and Entrepreneurship"	Nicolaou & Shane	2014	Neuroscience, neuroentrepreneurship, genetics of entrepreneurship, biology	+	+
"It's All in Your Head: Why We Need Neuroentrepreneurship"	De Holan	2014	Neuroscience and management, neuroentrepreneurship, entrepreneurial cognition	+	+
"Neuroentrepreneurship: an integrative review and research agenda"	Sharma et al.,	2021	Decision-making, Entrepreneurial intention, Entrepreneurship, Neuroscience, Opportunity recognition	+	+
"Assessing the Perceived Value of Neuroethics Questions and Policy to Neuro-Entrepreneurs"	Moss et al.,	2021	innovation, attitudes, venture capitalists, neuroscience, culture, business case for neuroethics, entrepreneurship, neurotechnology	+	+

Table 8. Continued

Title of Study	Author(s)	Publication Year	Keywords	WoS	SCOPUS
"Integration of Neuroscience and Entrepreneurship: A Systematic Review and Bibliometric Analysis"	Liu et al.,	2022	Entrepreneurship, neuroscience, neuro-entrepreneurship, literature analysis, entrepreneurs	+	+
"Advancing (Neuro)Entrepreneurship Cognition Research Through Resting-State fMRI: A Methodological Brief"	Ooms et al.,	2024	Entrepreneur, manager, fMRI, neuroentrepreneurship, cognitive flexibility, brain	+	+
"Looking Forward, Looking Backward: From Entrepreneurial Cognition to Neuroentrepreneurship"	Krueger & Day	2010	No Keywords	+	-
"Neuroentrepreneurship: what can entrepreneurship learn from neuroscience?"	Krueger & Welpe	2014	No Keywords	+	+
"Entrepreneurial cognition and premature scaling of startups: a qualitative analysis of determinants of start-up failures"	Joseph et al.,	2023	Entrepreneurship practice, Entrepreneurial cognition, Decision-making heuristics, Premature scaling, Self-regulation attitude theory, Sustainable development of startups	+	+
"Strong displayed passion and preparedness of broadcaster in live streaming e-commerce increases consumers' neural engagement"	Yu et al.,	2022	live streaming, e-commerce, entrepreneurial passion, consumer engagement, inter-subject correlation, ISC, EEG	+	-
"Entrepreneurial Cognition and effect on Neuro entrepreneurship"	Heydari et al.,	2020	Entrepreneurial Cognition, Neuro Entrepreneurship, Entrepreneurial Intentions, Entrepreneurial Self-efficacy, Entrepreneurial Learning	+	-
"Comparıng Braın Actıvıty Of Entrepreneurs And Non-Entrepreneurs Durıng Creatıve Thınkıng And Opportunıty Recognıtıon"	Dincer Aydin et al.,	2023	Neuroentrpreneurship, Creativity, Opportunity Recognition	+	-
"Analysis of the influence of emotions on the decision-making of entrepreneurs using neurotechnologies"	Serna-Zuluaga et al.,	2024	Entrepreneurship, Decision-making, Temporal evolution, Emotions, Neuroqualitative, Neuroentrepreneurship	+	+
"Neuroentrepreneurship: state of the art and future lines of work"	Juárez-Varón et al.,	2024	Neuroentrepreneurship, Neuroscience, Entrepreneurship, Neurotechnologies, Entrepreneur, Emotions	+	+
"Authentic Autism"	Saylors	2023	No Keywords	-	+

