

# FROM BRAIN TO BUSINESS: THE ROLE OF NEUROSCIENCE IN MARKETING, HR, AND FINANCE ALONG WITH ETHICAL ISSUES

Kriti Arya, Management Development Institute  
Vandana Bhardwaj, SDGI Global University  
Vandana Kumari, Banasthali Vidyapith, Rajasthan  
Divya Singh, KR Mangalam University, Gurgaon

## ABSTRACT

*The study intends to investigate the ever-evolving field of neuroscience and address ethical issues like privacy and manipulation, emphasizing its applications in consumer behavior analysis, advertising techniques, sustainable finance, and organizational practices. Research articles from the Wiley Online Library and Scopus databases were chosen for a systematic literature review that was carried out utilizing the PRISMA methodology. Mind map and Heat Map Analysis are used to analyse the study from different perspectives. By matching marketing to consumer values, neuromarketing greatly improves knowledge of customer preferences, advertising effectiveness, and sustainable financing practices. Emotional analytics and brain imaging are two methods that enhance advertising efforts and encourage moral investment. However, appropriate and transparent use is required due to ethical concerns about data privacy. In conclusion, the combination of marketing and neuroscience offers a profound understanding of consumer decision-making, improving marketing accuracy and supporting sustainable finance projects. The development and acceptance of the field depend on addressing ethical issues.*

**Keywords:** Neuroscience, Neuromarketing, Neurofinance, Human Resource, Ethical Challenges, Mindmap, Heat Map Analysis.

## INTRODUCTION

Neuroscience has evolved over the last 20 years from an academic theory to a useful instrument for enhancing business marketing plans. The term "neuromarketing," which was first used in the early 2000s, expands on previous studies on consumer psychology (Mehta, 2024). To better understand customer behavior and improve marketing accuracy, neuromarketing makes use of neuroscience tools such as fMRI and EEG (Sourov et.al.,2023). Although it provides valuable information for tailored approaches, it brings up moral questions of manipulation and mental privacy. Its responsible application requires an ethical mindset. (Goncalves et.al., 2024). Sustainable finance can be revolutionized by neuroscience, which uses AI and neuroimaging to reveal hidden investment and consumer motivations and promote morally sound, emotionally compelling solutions. However, because of privacy and manipulation concerns, accountable and transparent methods are necessary to guarantee autonomy, sustainability, and ethical integrity (Ahirwar & Singh 2025). It examines the brain mechanisms underlying consumer preferences, talks about its techniques and uses, raises moral questions, and projects its commercial future (Singh, et al. 2025). Businesses and academics throughout the world are becoming more interested

in neuromarketing, which combines marketing and neuroscience. Both developed and developing nations are contributing to this field of study (Kajla et al. 2024).

Table 1 LITERATURE REVIEW MATRIX				
Title	Author	Study focus	Methodology	Conclusion
“A review of AI cloud and edge sensors, methods, and applications for the recognition of emotional, affective, and physiological states”	Kaklauskas, A., Abraham, A., Ubarte, I., Kliukas, R., Luksaite, V., Binkyte-Veliene, A., ... & Kaklauskienė, L. (2022).	-human emotions and affective and physiological states -Plutchik's wheel of emotions -sensors	-Systematic review of AFFECT recognition using brain and biometric sensors. -sensors based on sensing area and real-world efficiency -Plutchik's wheel of emotions as a framework for emotional classification	-AFFECT recognition is a rapidly growing field with broad applications. -Brain and biometric sensors provide valuable insights but vary in efficiency and real-world implementation. -Nations with higher research output and citations on AFFECT recognition tend to show greater progress in innovation and technology.
“A study of neuromarketing techniques for proposing cost-effective information-driven decision-making framework”	Gill, R., & Singh, J. (2022).	-Neuromarketing -Consumer Behavior -Branding -Sustainable Marketing -Neurometric Data	-Comprehensive literature review on existing neuromarketing research -identify gaps in cost-effective neuromarketing frameworks. -new framework aimed at balancing performance and cost efficiency for advertisers.	-Neuromarketing understands consumer behavior and enhances business strategies. -lack an integrated framework for efficiently processing neurometric data. -cost-efficient neuromarketing framework is essential for advertisers -developing a new approach that ensures both high-performance and low-cost
“A Study on the Influence of Artificial Intelligence on Brain Plasticity with Reference to Consumer Behaviour and Workplace Dynamics”	Umashankar, K., & Charitra, H. G. (2024).	-Artificial Intelligence (AI) - Brain Plasticity -workplace dynamics -demographic factors	-extensive literature review to validate dimensions of neuromarketing and workplace dynamics influenced by AI. -Uses existing research to understand the moderating role	-AI adoption enhances neuromarketing strategies, strengthens brand loyalty -AI plays a crucial role in employee engagement and preventive stress management -AI in consumer and workplace strategies fosters both customer retention and employee well-being
“Analysing applications of	Bajaj, R., Ali Syed, A., &	-neuromarketing	-literature review of existing research -different neuromarketing	-valuable insights into consumer behavior through scientific analysis of brain

neuromarketing in efficacy of programmatic advertising”	Singh, S. (2024).	-programmatic advertising -consumer decision-making -neuromarketing techniques -brainwave activity -eye tracking - skin response -consumer reactions. -advertising effectiveness	techniques and their influence -how neuromarketing enhances programmatic advertising	activity. -increase customer base, market leadership, and brand loyalty -Programmatic advertising benefits significantly from neuromarketing
“Comparing Different Classifiers and Features for Electroencephalography-Based Product Preference Recognition”	Alnuman, N., Al-Nasser, S., & Yasin, O. (2024).	-Neuromarketing -Product preference -EEG,	-online EEG dataset from 25 users viewing 42 products with a 14-channel EEG system. -Extracted 21 EEG features from 1s windows over 4s of recorded signals -Identified best EEG features	-Temporal and frontal lobes showed the highest accuracy -The right frontal lobe was more dominant in decision-making -Findings support using EEG-based classification for neuromarketing applications
“Demystifying Neurotourism: An Interdisciplinary Approach and Research Agenda”	Lim, W. M. (2018)	-Neurotourism -Neuroscience -Neuromarketing -Tourist behavior	-Integrated knowledge inquiry approach -Content analysis -Thematic analysis	-Neuromarketing has the potential to drive new advancements -neuromarketing requires careful consideration and regulation. -The study clarifies key concepts and offers new research directions -Neuromarketing bridges the gap between theory and practice.
“EEG-Based Preference Classification for Neuromarketing Application”	Sourav, I. H., Ahmed, F. A., Opu, M. T. I., Mutasim, A. K., Bashar, M. R., Tipu, R. S., ... & Islam, M. K. (2023).	-EEG-based preference classification -Neuromarketing -Support Vector Machine (SVM) -K-Nearest Neighbor (KNN) -Feature extraction and selection	-Created an EEG dataset by recording responses -Evaluated accuracy, sensitivity, and channel performance of classifier -Analyzed data from frontal brain region electrodes for selective channel	-KNN classifier performed best for preference classification -frontal brain region electrodes showed superior performance
“Exploring the Dark Side of AI and Its	Bhardwaj, S., Jain, V., Mahapatra, D., &	-Artificial Intelligence (AI) -Consumer Emotions -Dark Side	-Total interpretive structural modeling (TISM) approach and MICMAC analysis. -Systematic literature review	-Adoption Challenges for AI -Issues with authenticity

