International Conference "Risk in Contemporary Economy" ISSN-L 2067-0532 ISSN online 2344-5386
XXIth Edition, 2020, Galati, Romania,
"Dunarea de Jos" University of Galati, Romania – Faculty of Economics and Business Administration

DOI https://doi.org/10.35219/rce2067053267

Neuroscience Tools for Human Resource Management in Contemporary Organisations

Teacu (Parincu)Alina
teacualina@yahoo.com
Dunarea de Jos University of Galati, Romania
Varon David Juarez
djuarez@upv.es
Universidad Politécnica de Valencia, Spain
Recuerda Ana Mengual
amengual@upv.es
Universidad Politécnica de Valencia, Spain
Micu Angela-Eliza
angelaelizamicu@yahoo.com
Ovidius University of Constanta, Romania
Capatina Alexandru
acapatana@ugal.ro
Dunarea de Jos University of Galati, Romania

This study aims to highlight the connection between Neuromanagement and human resource performance within the company, with an obvious impact on the overall performance of organizations. In this context, the answer to the general question must be identified: To what extent does neuromanagement influence organizational performance? The study aims to analyze the influence of Neuromanagement on human resource performance and overall performance of organizations in Romania, and the approach will consider building a complex research scenario, which will combine a quantitative empirical study with the use of research and neuroscientific methods, combining psychometric, biometric and neurometric techniques. The research topic addressed in this paper is relatively new, insufficiently explored by Romanian researchers; therefore the results of this study will most likely contribute to raising the level of understanding of the concepts presented and their practical applicability, in order to increase the performance of organizations in Romania.

Keywords: neuroscience, neuromanagement, human resource management, consulting

Introduction

The last years have been characterised by attempts to approach the human resource management discipline from an innovative perspective, in accordance with current trends, marked by complex challenges and fierce competition among organizations, both nationally and internationally.

Given the importance and impact of technological advances, as well as the explosion of research in the field, an interdisciplinary vision has been required to facilitate future research and explanations of decision-making, leadership practices, change management, innovation, creativity, human resource performance, involvement, commitment, motivation of people and emotions. This new approach is called Neuromanagement and opens the horizon of a new world to explore and discover (Ghadiri et al., 2008).

Classical human resource management theories and models have been revised in terms of the spectrum of neuroscience and the perspectives it opens, the functioning of the brain and its infinite potential, which has revealed new resources and tools to cope with current economic reality (Braidot, 2008). The aim is to confirm or refject a set of hypotheses, to facilitate access to a wide range of knowledge, with multiple possibilities of application in organizational management, to increase performance and to open new avenues for future research.

In a highly competitive business environment, all organizations need quality and reliable research that generates solutions and alternatives to achieve goals, differentiate themselves from the competition and give them the competitive advantage that leads to improved performance.

2. Neuroscientific methods applied to research in the field of neuromanagement

Neuroscientific methods and procedures include a wide range of tools and techniques for measuring, mapping neural activity, and understanding how our brain reacts to various stimuli (Lim, 2018).