Table 8. Continued

Title of Study	Author(s)	Publication Year	Keywords	WoS	SCOPUS
"Baby, I'm addicted! The pleasure-pain pathway that shifts entrepreneurial passion to entrepreneurial addiction: Pivotal role of dopamine"	Sinha	2022	Dopamine; Dopamine theory of addiction; Entrepreneurial addiction; Entrepreneurial passion; Neuroentrepreneurship	-	+
"Neuroentrepreneurship a new paradigm in the management science"	Korpysa	2020	Entrepreneur; Entrepreneurship; Neuroentrepreneurship; Neuroscience	-	+
"The Ethical Imperative for Neuro-Entrepreneurs"	Moss & Amadio	2019	No Keywords	-	+
"The entrepreneurial 'mindset': Entrepreneurial intentions from the entrepreneurial event to neuroentrepreneurship"	Kaffka & Krueger	2018	No Keywords	-	+
"A few words about what neuroentrepreneurship can and cannot help us with"	Guillory et al.,	2017	No Keywords	-	+
"Human psychophysiological and genetic approaches in neuroentrepreneurship"	Colosio et al.,	2017	No Keywords	-	+
"Entrepreneurial return on investment through a neuroentrepreneurship lens"	Day & Boardman	2017	No Keywords	-	+
"Unpacking neuroentrepreneurship: Conducting entrepreneurship research with EEG Technologies"	De Holan & Couffe	2017	No Keywords	-	+
"Handbook of research methodologies and design in neuroentrepreneurship"	Day et al.,	2017	No Keywords	-	+
"The neurosocial alchemy of entrepreneurial transformation: a deep dive into extended mirror neuron system and neuroplasticity"	Kaur	2025	Brain; entrepreneurial neuroplasticity; extended mirror neuron system; neuroentrepreneurship; social neuroscience; organizational neuroscience	+	+
"Deeper knowledge of entrepreneurs in decision-making. Innovating through neuroentrepreneurship"	Zuluaga et al.,	2025	Entrepreneurship; Knowledge; Decision-making; Cognitive; Emotional; Innovation; Neuroentrepreneurship	+	+
"Recasting entrepreneurship education as a neurolearning process"	Jones	2025	No Keywords	-	+

Table 8. Continued

Title of Study	Author(s)	Publication Year	Keywords	WoS	SCOPUS
"Neuroentrepreneurship: Pierce the veil of creativity in workplace"	Sharma & Devy	2024	No Keywords	-	+
"Creative and cultural ındustry entrepreneurshıp ın the 21st century: Challenges by and for polıcymakers"	Hill et al.,	2024	Creative and cultural industry entrepreneurship; sustainable development goals; policies for creative industries; policymaking; research impact; actionable research findings; cultural policies	-	+

Discussion and Recommendations

The rise of social welfare as a major topic of debate among countries and societies, coupled with the distinction between developed and underdeveloped countries, highlights the importance of development. With the recognition of entrepreneurship as a crucial factor in development, interest in entrepreneurship has grown over time. Furthermore, developments and social transformations in the modern world have paved the way for the emergence of various forms of entrepreneurship. Neuroentrepreneurship, as an entrepreneurial trend contributed by the field of neuroscience to entrepreneurship studies, is one of the new entrepreneurial forms of the 21st century. Neuroscience applications, pioneered by neuromarketing in the field of business, have been examined in the context of entrepreneurs, and the subfields of cognitive neuroscience, affective neuroscience, behavioral neuroscience, cultural neuroscience, computational neuroscience, neuroinformatics, systems neuroscience, and social neuroscience have emerged and developed within specific areas. Neuroentrepreneurship, encompassing these subfields, uses powerful neuroscientific techniques to understand the neural basis of entrepreneurial processes. According to Yu et al. (2023), common techniques used in neuroentrepreneurship include: EEG: Directly measures the brain's electrical activity and analyzes instantaneous brainwave responses. fMRI: Measures blood flow changes in brain regions, revealing brain regions active during decision-making. fNIRS: Measures oxygenation levels in superficial brain regions. These techniques are used to examine brain responses in entrepreneurship research. As Yu et al. (2023) noted, neuroentrepreneurship research seeks to understand the interaction of cognitive and emotional functions in entrepreneurs' strategic decision-making processes through these techniques.

