NEUROSCIENCE TECHNIQUES IN HUMAN RESOURCE MANAGEMENT - AN OVERVIEW

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EXTENDED ABSTRACT

Purpose Neuroscience is increasingly being applied to management and organizations, giving rise to neuromanagement or organizational neuroscience. Scholars have called for integrating human resource management (HRM) with neuroscience methods to gain a deeper understanding of employee behavior and organizational phenomena (Becker and Menges, 2013; Waldman *et al.*, 2019). This extended abstract summarizes techniques that are applied in the neuro-HRM context. The purpose is to identify how these tools have been used to enhance understanding of HRM topics, more precisely recruitment, training, employee well-being, leadership, and teamwork, and to synthesize key findings. By addressing the question "what's going on in a person's head that makes them think or act the way they do?" in the workplace, this review sheds light on the potential of neuroscientific techniques to inform HRM practices. It aims to clarify the state of the art in neuro-HRM and demonstrate how measuring brain activity and other physiological responses can complement traditional HRM methods. Ultimately, the purpose is to highlight the current contributions and challenges of applying neuroscience in HRM and to identify opportunities for future research in this emerging interdisciplinary field.

Design/methodology/approach A systematic literature review was conducted to gather peer-reviewed studies at the intersection of neuroscience and HRM. We searched the Scopus database with no date restrictions for articles related to neuromanagement, focusing only on scientific, peer-reviewed articles. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines for identification, screening, and inclusion of studies (Moher *et al.*, 2016). After removing duplicates and unrelated papers, we obtained a final sample of 71 publications. Since this extended abstract refers to research in progress, in the next phases, we will expand with additional keywords in the search query related to neuroscience, organizations, management, and similar. Each article was analyzed to extract its research design, the neuroscience techniques used, the HRM domain or issue addressed, and key findings. We categorized the studies according to the major HRM functional areas of the employee life cycle. This methodological approach ensured that preliminary results are drawn from a broad evidence base of peer-reviewed sources, and the analysis distills common themes and outcomes across studies.

Findings Neuroscience techniques adopted in HRM research are diverse, ranging from brain-imaging methods to physiological and behavioral measurements. These tools have found a growing application as they enable capturing the employees' subconscious or involuntary responses, complementing traditional self-report surveys by providing physiological and neural

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data in real time (Waldman *et al.*, 2019). To begin with, electroencephalography (EEG) and related neurophysiological measures are the most frequently used techniques in organizational neuroscience studies, considering their appeal lies in their millisecond-level temporal resolution for tracking brain activity states like engagement or stress in real time (Zazon *et al.*, 2023). Functional magnetic resonance imaging (fMRI), with high spatial resolution, has also been applied, though less often, to map which brain regions are activated by managerial stimuli, mostly in the context of ethical dilemmas or leadership scenarios (Choi *et al.*, 2022). A newer portable imaging method, functional near-infrared spectroscopy (fNIRS), appears in a few studies to monitor cortical activity during tasks in more natural settings (Zhang *et al.*, 2021). In addition, several HRM studies incorporate eye-tracking (ET) technology, which records where and how long individuals direct their gaze. Eye-tracking is used to examine visual attention patterns, for instance, in how job candidates or employees scan information on career websites or during training materials (Mönke *et al.*, 2025). Similarly, facial expression analysis is employed to capture emotional responses either through software or sensors that detect subtle muscle movements (Su et al., 2021). These reflexive measures of gaze, pupil dilation, and facial cues provide a more objective direction in terms of individuals' reactions and affective states when exposed to HR-related stimuli. Furthermore, studies have used physiological sensors such as electrodermal activity (EDA) or galvanic skin response to gauge arousal and stress levels, heart rate or ECG for workload and stress, and even hormone levels in a few cases, although such measures are less common in HRM literature (Zito *et al.*, 2021). Some research incorporates behavioral response metrics like reaction time tests to infer cognitive processes and implicit biases relevant to HR decisions (Waldman *et al.*, 2019). Table 1 provides an overview of these neuroscientific techniques and their application in HRM literature.