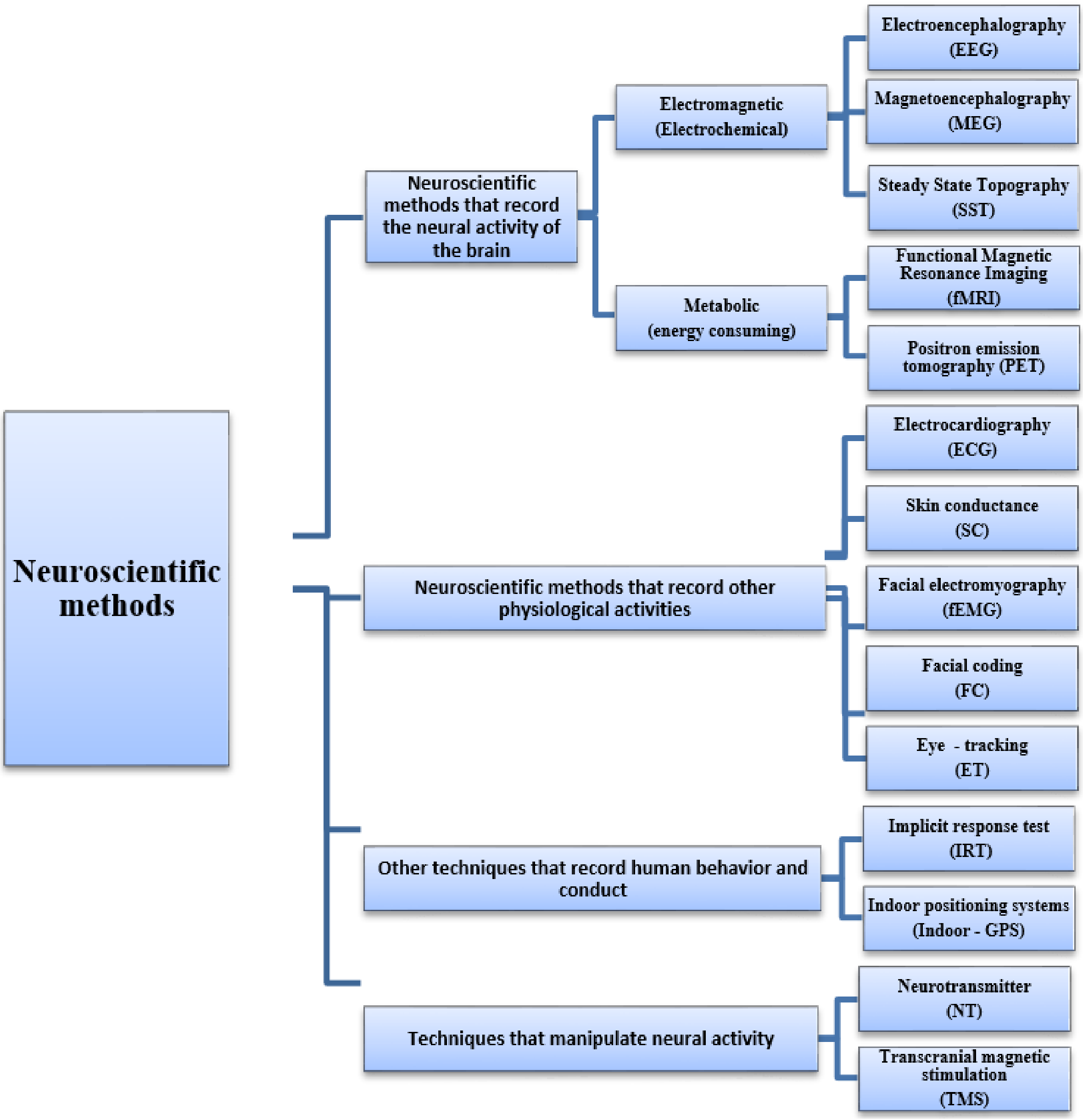

Figure 1: Neuroscientific techniques applied to research in the field of neuramanagement
Source: Literature review

Emotional, cognitive and behavioral information can be obtained with the following techniques, noting that not all neuroscientific methods provide value to neuromanagement studies:

A. Neuroscientific methods that record the neural activity of the brain (respectively the central nervous system).

B. Neuroscientific methods that record other physiological activities (respectively of the peripheral nervous system).

C. Other techniques that record human behavior and conduct.

D. Techniques that manipulate neural activity.

We must keep in mind that the reliability of these neuroscientific techniques depends on several factors, including:

- Quality of technologies: reliability and accuracy for measuring specific physiological activity;
- Data processing: algorithms translate physiological changes into cognitive or emotional information;
- Context of use: not all technologies can be applied in any context.
- Experimental protocol: an inadequate procedure in neuroscience can favor random results or even the opposite of reality.

3. Neuroscientific methods that record the neural activity of the brain

- **Electroencephalography/ EEG**

Electroencephalography (EEG) provides valuable information about electrical activity in the brain, captured and recorded using electrodes, sensors, positioned in the scalp (Kable, 2011). This is a non-invasive method that detects changes in electrical currents in the form of brain waves, which are produced and recorded when the tested subjects are exposed to a stimulus. (Morin, 2011; Plassmann et al., 2010). EEG technology records the spontaneous electrical activity of the brain, produced by the connection of neurons and provides direct information about the dynamics of neural activity and the location of their sources in the brain. EEG signals are represented by different frequencies and components, reflecting characteristics such as memory processing, attention and emotional engagement, being able to track very fast neural activity in real time.