This study utilized bibliometric and content analysis to examine neuroentrepreneurship studies holistically, observe development trends, and uncover conceptual maps. One of the most important aspects of this study is to emphasize the importance of using a common language in the field and to outline the framework for studies in this context. While there are studies that could be considered neuroentrepreneurship, many studies do not directly use the term "neuroentrepreneurship." Therefore, studies that incorporate the key concept of "neuroentrepreneur**" form the basis of this study.

The findings obtained in this regard first reveal that the concept of neuroentrepreneurship is relatively new. Furthermore, despite increasing research efforts on the concept, there are shortcomings in the field's progress. While Krueger and Day highlighted this in their 2010 study, it can be argued that progress within the scope of "neuroentrepreneurship" is currently weak, and the field remains in its infancy. This is further evidenced by the fact that the first study on the concept was published in 2010 and that a total of 29 studies were found in the WoS and Scopus indexes. Furthermore, the peak in citations to these studies in recent years also indicates that the field is on a growth trajectory.

On the other hand, studies in this area are more prominent in management and entrepreneurship journals. However, psychology journals also offer research in this area. This is reflected in the research areas in which studies are concentrated. Prominent fields within the context of neuroentrepreneurship include Business, Management, and Accounting; Economics, Econometrics, and Finance; and Psychology.

Furthermore, one striking aspect of the research results is that both indexes show a concentration of research in the US context. This may be due to the high number of initiatives occurring in the US, as well as the influence of neuroscience activities' advanced research infrastructure and extensive funding sources. While neuroscience research has increased in recent years in both developed and underdeveloped countries (Ahmad & Komai, 2016), neuroscience remained among the five most-funded fields by the National Institutes of Health in the US over the past decade and

became the second most-funded field in 2023 (National Institutes of Health (NIH) RePORT, 2024). The involvement of projects supporting innovative neurotechnologies, such as the Brain Initiative within the National Institute of Health (The BRAIN Initiative, 2024), demonstrates the US's leadership in this field. Another factor influencing country rankings is the country of origin of the authors. The authors who stand out in the study are Boardman, M.C.; Day, M.; Juárez-Varón, D., and Krueger, N. Krueger, in particular, can be considered a critical figure in the literature due to his authorship of multiple studies and the fact that his work is among the most highly cited.

On the other hand, it is important to examine key concepts in neuroentrepreneurship studies. When examining research both by index and overall, the concepts of entrepreneurship and neuroentrepreneurship are prominent. These key concepts also inform the direction of the studies, research methods, tools used, and theories employed. In this regard, the prominent use of neuroscience tools such as fMRI is evident. Furthermore, theories like the self-regulation attitude theory and dopamine addiction theory represent theories used in the field.

Through content analysis, the research methods employed in the studies were systematically examined. Despite neuroentrepreneurship's prominence as an interdisciplinary field, it was observed that mixed-method studies are scarce. In this context, it is important to conduct studies employing mixed methods. Furthermore, while brain imaging techniques are key concepts and discussed in more detail in the studies, it can be said that experiments/applications using brain imaging techniques are limited and primarily comprise qualitative studies.

Upon examining studies in the field and identifying existing gaps, certain recommendations can emerge for future researchers. Therefore, the following recommendations for future studies are presented:

Desmond (2010) prioritizes qualitative research for analyzing entrepreneurship studies. He believes that qualitative research allows for comprehensive observation of entrepreneurs in their natural environments while they conduct their activities. However, quantitative research is also important for making calculations and developing predictions. Baucus et al. (2014) argued that the brains of entrepreneurs are no different from those of non-entrepreneurs, arguing that the resulting differences stem from the experience and knowledge accumulated in abstract representations. Therefore, using both quantitative and qualitative studies together to uncover the differences between entrepreneurs and non-entrepreneurs, and to learn about experiences and knowledge that may be difficult to uncover using the quantitative methods used in neuroscience, could be more beneficial. This allows for comprehensive observations of the entrepreneur's brain, emotions, and thoughts.