Influence on Consumer Emotion”	Sindhvani, R. (2024).	-Service Industry -Ethical Concerns Technostress		-Problems with affective (emotional) -Moral conundrums -Human-Centric AI Design Is Required -Pay attention to privacy -Talk about ethical issues and cultural norms.
“Fostering Inclusivity for Children with Intellectual Disabilities through Data Protection by Design. European”	Hsu, L. R., & van der Hof, S. (2023).	- Intellectual Disabilities -Data Protection -GDPR -Inclusivity -Children's Rights -Online Safety	-Analyzes existing literature on digital risks faced by children with intellectual impairments. -Examines legal frameworks (GDPR) and their implications for child data protection. -Proposes practical measures to enhance online safety and accessibility for affected children.	-Children with intellectual disabilities face significant online risks due to cognitive limitations. -Data Protection by Design can help mitigate these risks by tailoring digital experiences to their needs -based interactive assistive tools for guidance and support.
“Harnessing Emotional Engagement for Success”	Mehta, 2024	· Neuromarketing · Neuroscience · Consumer behavior · EEG · MRI · Eye-tracking · Facial coding · Subconscious factors · Marketing strategies · Customer satisfaction	Quantitative Research	Consumer preferences and emotional reactions are revealed using EEG, MRI, eye tracking, and face coding techniques.
“Impact of neuromarketing applications on consumers”	Singh, S. (2020).	-Neuromarketing -Consumer Behavior -Online Retailing -Advertising Campaigns -Gaze Points -Fixation Counts -Heat Maps	-a stimuli-based instrument to measure the impact -eye-tracking, mouse tracking, and emotion measurement to analyze consumer reactions.	-Neuromarketing tools effectively measure the impact of advertising campaigns -Study is limited to certain tools -Future research should explore neuromarketing's impact on other marketing elements -neuromarketing's role in optimizing online advertising strategies.
“Intelligent neuromarketing framework for consumers' preference prediction from electroencephalography signals and eye	Mashrur, F. R., Rahman, K. M., Miya, M. T. I., Vaidyanathan, R., Anwar, S. F., Sarker, F., & Mamun, K. A. (2024).	· Neuromarketing · Consumer preference prediction · Electroencephalography (EEG) · Machine learning · Eye-tracking · Advertising stimuli	-participants in static ads from GrameenPhone Ltd. that include several elements (symbol, offer, and endorsement) -Responses to questionnaires using a seven-point Likert scale were gathered. -Support Vector Machine (SVM) with RBF kernel is used for preference classification, while SVM-based recursive feature	-With machine learning and EEG readings, ad preferences may be predicted with 96.97% accuracy. - Eye tracking shows that while recommendations increase preference, many endorsements have no beneficial effect. -The framework works well for applications

tracking”			elimination (SVM-RFE) is used for feature selection and hyperparameter adjustment.	involving cost-effective advertising.
“Intelligent systems and consumer neuroscience in the age of computational advertising”	Zámečník, R. (2024).	<ul style="list-style-type: none"> <li>-Intelligent systems</li> <li>-Consumer neuroscience</li> <li>-Computational advertising</li> <li>-Artificial intelligence</li> <li>-Ethical concerns</li> </ul>	<ul style="list-style-type: none"> <li>-systematic literature review</li> <li>-studies based on specified parameters</li> <li>-identifying intelligent systems and consumer neuroscience tools</li> </ul>	<ul style="list-style-type: none"> <li>-a variety of intelligent systems and neuroscience tools are already influencing all phases of the advertising lifecycle.</li> <li>-Computational advertising is rapidly evolving, integrating AI, VR, and neuroscience techniques.</li> <li>-Ethical challenges related to privacy, data security, and manipulation require further exploration.</li> <li>-The study fills a research gap by critically assessing these technologies and their ethical implications in advertising</li> </ul>
“Maximizing the Effectiveness of Anti-Smoking Campaigns With Targeted Framing Strategies: Evidence From Behavioral and Neurological Studies”	Ghods, H., Aghayari, M., Golbazi Mahdipour, A., Arabi Zanjani, R., Aghayari, H., Soparnot, R., & Bonyadi Naeini, A. (2024).	<ul style="list-style-type: none"> <li>-Anti-smoking campaigns</li> <li>-Message framing</li> <li>-Counterarguing responses</li> <li>-Neuroscientific methods</li> <li>-Ad effectiveness</li> </ul>	<ul style="list-style-type: none"> <li>-Used Electroencephalography (EEG) with 31 participants.</li> <li>-Measured how smoking behavior and message framing influence ad effectiveness.</li> </ul>	<ul style="list-style-type: none"> <li>-Smokers perceived anti-smoking ads as less effective</li> <li>-Message framing and smoking behavior significantly influenced neural responses in key brain regions.</li> <li>-Tailoring separate anti-smoking campaigns for smokers and non-smokers could improve effectiveness.</li> </ul>
“Neuro-signaling techniques in advertisement endorsements: Unveiling consumer responses and behavioral trends”	Adalarasu, K., Begum, K. G., Priyan, M. V., Devendranath, C., & Sriram, G. V. (2025).	<ul style="list-style-type: none"> <li>· Neuro-signaling techniques</li> <li>· Electroencephalography (EEG)</li> <li>· Neuromarketing</li> <li>· Advertisement effectiveness</li> <li>· Brain connectivity analysis</li> <li>· Consumer behavior</li> <li>· Emotional engagement</li> <li>· Brand Recall</li> <li>· Theta, beta, and gamma brain activity</li> </ul>	<ul style="list-style-type: none"> <li>· EEG Data Collection</li> <li>· Analysis was done using EEG Processing</li> <li>-ANOVA, post-hoc LSD for significance, and MATLAB for functional mapping</li> </ul>	Neuromarketing using EEG shows that emotionally engaging ads enhance memory, emotions, and purchase intent by activating key brain regions.
“Neurofinance Revolution: 5	Ahirwar & Singh, 2025	<ul style="list-style-type: none"> <li>· Neuromarketing</li> <li>· Sustainable Finance</li> </ul>	Qualitative method used	The term "neurofinance," which refers to the fusion of neuromarketing and