Through this device, affective valence can be measured, respectively if a stimulus is perceived as positive or negative, the probability of memorization, the degree of attention and involvement (personal relevance), being one of the most used technologies in neuroscientific studies, mainly in Neuromarketing research, as it is reliable, comfortable and easily acceptable to the user, so that it can capture the natural behavior of the individual participating in the research.

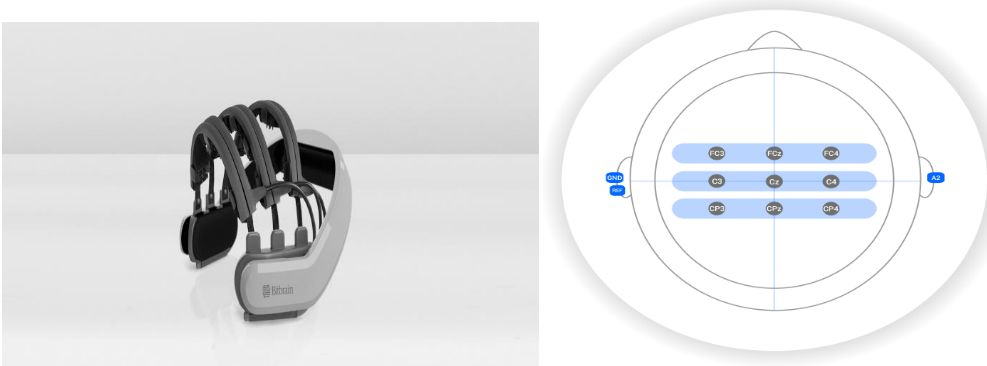

Fig. 2. Electroencephalography equipment

- **Magnetoencephalography / MEG**

Magnetoencephalography (MEG) tests, analyzes and records the magnetic activity of the brain, using a headset with over 100 and up to 300 detectors with sensitive superconducting quantum interferences, positioned at the scalp of the tested subject (Ariely & Berns, 2010). It is a non-invasive method that detects changes in magnetic fields induced by the electrical activity of the brain when the tested subjects are exposed to a stimulus (Morin, 2011; Plassmann et.al., 2010). MEG offers the advantage of a very good temporal resolution for detecting spontaneous changes in brain activity and thus contributes to the evaluation of the value of a stimulus (Bercea, 2012).