Furthermore, for a study that is still in its infancy and draws on diverse observations to advance in the literature, its theoretical foundation needs to be strengthened. In this study, only the theories "self-regulation attitude theory" and "dopamine theory of addiction" are highlighted. Furthermore, the number of studies based on these theories is limited. Therefore, conducting theoretically oriented studies could contribute to the strengthening of the field.

These theories can also be linked to other theories in the literature. These theories can contribute to strengthening the existing theoretical framework by shedding light on both an individual's capacity to regulate their behavior and the influence of neuropsychological processes on behavior. The subject can be investigated and explained in depth with the self-determination theory (Deci & Ryan, 2012), which emphasizes the intrinsic motivation, autonomy, relatedness and competence needs behind an individual's behavior, the Theory of Planned Behavior (Ajzen, 1991), which explains individuals' behavior through attitudes, subjective norms (social expectations) and perceived behavioral control, or the Social Cognitive Theory developed by Bandura (2001). In addition, Incentive Sensitization Theory (Robinson & Berridge, 1993), which is quite close to dopamine theory and argues that addiction can be explained not only by the liking but also by the hypersensitivity of the "wanting" drive at the neurological level, could be a subject of study. This would also provide theoretical depth to the field.

The findings in this study reveal the paucity of quantitative studies aimed at testing theories. In this context, both mixed-method and experimental studies could be conducted. The research methods and practices outlined in this study could be examined accordingly. This would also contribute to the development of studies in the literature. These findings provide a roadmap for the techniques and tools researchers will select, and studies addressing organizational neuroscience and entrepreneurship based on core concepts can be conducted.

The findings of the study offer several recommendations not only for researchers but also for entrepreneurs and policymakers. For example, developing neuro-based entrepreneurship training is crucial and could facilitate the early discovery of entrepreneurs. Therefore, entrepreneurship programs should be redesigned to enhance competencies such as cognitive flexibility, creativity, and stress management, and evaluated in relation to individual behaviors.

Conclusion and Limitations

While numerous previous studies have been conducted at the intersection of entrepreneurship and neuroscience, this article primarily relies on studies published using the keyword "neuroentrepreneurship." While this concept is presented as a developmental trend that will better define the field in the future, it presents a significant limitation for this study. Despite examining fewer studies under this limitation, conclusions regarding the future of the field are still drawn.

A review of the studies reveals the need for an approach that considers both neuroscientific and cultural, social, and economic dimensions in the field of entrepreneurship. Furthermore, an in-depth examination of the study results within the scope of this study suggests that experienced entrepreneurs, despite experiencing higher stress in certain areas, have better emotional regulation and focus capacity than inexperienced ones. Therefore, measurements of entrepreneurs using brain imaging techniques may be useful in determining their roadmap.

When studies are examined in general and key concepts are highlighted, neurotechnologies are considered important, and brain imaging techniques such as EEG, GSR, and fMRI are discussed under the heading of "neurotechnology." This will facilitate a more conceptual process, particularly in the social sciences. Furthermore, these technologies offer powerful methods for understanding the subconscious processes of entrepreneurial decision-making, thus providing different evaluation criteria for future research that will guide future researchers.

Ultimately, the primary motivation for this study is to define the conceptual boundaries of neuroentrepreneurship, a recent form of entrepreneurship, and to establish the groundwork for future development within an interdisciplinary framework. The study aims to chart a path for both future researchers and entrepreneurs, raise awareness for policymakers who will promote neuroentrepreneurship, and explore the roots and shortcomings of the field.