Table 1: Neuroscientific techniques in human resource management, applications and key findings

Technique	Typical measures	HRM application areas	Illustrative findings
EEG	Brainwave activity (alpha, beta, theta) indicating attention, engagement, stress, mental workload	• Recruitment and selection • Training and learning • Leadership • Fatigue monitoring	• Detecting candidate stress peaks during interviews and identifies engaging discussion topics (Zito et al., 2021), • Tracking real-time attention and cognitive load during training sessions to optimize content delivery (Wang et al., 2021), • Revealing neural signatures of inspirational leadership (Waldman et al., 2019).
fMRI	Blood-oxygenation (BOLD) signals identifying activated brain regions	• Leadership • Decision-making • Employee ethics	• Maping neural correlates of moral reasoning and vision communication in leaders, highlighting activity in prefrontal and limbic regions (Balthazard et al., 2012).
fNIRS	Cortical oxygenation levels during naturalistic tasks	• Decision-making, • Workload monitoring	• Showing frontal cortex synchrony can predict team coordination quality under pressure (Zhang et al., 2021).
ET	Fixation duration,	• Recruitment (resume	• Revealing recruiter gaze patterns on resumes and candidate profiles,

	saccades, pupil dilation	screening and website design) • Training material evaluation	guiding layout optimization (Pina et al., 2023), • Detecting attention hotspots in e-learning interfaces (Mönke et al., 2025).
Facial expression analysis / facial EMG	Micro-expressions, muscle activation linked to discrete emotions	• Recruitment interviews • Employee engagement • Customer-service training	• Identifying subtle affective responses to interview questions or training stimuli, complementing self-report measures (Su et al., 2021).
EDA	Skin conductance reflecting arousal and stress	• Recruitment • Workload monitoring • Stress monitoring	• Capturing stress peaks during critical job-interview phases (Zito et al., 2021), • Signaling rising stress during back-to-back virtual meetings, supporting break scheduling (Becker & Menges, 2013).
Heart-rate/ECG and other peripheral sensors	Heart-rate variability, respiration	• Well-being • Fatigue detection	• Providing early warning of cognitive overload in safety-critical occupations (Caldwell et al., 2019).

(Source: Authors' work)

Still, across methods, threats to validity, generalizability, and laboratory bias persist. Some of these challenges stem from small samples, task artificiality, analytic flexibility, and over-interpretation of proxies, such as EEG indices of engagement, and EDA peaks as stress without behavioral triangulation (Massaro and Baljević, 2022). These concerns are widely noted in the literature and call for hypotheses' pre-registration, power and sensor justifications, and field validation beyond laboratory contexts (Radtke Caneppele *et al.*, 2022). Thus, recent works echo the lab-to-field gap, and portability promises for EEG/fNIRS and wearables, urging multi-site replications and explicit reporting of sensor quality and preprocessing choices (Radtke Caneppele *et al.*, 2022; Waldman *et al.*, 2019).

Originality/value This review is among the first to systematically map the neuroscience techniques applied in HRM and to integrate findings across recruitment, training, leadership, and well-being research. Its value lies in demonstrating how methods such as EEG, fMRI, fNIRS, eye-tracking, and physiological sensors can pinpoint subconscious drivers of employee behavior and provide evidence-based guidance for HR professionals and managers in general. Hence, the implications for managers and HR professionals point out that bio-signals can be applied as process-improvement decision support rather than individual gatekeeping. Illustratively, pilot eye-tracking and EDA can be used to redesign hiring UX and interview pacing, workload, and attention indicators can be utilized to pace training and coach teams, and employees' well-being can be monitored at the aggregate level to guide task rotation and recovery policies, coupled with performance and participant feedback (Awumey *et al.*, 2024; Mönke *et al.*, 2025; Wang *et al.*, 2021). To balance benefits with risks, strict ethical guardrails should be imposed by management to purpose limitation, obtain informed, revocable consent, vouch for local processing and short retention of data, implement role-based access and third-party audits, as well as ban covert use or disciplinary decisions based on physiology, to name a few (Hurley *et al.*, 2024). Considering this, the study extends HRM theory to the biological

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level of analysis while offering practitioners novel tools for improving employee experience and organizational effectiveness (Waldman *et al.*, 2019).

By consolidating scattered studies, the review identifies that some areas, like diversity management and employee satisfaction, remain underexplored, joining the call for increased multidisciplinary collaboration. Namely, we propose some future research trends: 1) field-based trials with mobile EEG or fNIRS and wearables inside authentic HR workflows like assessment centers, onboarding and recruitment stages, while evaluating downstream outcomes; 2) benchmark models across genders, age groups, cultures, and integrate subgroup performance to mitigate bias in physiological or affective inference; 3) longitudinal facial-EMG markers can be connected with job satisfaction and engagement trajectories for employees instead of just momentary states; 4) hyperscanning of EEG or fNIRS can be scaled in hybrid teams to test how inter-brain synchrony relates to psychological safety, adaptation, and performance under pressure (Wang *et al.*, 2021; Réveillé *et al.*, 2025; Massaro *et al.*, 2025).

Keywords: *Neuromanagement, Human resource management, Neuro-human resource management, Neuroscience techniques*

JEL classification: *M12, M54, O15*

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