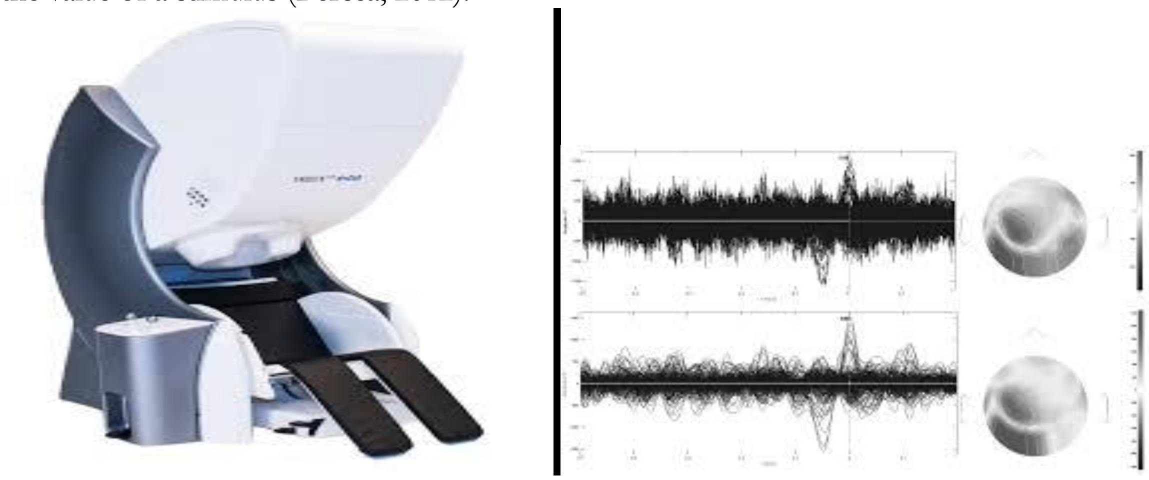

Fig. 3. Magnetoencephalography equipment

- **Steady – state topography/ SST**

Steady-state Topography (SST) tests and records the electrical activity of the brain, using a 64-electrode band or helmet on which the scalp of test subjects is placed, while visualizing audio-visual materials and performing a psychological task simultaneously with a sinusoidal intermittent present in the visual periphery, to cause an oscillating electrical response of the brain, in the form of steady-state visually evoked potential (SSVEP) (Silberstein, 1995).

It is a non-invasive method that detects task-related changes in brain activity with SSVEP measurements. SST measures variations in phase difference between SSVEP and a particular stimulus, whereby a reduction in latency indicates an increase in synaptic excitation.

Fig. 4. Steady – state topography/ SST equipment

- **Functional Magnetic Resonance Imaging (fMRI)**

Functional magnetic resonance imaging (fMRI) measures and maps brain activity by detecting changes associated with blood flow, which occur in response to neural activity, using an MRI scanner (Huettel et al., 2009). In this non-invasive method, the tested subjects have their head surrounded by an NMR scanner that determines the alignment of the atomic particles at the level of the head with the magnetic field (Zurawicki, 2010).

MRI scans track blood oxygenation in the brain and exploit the magnetic properties of oxygenated and deoxygenated blood, which correlate with basal neural activity. It also provides a three-dimensional view of the brain, with coordinates for identifying areas of the brain. Thus, when a test subject is exposed to a stimulus, certain areas of the brain will receive more oxygenated blood flow than is normal, causing distortions in the magnetic field emitted by hydrogen protons in the water molecules in the blood. of the brain area, all of which are captured in the MRI scanner. A computer screen connected to the MRI scanner allows neurologists to identify changes in signals in real time, displaying colored areas that overlap the grayscale image of the brain (Bercea, 2012; Zurawicki, 2010).

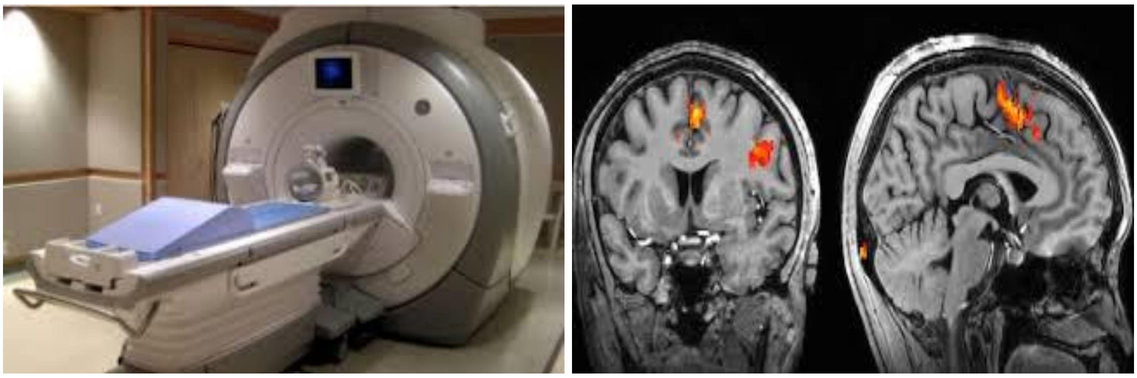

Fig. 5. Functional Magnetic Resonance Imaging (fMRI) equipment

- **Positron emission tomography (PET)**

Positron emission tomography (PET) is an invasive method that uses a battery of detectors that is placed on the head of the test to monitor the pulse of radiation and to show in detail the metabolism of glucose in the brain (Bercea, 2012; Zurawicki, 2010). PET offers the advantage of high spatial resolution, which allows the detection of changes in chemical composition or fluid flow in smaller and deeper structures in the brain (Wang & Minor, 2008), but with compromises such as temporal resolution. weaker, restrictive application and higher costs. PET is an invasive method that uses radioactive agents and exposes subjects tested to radiation, its application to healthy subjects and for non-clinical studies being restricted (Shamoo, 2010).