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Özet

Girişimcilik, uzun yıllardır araştırılan ve literatürde farklı disiplinler tarafından ele alınan bir konudur. Ülkelerin kalkınması için temel bir araç olarak konumlandırılmasından dolayı girişimcilik önemli bir araştırma konusu olmaktadır. *Bu doğrultuda literatürde girişimciliğin çeşitli türleri yer almaktadır. Girişimci özellikleri, makro çevresel unsurların değişimi vb. birçok unsur doğrultusunda ortaya çıkan girişimcilik türleri birey veya toplum için değer oluşturmayı amaçlamaktadır.*

Araştırmalar ve ihtiyaçlar doğrultusunda ortaya çıkan bu girişimcilik türleri, zaman içerisinde geniş bir alana yayılmış ve araştırmaların da konusu olmuştur. Ancak son dönemde ön plana çıkan girişimcilik türleri (Covid-19 girişimcilik vb.) arasında nörogirişimciliğin çok fazla ele alınmadığı gözlemlenmektedir. 2006 yılından itibaren literatürde yer almaya başlayan nörogirişimcilik yeni bir kavram olup girişimcilerin karar alma süreçleri ve davranışlarına odaklanmaktadır. Son dönemlerde daha fazla ön plana çıkan nörobilim disiplininin yönetim ve ekonomi alanına entegre edilmesiyle birçok yeni kavram doğmuştur. Bu kavramlardan biri de bu çalışmayı da şekillendiren "nörogirişimcilik"tir.

Girişimciliğin yeni bir alanı olarak ortaya çıkan nörogirişimcilik, girişimcilik niyetini davranışsal ve zihinsel süreçler bağlamında anlamayı hedefleyen, çok disiplinli bir yaklaşımdır. Bu yaklaşım, insan beyninin daha iyi anlaşılması gerektiği düşüncesine dayanır ve beyin işleyişi ile hormonların girişimcilik unsurlarıyla nasıl ilişkili olduğunu inceleyerek girişimcilik olgusuna yeni bir bakış açısı kazandırır. Sinirbilimin yöntemlerini kullanarak anlamlandırılan girişimcilik, girişimci zihniyetinin şifrelerini çözerek hem girişimciliğin hem de toplumsal hayatın gelişimine katkı sağlamayı amaçlamaktadır. Bu amaç girişimciliği araştırmak, eksik yönlerini ortaya koymak ve girişimciyi anlamlandırabilmektir. Çünkü farklı kişilik özelliklerine sahip ve farklı arka planı olan kişilerin nihai olarak girişimcilik eğiliminde bulunduğu literatürde gözlemlenmektedir. Bu doğrultuda, girişimci davranış gösteren bireylerin sadece kişilik testleri ile analiz edilemeyeceği ve bu yaklaşımın birbiriyle çelişen sonuçlar gösterdiği ileri sürülmüş ve bireyin diğer özelliklerine odaklanılmaya başlanmıştır. Bilişsel bilim, bahsi geçen bu diğer özellikleri açıklamaya çabalamıştır. Bu doğrultuda girişimcinin bilgiyi edinmesi, işlemesi ve onu kullanmasıyla ilgili olan zihinsel süreçlerin girişimsel davranışları belirlemede önemli olduğu ileri sürülmüştür. Buna göre, girişimciler yenilikçi yaklaşım, sezgiye dayalı karar verme yeteneği, alana özgü uzmanlık, olanakları fark etmeye yönelik özgüven, risk almaya yatkınlık ve yapılacak girişimin sonuçlarına yönelik geçmişe yönelik analiz yapabilme gibi farklı bilişsel özellikler sergilemektedirler. Bu bağlamda bilişsel paradigmaya göre, özellikle planda olmayan engellerle başa çıkmaya yönelik öz yeterlilik inançları, girişimci bireyleri girişimci olmayan bireylerden ayıran en önemli faktördür.