Emerging Technologies and Future Trends at the Intersection of Neuromarketing and Sustainable Finance”		<ul style="list-style-type: none"> <li>· Subconscious motivations</li> <li>· Green consumerism</li> <li>· ESG investing</li> <li>· Neuroimaging</li> <li>· AI-driven predictive modeling</li> <li>· Ethical preferences</li> <li>· Data privacy</li> <li>· Manipulation</li> <li>· Transparent practices</li> <li>· Ethical stewardship</li> <li>· Socially responsible</li> <li>· Sustainability goals</li> </ul>		sustainable finance, emphasizes ethical implementation to handle privacy concerns while utilizing technology such as EEG and AI to match consumer insights with ESG-focused investment strategies.
“Neuroimaging techniques in advertising research: Main applications, development, and brain regions and processes”	Alsharif, A. H., Salleh, N. Z. M., Baharun, R., Hashem E, A. R., Mansor, A. A., Ali, J., & Abbas, A. F. (2021).	<ul style="list-style-type: none"> <li>-Neuromarketing</li> <li>-Neuroimaging tools</li> <li>-Advertising research</li> <li>-Brain processes</li> <li>-Decision-making</li> <li>-Emotion</li> </ul>	<ul style="list-style-type: none"> <li>-Literature review and bibliometric analysis of existing research from 63 empirical and review articles (Web of Science database)</li> <li>-Analyzed the most commonly used neuroimaging techniques in advertising research.</li> </ul>	<ul style="list-style-type: none"> <li>-Identified four major neuroimaging techniques used in advertising studies</li> <li>Orbitofrontal cortex (OFC): Associated with positive and negative valence in decision-making.</li> <li>-Ventromedial &amp; dorsolateral prefrontal cortex: Crucial for decision-making processes.</li> <li>-Thalamus &amp; primary visual area: Involved in bottom-up attention processing</li> </ul>
“Neuromarketing algorithms’ consumer privacy and ethical considerations: challenges and opportunities”	Goncalves, M., Hu, Y., Aliagas, I., & Cerdá, L. M. (2024).	<ul style="list-style-type: none"> <li>-Neuromarketing</li> <li>-Consumer Privacy</li> <li>-Ethical Considerations</li> <li>-Artificial Intelligence</li> <li>-Machine Learning</li> <li>-GDPR Compliance</li> </ul>	<ul style="list-style-type: none"> <li>-Bibliometric analysis and a study of the literature.</li> <li>-Conducted semi-structured interviews and surveys with U.S. and Spanish professionals to gather empirical data.</li> <li>-Used a qualitative exploratory design and PRISMA (Applied Systematic Review Guidelines)</li> <li>-To guarantee analytical rigor, NVivo software was utilized for theme coding and analysis.</li> </ul>	<ul style="list-style-type: none"> <li>-AI and ML-powered neuromarketing provides insightful information</li> <li>-presents serious ethical and privacy issues.</li> <li>-Global regulatory frameworks are desperately needed to protect consumer rights.</li> <li>-Ethical and transparent business practices can aid in striking a balance between consumer welfare and technology improvements.</li> <li>-Fostering trust, accountability, and ethical openness in neuromarketing tactics is emphasized in policy recommendations.</li> </ul>
“Neuromarketing and Big Data Analysis of	Giannakopoulos, N. T., Sakas, D. P., &	<ul style="list-style-type: none"> <li>· Neuromarketing</li> <li>· Banking Firms</li> <li>· Big Data Analysis</li> <li>· Website Interface</li> </ul>	<ul style="list-style-type: none"> <li>-Quantitative analysis using correlation, linear regression &amp; ANOVA</li> <li>Data extracted through</li> </ul>	Banking organizations may improve user engagement, optimize website design, and boost

Banking Firms' Website Interfaces and Performance"	Migkos, S. P. (2024).	<ul style="list-style-type: none"> <li>· Digital Marketing Analytics</li> <li>· Customer Engagement</li> <li>· Decision Support System (DSS)</li> <li>· Website Performance Optimization</li> </ul>	Semrush -Eye-tracking & Heatmap Analysis and Scan-path Analysis	overall performance by combining neuromarketing and big data analytics.
"Neuromarketing and consumer behavior: A bibliometric analysis"	Kajla <i>et.al.</i> , 2024	Neuromarketing Neuroscience -Consumer behavior - Decision-making -Electroencephalography (EEG) -Functional magnetic resonance imaging (fMRI) -Emotional responses -Advertising strategies	PRISMA framework Bibliometrix and Vosviewer	Future studies will focus on emotions and narrative, as neuromarketing enhances insights into consumer responses.
"Neuromarketing and Sustainable Finance: Real-World Case Studies of Green Investment Promotions"	Balaji, 2025	<ul style="list-style-type: none"> <li>· Neuromarketing &amp; techniques</li> <li>· Sustainable Finance</li> <li>· Investor behavior</li> <li>· Green investments</li> <li>· Subconscious drivers</li> <li>· Green investment promotions</li> <li>· Brain imaging</li> <li>· Eye-tracking</li> <li>· Emotional analytics</li> <li>· Compelling messaging</li> <li>· Financial institutions</li> <li>· Sustainable development</li> </ul>	Qualitative research by using various Case studies	By using strategies like brain imaging, eye tracking, and emotional analytics to affect subconscious investor behavior, neuromarketing promotes green investments.
"Neuromarketing Unveiled: Decoding the Science Behind Consumer Choices"	Singh <i>et.al.</i> , 2025	<ul style="list-style-type: none"> <li>· Neural substrates</li> <li>· Decision-making processes</li> <li>· Psychological mechanisms</li> <li>· Consumer preferences</li> <li>· Neuromarketing</li> <li>· Neuroscience</li> <li>· Neural mechanisms</li> <li>· Psychological factors</li> </ul>	Qualitative analysis	Neuromarketing addresses ethical and upcoming business trends by revealing the brain underpinnings of customer decisions.
"Organizational Cognitive Neuroscience: A New Frontier for Magnetoencephalography"	Braeutigam, S., Lee, N., & Senior, C. (2019).	<ul style="list-style-type: none"> <li>· Organizational Cognitive Neuroscience (OCN)</li> <li>· Magnetoencephalography (MEG)</li> <li>· Neuroeconomics</li> <li>· Workplace Behavior</li> <li>· Leadership Styles</li> <li>· Employee Engagement</li> <li>· Brain Activity in Organizations</li> <li>· Ethical Considerations in Neuroscience</li> </ul>	<ul style="list-style-type: none"> <li>-Focuses on the advantages of MEG, a noninvasive technique research.</li> <li>-management and organizational behavior studies.</li> <li>-neuroscience in business and decision-making research.</li> </ul>	<ul style="list-style-type: none"> <li>-potential of MEG as a valuable tool in organizational cognitive neuroscience.</li> <li>-the importance of ethical considerations for both neuroscientists and management scholars.</li> <li>-neuroscience with management studies can provide deeper insights into workplace behavior and decision-making.</li> </ul>