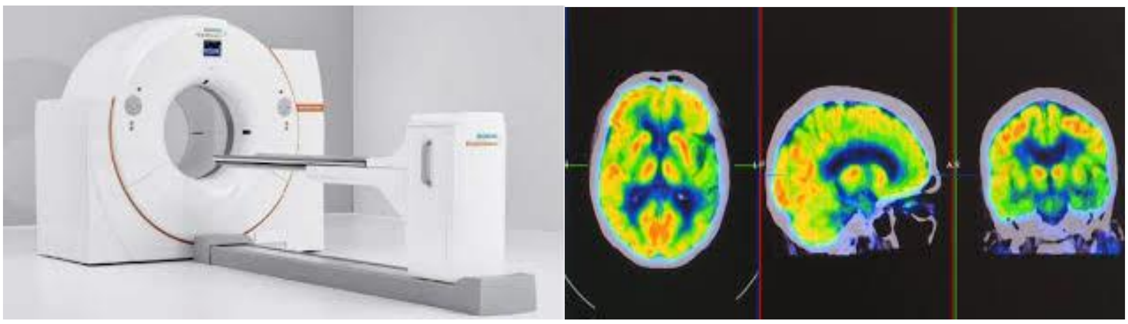

Fig. 6. Positron emission tomography equipment

4. Neuroscientific methods that record other physiological activities (respectively of the peripheral nervous system)

- **Electrocardiography/ ECG**

Electrocardiography (ECG) measures and records the electrical activity of the heart by placing external electrodes on the skin (Bercea, 2012). The signals of electrical activity are determined by the action potentials generated by individual cells and their sequence of activation, which can be influenced by cardiac and extracardiac factors.

Through this technology we can measure the emotional activation produced in a time interval that oscillates between a state of calm and a state of arousal (emotional activation) and the instantaneous increase of the emotional activation produced by a specific stimulus (emotional impact). ECG offers the possibility to obtain physiological responses that are less likely to be affected by prejudice, social desirability (Plassmann et.al., 2011). In addition, this technique is low cost and not very intrusive, and participants are comfortable with this technology.

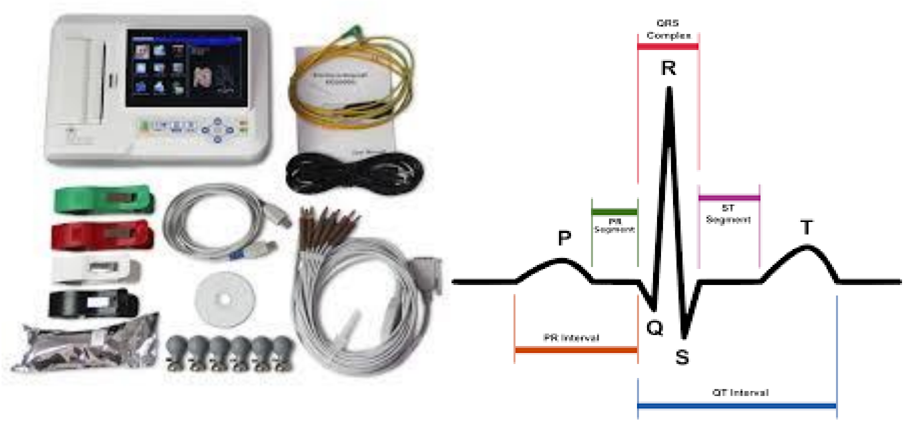

Fig. 7. Electrocardiography equipment

- **Facial electromyography (fEMG)**

Facial electromyography (fEMG) is a non-invasive method that measures and records the physiological properties of facial muscles, by detecting and amplifying small electrical impulses generated by muscle fibers when they encounter surface electrodes of EMG equipment (Ohme et al., 2011). This method can be used to test voluntary and involuntary facial muscle movements, to understand the conscious and unconscious expressions of emotions, in tested subjects. fEMG has the ability to detect and record changes in facial expressions, as any electrical impulse generated by facial muscle activity can be measured and recorded, with the use of equipment having a relatively low cost (Plassmann et.al, 2011).