Beyin temelli girişimcilik olarak da ifade edilen nörogirişimcilik sadece girişimciyi ayırt eden faktörleri değil aynı zamanda bellek, dikkat ve algı gibi süreçlerin girişimciliği nasıl etkilediği üzerinde de araştırmalar yapılmaktadır. Ancak, nörogirişimciliğe yönelik çalışmaların kısıtlı kaldığı da göz ardı edilmemelidir. Ek olarak, kavrama yönelik çalışmaların çerçevesinin teori ile sınırlı kaldığı tartışmaları da yer almaktadır. Nörogirişimcilik kavramını tanımlamak ve bu kavramın katkılarını anlayabilmek adına literatür incelenerek alandaki boşlukların ortaya konulmasıyla birlikte nörogirişimciliğin odak noktası ve teorik arka planı ve gelecek araştırmaların yönünü ortaya çıkarabilir. Bunun için literatürde son dönemlerde popüler olarak da kullanılmaya başlanan bibliyometrik analiz yöntemiyle nörogirişimcilik kavramına yönelik WOS ve SCOPUS veritabanları kapsamında tarama yapılmıştır. Bu taramada ("neuroentrepreneur") or ("neuro entrepreneur*") or ("neuro-entrepreneur*") anahtar kelimeleri kullanılarak veriler elde edilmiştir. Bibliyometrik veri analizi için veri tabanlarından toplanan çalışmalar özellikle nitel yönünün analizi için ayrıca içerik analizine tabi tutulmuştur. Nitel araştırma yöntemleri içerisinde yer alan içerik analizi tekniği kodlama, kategorileştirme vb. yollarla materyaller içerisindeki bilginin sınıflandırılmasını ve ölçülebilir bir bilginin oluşmasına imkân sağlamaktadır.*

Belirlenen anahtar kelimeler doğrultusunda yapılan bibliyometrik analiz sonucunda WoS veri tabanında 15, SCOPUS veri tabanında ise 25 çalışmaya ulaşılmıştır. Genel olarak yayın sayısının sınırlı olmasına karşın yıllar içinde kavramın artış gösterdiği görülmektedir. Ayrıca belirli ülkeler ve dergilerin bu alanda öncü bir konumda olduğu, atıf oranlarının ise alana yönelik artan ilginin seviyesini ortaya koymaktadır. İçerik incelemesi, nörogirişimcilik literatürünün daha çok girişimcilik davranışı, karar alma süreçleri ve nörobilimsel ölçüm teknikleri etrafında şekillendiğini göstermektedir.

Bununla birlikte, yöntemsel açıdan yapılan değerlendirmeler farklı bir tablo ortaya koymaktadır. Nörogirişimcilik disiplinlerarası bir alan olarak dikkat çekmesine rağmen, karma yöntemli çalışmaların sayıca oldukça az olduğu belirlenmiştir. Dolayısıyla gelecekte bu alanda gerçekleştirilecek araştırmalarda karma yöntem yaklaşımının daha fazla benimsenmesi, literatürün hem derinlik hem de çeşitlilik açısından gelişmesine önemli katkılar sağlayacaktır.

Yapılan analizler sonucunda, nörogirişimciliğin emekleme aşamasında olduğu ve alanyazında gelişim göstermesi için teorik arka planının güçlendirilmesi gerektiği söylenebilir. Özellikle araştırma sonucunda ortaya çıkan "self-regulation attitude theory" ve "dopamine theory of addiction" teoriler ise teorik açıdan nörogirişimciliğe bakışı gösterirken teorik zayıflık da görülmektedir. Ancak deneysel çalışmaların artması ve nöroteknoloji olarak sınıflandırılan beyin görüntüleme teknikleriyle girişimciye dair araştırmalar ile girişimcinin zihin dünyasını tanımakta elzemdir.

Sonuç olarak, bu çalışmanın temel motivasyonu, yeni bir girişimcilik biçimi olan nörogirişimciliğin kavramsal sınırlarını tanımlamak ve disiplinlerarası bir çerçevede gelecekteki gelişmeler için temel oluşturmaktır. Çalışma hem geleceğin araştırmacıları hem de girişimciler için bir yol haritası çizmeyi, nörogirişimciliği teşvik edecek politika yapıcılar için farkındalık yaratmayı ve alanın köklerini ve eksikliklerini araştırmayı amaçlamaktadır.