		<ul style="list-style-type: none"> <li>· Neural Mechanisms of Leadership</li> <li>· Neuroscientific Methods in Management</li> </ul>		
“Predicting consumer ad preferences : Leveraging a machine learning approach for EDA and FEA neurophysiological metrics”	Marques, J. A. L., Neto, A. C., Silva, S. C., & Bigne, E. (2025).	<ul style="list-style-type: none"> <li>-consumer preferences</li> <li>-Electrodermal activity (EDA)</li> <li>-Facial Expression Analysis (FEA)</li> <li>-physiological features</li> </ul>	<ul style="list-style-type: none"> <li>-statistical module using inferential and exploratory analysis</li> <li>-AI-based system using machine learning techniques such as k-Nearest Neighbors, Support Vector Machine (SVM), and Random Forest (RF).</li> <li>-Explainable AI module</li> </ul>	<ul style="list-style-type: none"> <li>-AI-driven EDA and FEA-based models can effectively predict consumer ad preferences</li> <li>-Random Forest (RF) proves to be the most efficient technique for ad preference</li> <li>-use of intelligent systems as practical tools for marketing specialists, enhancing targeted advertising strategies</li> </ul>
“Reconsidering the path for neural and physiological methods in consumer psychology”	Clithero, J. A., Karmarkar, U. R., Nave, G., & Plassmann, H. (2024).	<ul style="list-style-type: none"> <li>· Consumer neuroscience</li> <li>· Neural and physiological methods</li> <li>· Consumer psychology</li> <li>· Decision-making processes</li> <li>· Sensory perception and memory</li> <li>· Gaze spots</li> <li>· Emotions</li> <li>· Stimuli response</li> </ul>	<ul style="list-style-type: none"> <li>· Neuroimaging (EEG, fMRI)</li> <li>· Physiological measures (heart rate, skin conductance, hormonal levels)</li> <li>· Multivariate brain activity patterns</li> <li>· Conceptual framework applications</li> <li>· Behavioral studies</li> </ul>	<ul style="list-style-type: none"> <li>-Neuroscience integration for comprehensive consumer insights</li> <li>-Increasing comprehension of consumer psychology by bridging levels of analysis</li> <li>-Suggestions for implementing more comprehensive neural tools</li> <li>-Prioritizing multidisciplinary research</li> <li>-Overcoming obstacles in the implementation of consumer neuroscience</li> </ul>
“Sustainable Finance Meets Neuromarketing: A New Approach to Addressing Environmental Challenges”	Kundra & Hussain, (2025).	<ul style="list-style-type: none"> <li>· Sustainable Finance</li> <li>· Neuromarketing</li> <li>· Environmental challenges</li> <li>· Consumer decision-making</li> <li>· Green investment strategies</li> <li>· Consumer behavior</li> <li>· Brain science</li> <li>· Environmental responsibility</li> <li>· Ethical investing</li> <li>· ESG criteria</li> <li>· Behavioral insights</li> <li>· Business sector</li> </ul>	Qualitative research	Leveraging neuromarketing provides a potent instrument to advance environmentally conscious company practices and sustainable finance.
“The application of neuromarketing tools in communication”	Casado-Aranda, L. A., Sánchez-Fernández, J., Bigne,	<ul style="list-style-type: none"> <li>- Neuromarketing</li> <li>-Communication Research</li> <li>-Advertising</li> <li>-Consumer Neuroscience</li> <li>-Brain Imaging Tools</li> </ul>	<ul style="list-style-type: none"> <li>-Keyword co-occurrence analysis and science mapping tools.</li> <li>-Performance analysis to track publication growth</li> </ul>	Neuromarketing research has seen strong growth over the last decade but experienced a slight decline.

tion research: A comprehensive review of trends”	E., & Smids, A. (2023).	-Persuasion	-Examined citation trends across business, communication, psychology, and neuroimaging	Key emerging research areas include brain imaging for ad persuasion in virtual environments, social marketing (e.g., health, sustainability), neural synchronization metrics, and deep learning for data analysis.
“The hope and hype of neuromarketing: a bibliometric analysis”	Siddique, J., Shamim, A., Nawaz, M., & Abid, M. F. (2023).	Neuromarketing Emotions EEG Consumer behaviour Eye Tracking	-Bibliometric analysis of 463 neuromarketing-related documents. -Web of Science database covering 2006–2021. -VOS Viewer software used for graphical visualization of data.	-EEG is the most widely used tool in neuromarketing research -Emotions" emerged as a central theme in neuromarketing studies.
“The impact of neuromarketing on consumer behavior”	Ismajli, A., Ziberi, B., & Metushi, A. (2022)	-Neuromarketing -Preference -Perception -Consumer Behavior -Decision-Making	-Questionnaire as the primary data collection method -Focuses on factors influencing consumer choices when selecting products -Reviews existing literature on consumer decision-making and neuromarketing	-Neuromarketing helps companies understand and predict consumer preferences -effectiveness of marketing strategies by providing insights into consumer behavior. -Businesses should integrate neuromarketing techniques
“The social impact of clinical tools for neuromarketing research: Possible applications for the wine sector”	Festa, G., Pjero, E., & Feoli, S. (2022).	· Healthcare Marketing · Consumer engagement · AI-driven stimuli · Ethical concerns · Non-invasive tools · Eye-tracking · Emotional responses · Cognitive engagement · Digital marketing · Patient communication · Responsible marketing · Gender-sensitive approaches	-Survey tools include clinical tool (EEG, EMG, GSR, HRV., MRI & MRT) and nonclinical tools (Eye tracking & face reading)	Neuromarketing in healthcare enhances engagement but requires ethical, non-invasive approaches for responsible application.
“Two decades of research on "masstige" marketing: A systematic literature review and future research agenda”	Chaurasia, M., Kumar, A., & Panda, R. K. (2024).	· Neuromarketing · Neuroscience · Consumer behavior & decision making · Brain responses · Marketing strategies	Systematic literature review of 75 neuromarketing articles. SPAR-4 & TCCM framework applied	Neuromarketing research is flourishing in both developed countries and developing countries.