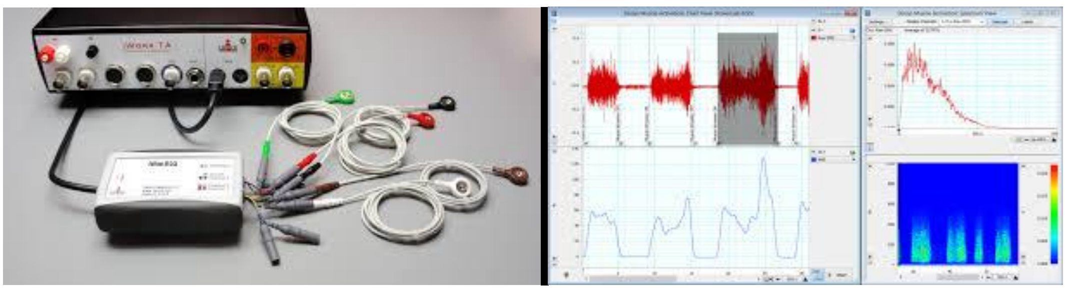

Fig. 8. Facial electromyography (fEMG) equipment

- **Face coding/ FC**

Facial coding (CF) technology is based on the facial action coding system, identifying 32 patterns of facial muscle activity. It measures and records the voluntary and involuntary movements of the facial muscles. The main difference from electromyography is that it is not necessary to place sensors on participants' faces, as a camera is responsible for recording facial microexpressions (voluntary and involuntary) associated with specific emotional and cognitive states, while participants are exposed to stimuli.

The biggest advantage of FC is that it is a cheap and portable technology, since it can be implemented with a webcam. However, facial coding loses its accuracy in measuring facial movements compared to EMG. FC is less intrusive, but also less accurate. Facial coding answers questions about the response rates of expressions, the percentage and even the type of positive and negative emotions that are expressed and measures the impact and attraction (intensity and valence).

Fig. 9. Face Coding/ FC equipment

- **Galvanic skin response/ GSR**

GSR (galvanic skin response) technologies are based on methods of measuring the reaction to different types of stimuli through the activity of the sweat glands present on the skin. GSR is the result of activity in the autonomic nervous system following informational, sensory or ideational stimulation, and its intensity can be measured by the degree of conductivity of the skin created by various sweating rates. As arousal increases, the stress response of the autonomic nervous system comes into play and adrenaline causes increased sweating, which is measured instantly.

GSR measures subtle changes in participants' skin perspiration when the skin becomes a better conductor of electricity, which may occur due to increased activity of the endocrine glands (sweating) after exposure to a physiologically stimulating stimulus (Ohme et al., 2011).

Skin conductance (SC) is a non-invasive method that exclusively measures the degree of emotional arousal and cannot provide any conclusive evidence of the validity of the emotional reaction.

Fig. 10. Galvanic Skin Response/ GSR equipment

- **Eye – tracking (ET)**

The eye-tracking (ET) method measures and records eye positions and movements using eye-tracker technology (eye tracking) (Vidal et al., 2012), using an optimal camera, video or with contact lenses, to identify the position cornea and pupil, using infrared light for corneal reflection. ET allows the identification and recording of focal points as they are exposed to stimuli. In other words, it follows the eye movements to identify the focus of the gaze on certain areas of impact and records the participants' gaze patterns, through the method of thermal maps (heat maps). The equipment records in detail what attracts the viewer's attention and how long it looks at each focus point, the data being recorded and reported on the sample.

Fig. 11. Eye – tracking equipment

Conclusions

Applying the basic knowledge of neuroscience in the human resource management means a real progress in improving HR performance, therefore neuromanagement consulting services can enable a positive change, lasting at the organizational level, which opens new perspectives, solid in terms of scientific view and facilitates the testing and validation of good management practices. The application of the discoveries in the field of neuromanagement and neuroleadership is necessary in the extremely dynamic and competitive organizational gear, considering their positive influence both on the individual performance, but also on the global organizational performance.