“Using neural data to forecast aggregate consumer behavior in neuromarketing: Theory, metrics, progress, and outlook”	Yao, X., & Wang, Y. (2024).	<ul style="list-style-type: none"> <li>-Neuroforecasting</li> <li>-Neuromarketing</li> <li>-Consumer Choice Prediction</li> <li>-Aggregate Behavior</li> <li>-Neural Data</li> <li>-Affect-Integration-Motivation Framework</li> <li>-Frontal Asymmetry</li> </ul>	<ul style="list-style-type: none"> <li>-Systematic review of existing research on neuro forecasting</li> <li>-key findings from theoretical models and empirical studies.</li> </ul>	<ul style="list-style-type: none"> <li>-Neuroforecasting offers effective predictions of consumer behavior and deeper insights into preferences</li> <li>-High costs, small sample sizes, ecological validity concerns, and challenges with reverse inference.</li> <li>-diverse data types with machine learning for better forecasting.</li> </ul>
“Value-based marketing: Examining the role of leadership support in promoting neuromarketing”	Chatterjee <i>et.al.</i> (2023)	<ul style="list-style-type: none"> <li>· Neuromarketing</li> <li>· Leadership support</li> <li>· Customer loyalty</li> <li>· Business Value</li> <li>· Marketing performance</li> <li>· Competitive advantage</li> <li>· Marketing departments</li> <li>· Firm support</li> </ul>	<ul style="list-style-type: none"> <li>-Empirical study of 372 employees in marketing departments in different organizations</li> <li>-CB-SEM technique used to analyze data</li> </ul>	For neuromarketing to be implemented successfully and to increase consumer loyalty, corporate value, and competitive advantage, leadership support is essential.
“War For Talents Meets Facial Expression-leveraging recruiting videos in professional service firms”	Etzold, V., Wanner, T., & Butz, L. (2020)	<ul style="list-style-type: none"> <li>· Neuromarketing</li> <li>· Talent Acquisition</li> <li>· Facial Expression Analysis</li> <li>· Emotional Response</li> <li>· Recruiting Videos</li> <li>· Employer Branding</li> <li>· Candidate Engagement</li> <li>· Eye Tracking</li> <li>· Job Perception</li> <li>· Emotional Appeal in Recruitment</li> <li>· Digital Recruitment Strategies</li> <li>· Workplace Transparency</li> <li>· Employee Experience Optimization</li> </ul>	<ul style="list-style-type: none"> <li>-Facial expression analysis using NViso software</li> <li>-Pre &amp; post questionnaire study</li> <li>-Emotional analysis using Paul Ekman’s Facial Action Coding System (FACS).</li> <li>-Data of Implicit (neuromarketing-based) emotional responses vs. Explicit (survey-based) perceptions compared.</li> </ul>	By exposing unconscious biases, neuromarketing aids in improving hiring practices.

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## REVIEW OF LITERATURE

The review of literature is based on descriptive semi-thematic analysis, which is represented in a Matrix structure. The papers were selected based on the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework shown in the study:

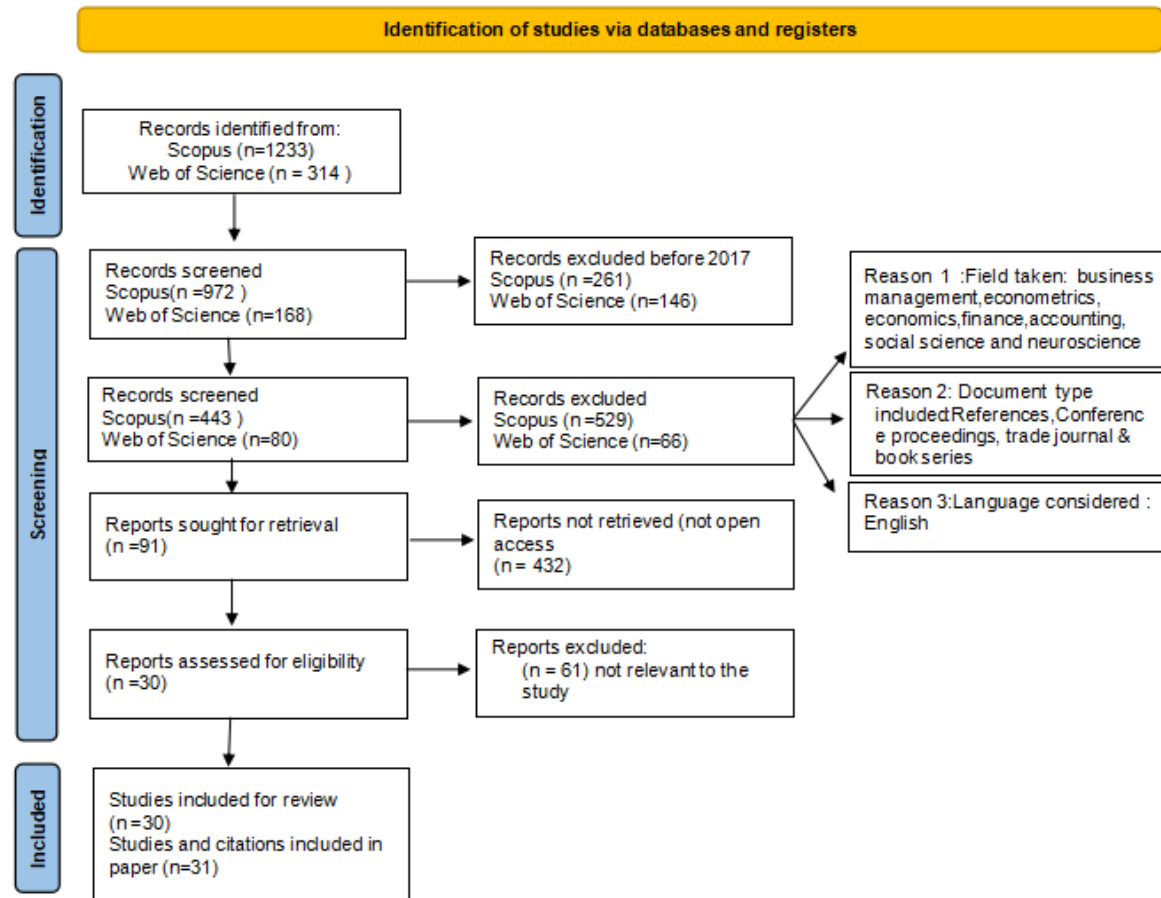
## RESEARCH OBJECTIVES

The following are the objectives of the study:

- 1) Examine how customer behavior, marketing tactics, and decision-making are affected by neuromarketing tools (eye tracking, brain imaging, emotional analytics).
- 2) Study how neuroscience, through cognitive and emotional insights, might improve HRM procedures including hiring, employee engagement, and leadership development.
- 3) Investigate how neurofinance might be used to encourage sustainable investing by addressing ethical issues with data privacy and transparency and matching financial products with customer values.

## RESEARCH METHODOLOGY

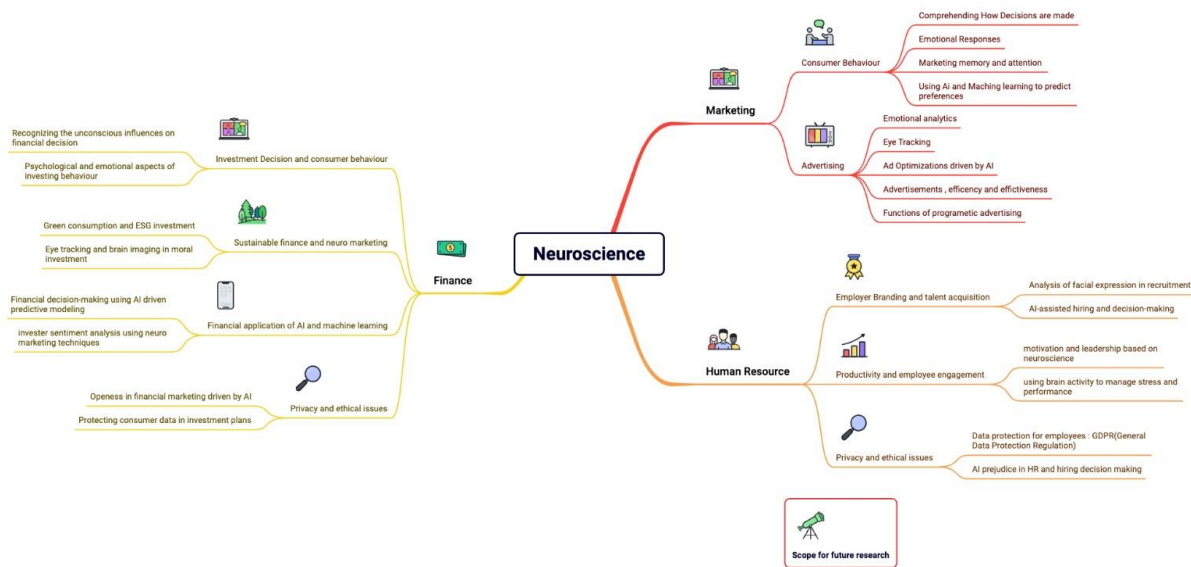
The study is based on systematic literature review of research papers, chapters, and articles. The literature is selected using PRISMA technique (Page et al. 2020). Two databases are used to select relevant papers, ie., from Wiley online library and Scopus Figures 1 & 2.



**FIGURE1**  
**PRISMA FLOWCHART (PAGE ET AL, 2020)**

Two different databases were used to extract papers for the review: Scopus database and Web of Science(WoS). A total of 1547 papers were found. The data was searched using boolean as “Neurscience\*” AND “Marketing” OR “Neuromarketing” AND “Human Resource Management” OR “HR” AND “Finance\*”. Papers were selected on the basis of field” business manegement,econometrics,economics,finance,accounting,social science and neuroscience. All types of research papers including book series, conference proceedings and trade journals were included. Papers in English language were selected. Some of the papers were not retrievable. After applying these filters, a total of 91 papers were left for assessment. In these papers, 61 papers were found to be irrelevant for the study. So, finally 30 papers were included for the reviewing and one paper/citation was used for PRISMA framework.

## Findings



Presented with xmind AI

**FIGURE 2**  
**MIND MAP REPRESENTATION OF THE STUDY (AUTHOR'S OWN)**

## Neuroscience in Marketing: “Neuromarketing”

The application of brain research, such as eye tracking, in neuromarketing, helps to forecast customer behavior and enhance advertising (Bajaj, et al. 2024; Siddique, Shamim, and Abid, 2023). The advancement of neuromarketing through neuroscience and psychophysiology for improved customer understanding is the main topic of Casado et al. (2023). Its function in assessing brain activity to efficiently satisfy client wants is confirmed by Ismajli, Ziberi, and Metushi (2022).



**FIGURE 3**  
**WORD CLOUD (AUTHOR'S OWN)**

## Neuromarketing & Consumer Behaviour

Neuromarketing determines the demands and preferences of customers. It examines how the brain works and how consumers perceive products when making judgments (Ismajli *et.al.*,2022). Neuromarketing helps in analyzing brain signals to refine marketing strategies and consumer insights (Kajla *et al.*,2024). Neuro-forecasting is a method that helps to concentrate on predicting the overall preferences and motivational structure of the clientele (Yao & Wang, 2024). Consumer decision-making varies based on brain responses to advertisements (Clithero *et al.*,2024). Neuromarketing identifies consumer needs by analyzing brain activity and product perception (Ismajli, Ziberi & Metushi,2022). The gaze patterns, fixation counts, and emotional reactions are studied for online ads. These factors influence purchasing decisions and consumer preferences (Clithero *et al.*,2024). By analyzing images and videos and combining facial expression and eye tracking to improve emotion recognition, neuromarketing techniques (eg. Fnris) help marketers make better decisions and plan their marketing strategies (Gill & Singh, 2022). Through content personalization, enhanced emotional engagement, and the use of gamification, narrative, and interactive graphics to increase brand connection, memory recall, and loyalty, artificial intelligence (AI) and digital experiences influence the relationship between neuromarketing and consumer behavior (Umashankar & Charitra,2024)

### **Neuromarketing in Concern with Advertisement**

Neuromarketing enhances programmatic advertising by analyzing consumer responses to understand preferences and influence decision-making (Bajaj, Ali & Singh, 2024). Ad effectiveness is shaped by important elements that affect consumers' mental health, including emotions, perception, motivation, memory, and attention (Alsharif *et al.*, 2024). By evaluating attention, engagement, delight, and disgust, methods such as Electrodermal Activity (EDA) and Facial Expression Analysis (FEA) can predict consumer ad choices with 81% accuracy (Marques *et al.*, 2025). Nonprofit advertisements gain from emotional and cognitive engagement, whereas celebrity, jingle, and humor advertisements increase remember and buy intent (Martinez *et al.*, 2022; Adalarasu *et al.*, 2025). Incorporating neuromarketing into contemporary marketing requires a reasonably priced neurometric framework (Gill & Singh, 2022). Because smokers' distinct EEG patterns make them less receptive to anti-smoking advertisements, customized neuroimaging-based advertisements are essential (Ghods *et al.*, 2024). While AI, VR, and neuroscience enhance ad targeting by resolving data usage and transparency concerns (Zámečník, 2024; Hsu *et al.*, 2023), neuromarketing's varied techniques and ethical challenges continue to change marketing research (Lim, 2018).

### **Neuroscience in Organizations (Human Resource Management): “Organisational Neuroscience/Neuro-HR”**

Businesses can better understand consumer preferences and increase satisfaction by utilizing neuroscience (Ismajli, Ziberi & Metushi, 2022). Addressing ethical issues and examining consumer behavior, emotions, and product positioning, improves corporate strategies (Bhardwaj *et al.*,2024). Neuromarketing's promise for real-time consumer insights and strategic decision-making is supported by the great accuracy with which EEG data has been utilized to predict product preferences (Alnuman *et al.*, 2024). With an emphasis on ethical sustainability, Festa *et al.* (2022) emphasized the rise of neuroscience in healthcare, which is being propelled by digital marketing and non-invasive techniques like eye tracking. While AI-generated material improves health messaging through attention and emotional engagement, highlighting gender-sensitive

techniques, EEG signals are analyzed to differentiate cognitive and affective reactions in healthcare fundraising (Balafas *et al.*, 2024).

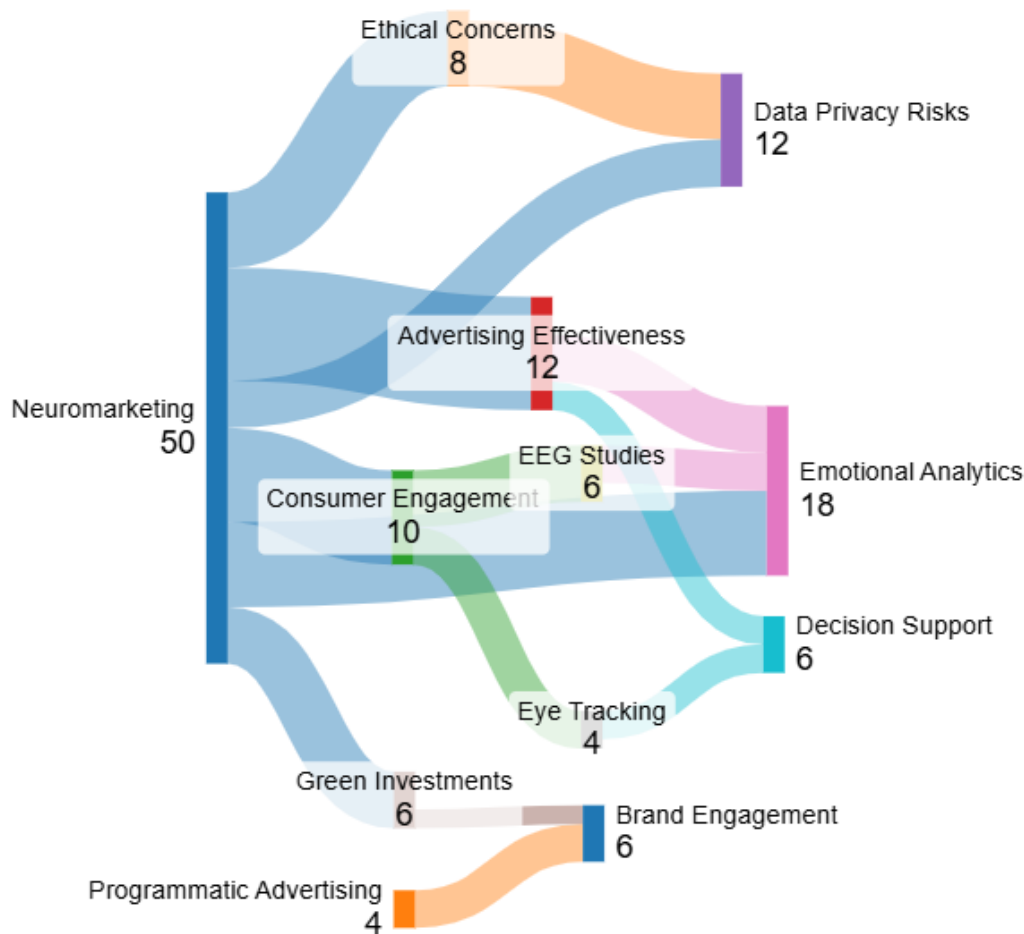
While AI-generated material improves health messaging through attention and emotional engagement, highlighting gender-sensitive techniques (Lyulyov *et al.*, 2024), EEG signals are analyzed to differentiate cognitive and affective reactions in healthcare fundraising (Balafas *et al.*, 2024). By combining neuromarketing and big data analytics, hybrid approaches can be used to enhance organizational performance and website interfaces (Giannakopoulos *et al.*, 2024). Deeper consumer insights can be obtained by combining conventional and neuroscience-based approaches (Hsu *et al.*, 2023). To advance neuroscience in organizations and improve competitive advantage, corporate value, and customer loyalty, strong leadership support is necessary (Chatterjee *et al.*, 2023). Facial expression analysis is one way that neuroscience plays a big part in talent acquisition (Kaklauskas *et al.*, 2022). As a result, it influences employer branding and enhances hiring practices (Koochang *et al.*, 2023). Organizational Cognitive Neuroscience (OCN) was presented by Braeutigam *et al.* (2019) as a promising field for researching behavior, leadership, and decision-making in the workplace. MEG is driving research improvements in OCN while highlighting ethical considerations for responsible implementation.