This article aims to adopt an integrated approach to knowledge research that explains the concept of neuromanagement and its applicability in HR, the methods used in this field, ethical issues and the contributions resulting from this practice, to identify the future role of neuromanagement, as a provider of new impulses for advancing science. management.

The study also aims to identify new ways to use the potential of neuromanagement techniques to increase the individual and global performance of organizations, Neuromanagement being a field of research in full swing, which is an alternative to traditional management methods and techniques.

The goal of neuromanagement is to adapt neuroscience theories and methods and combine them with management and leadership theories and methods and related disciplines to develop sound neuroscientific explanations of the impact of management on the behavior of target individuals. Indeed, neuromanagement, as a method of investigation, is important because it uses neuroscientific theories and methods to access new information, which we cannot access through traditional methods. Such information materializes by observing and analyzing neural processes, without requiring people to directly express thoughts, feelings, memories, evaluations, or decision-making strategies. The results can provide new ground for generating new management theories or complementing existing management theories and related disciplines.

References

1. *Ariely D, Berns GS (2010), Neuromarketing: the hope and hypeof neuroimaging in business. Nat Rev Neurosci 11:284–292.*
1. *Bercea, M. D. (2012). Anatomy of methodologies for measuring consumer behavior in neuromarketing research. Proceedings of the Lupcon Center for Business Research (LCBR) European Marketing Conference; August 9–10, 2012; Munich, Bavaria, Germany.*
2. *Braidot, N. P. (2008). Neuromanagement : cómo utilizar a pleno el cerebro en la conducción de organizaciones, Ed. Buenos Aires: Granica.*
3. *Ghadiri, A., Habermacher, A., & Peters, T. (2013). Neuroleadership: A journey through the brain for business leaders. Springer Science & Business Media.*
4. *Huettel S.A., Song A.W., McCarthy G. (2009b), Functional magnetic resonance imaging, 2nd edn. Sinauer, Sunderland.*
5. *Kable, J. W. (2011). The cognitive neuroscience toolkit for the neuroeconomist: A functional overview. Journal of Neuroscience, Psychology, and Economics, 4(2), 63–84.*
6. *Lim, W.M. (2018), Demystifying neuromarketing. J. Bus. Res. 2018, 91, 205–220.*
7. *Morin, A. (2011), Self-Awareness Part 2: Neuroanatomy and Importance of Inner Speech, Social and Personality Psychology Compass, 10.1111/j.1751-9004.2011.00410.x, **5**, 12, (1004-1017).*
8. *Ohme, R., Matukin, M., Pacula-Lesniak, B. (2011). Biometric measures for interactive advertising research. Journal of Interactive Advertising, 11(2), 60-72.*
9. *Plassmann, H., Feinberg C., Fred M., Shiv, B. (2010), Consumer Neuroscience, International Encyclopedia of Marketing, Jagdish Sheth and Naresh K. Malhotra, eds. Chichester, UK: John Wiley & Sons, 115–22.*
10. *Silberstein, R.B. (1995), Steady state visually evoked potentials, brain resonances and cognitive processes, Neocortical dynamics and human EEG rhythms. New York. Oxford University Press. 272-303. 34.*
11. *Shamoo, AE (2010), Ethical and regulatory challenges in psychophysiology and neuroscience-based technology for determining behavior. Account Res 17:8–29.*
12. *Wang, Y.J., Minor, M.S. (2008). Validity, Reliability and Applicability of Psychophysiolgical Techniques in Marketing Research. Psychology & Marketing, 25(2), 197-232.*
13. *Zurawicki, L. (2010). Neuromarketing, Exploring the Brain of the Consumer. (42-53). Berlin Heidelberg. Springer-Verlag.*
14. *Vidal, M., Turner, J., Bulling, A., & Gellersen, H. (2012). Wearable eye tracking for mental health monitoring. Computer Communications, 35(11), 1306-1311.*