### **Neuroscience and Finance: “Neurofinance”**

Consumer neuropsychology, neuromarketing, and ethical finance shape sustainable investing (Ahirwar & Singh, 2025). Techniques like eye tracking, fMRI, and EEG reveal that ethically branded products activate reward-related brain regions, linking sustainability to personal fulfillment. These insights help financial firms create investment products that align with consumers' unconscious values and ESG criteria.

Through the use of brain research to sway consumer decisions, the promotion of green investment techniques, and the strengthening of corporate environmental responsibility, neuromarketing and sustainable finance combine to encourage environmentally conscious investments (Kundra & Hussain, 2025; Balaji, 2025).





**FIGURE 4**  
**VISUAL ANALYSIS OF THEMES, METHODOLOGIES, AND OUTCOMES**  
**(AUTHOR'S OWN)**

The Sankey diagram graphically illustrates the complex connections between the main research topics, approaches, and findings found in the literature on consumer behavior and neuromarketing. The above diagram is made through SankyMATIC. Each flow line's width provides information about the prominence of particular linkages by indicating the frequency and strength of connections between nodes. The focus is on "Neuromarketing," which has a close connection to important subjects like "Ethical Concerns," "Consumer Engagement," and "Advertising Effectiveness." These links demonstrate the field's twin emphasis on utilizing neuroscience to improve marketing tactics and resolve moral dilemmas. The transitions between "Ethical Concerns" and "Data Privacy Risks" highlight the continuous discussion about privacy and the moral ramifications of neuromarketing techniques. The connections between "Consumer Engagement" and cutting-edge methods like "Eye Tracking" and "EEG Studies" highlight how important they are for comprehending unspoken customer reactions. Similarly, the correlations between "Emotional Analytics" and "Advertising Effectiveness" suggest that using emotional insights to create compelling marketing efforts is becoming more and more common. Notably, weaker correlations, like those about "Green Investments" and "Brand Engagement," point to new directions that need investigation, especially when it comes to fusing sustainability with

neuromarketing techniques. As a result, this graphic facilitates the mapping of current research contributions and the identification of possible research gaps.

## DISCUSSION

Neuromarketing offers insights into customer behavior by exposing unconscious decision-making processes through the use of cutting-edge brain research techniques including EEG, eye tracking, and skin response. It improves marketing tactics by examining emotional, attentional, and memory reactions, especially in online shopping and advertising. AI and digital experiences combined with neuromarketing produce individualized and emotionally compelling advertising. Green investments and ethical goods are also encouraged by their use in sustainable finance. To strengthen customer relationships for organizations, future developments in neuromarketing will rely on additional empirical research, technological breakthroughs, and ethical considerations.

Table 2 HEAT MAP ANALYSIS (AUTHOR'S OWN)			
Category	Benefits	Challenges	Opportunities
Technology Adoption	5	4	5
User Experience & Engagement	4	3	4
Data Management	4	5	5
Scalability & Performance	5	4	5
Ethical & Regulatory Concerns	3	5	4

On a scale of 1 to 5, the heat map rates the important elements impacting a system or technology in three areas: Benefits, Challenges, and Opportunities. Although moderate obstacles (4) indicate some implementation barriers, Technology Adoption ranks highly in both Benefits (5) and Opportunities (5), showing its great present and future influence. The need for more improvements is highlighted by the fact that User Experience & Engagement face significant obstacles (3) but also exhibit moderate benefits (4) and future potential (4). The complexity of managing data properly is shown by the fact that Data Management poses substantial obstacles (5), even in the face of substantial advantages (4) and promising prospects (5). While moderate limitations (4) point to technical obstacles, Scalability & Performance reflects Technology Adoption with high advantages (5) and future potential (5). Finally, the greatest difficulty (5) is presented by Ethical & Regulatory Concerns, which also show moderate advantages (3) and future scope (4), suggesting the necessity for regulatory developments. For strategic decision-making, this heat map offers an organized summary of the company's advantages, disadvantages, and potential growth regions.

To better understand customer behavior and emotional involvement, future neuromarketing research will also make use of cutting-edge neuroscientific technology such as fMRI, EEG, and eye tracking. Cultural disparities, gender-based marketing, and ethical consumerism are important research topics. Through OCN, insights into employee dynamics and leadership may be useful for organizational policies. Personalized marketing is made possible by the incorporation of AI-driven analytics, which also improves practicality. Furthermore, researching neuromarketing's application in social media and digital marketing as well as moral issues like trust and privacy will be essential to its advancement.

## CONCLUSION

The integration of neuroscience into marketing, human resource management, and finance offers transformative potential for businesses. Deep insights into customer behavior are provided by neuromarketing methods such as EEG, eye tracking, and emotional analytics, which improve advertising strategies by creating emotionally compelling and customized campaigns. By examining cognitive and emotional reactions, enhancing recruitment tactics, and creating a good work atmosphere, neuroscience in human resource management supports talent acquisition, employee engagement, and leadership development. Neurofinance is a branch of finance that uses brain science to support sustainable investments by matching financial goods to users' ESG standards and ethical beliefs. Neuroscience has a bright future in marketing, human resources, and finance. AI and cutting-edge neuroimaging can be combined in marketing research to provide real-time customer insights, cross-cultural research, and tailored advertising. Organizational cognitive neuroscience can help HR with digital recruitment, employee well-being, and leadership. Opportunities to research ethical finance, AI-driven financial products, and brain-based investment behavior are presented by neurofinance. For these industries to flourish sustainably, ethical issues like data privacy and legal frameworks will be major areas of concern.

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