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Neuromarketing in Consumer Behaviour: Insights into B2C Purchasing Decisions.

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ABSTRACT
Neuromarketing integrates neuroscience tools to uncover subconscious drivers of B2C purchasing decisions in digital environments. Despite growing interest, limited frameworks connect neuromarketing insights with digital marketing strategies, particularly in emerging markets. This PRISMA-guided systematic review (2018–2025) synthesizes 30 high-quality studies from Scopus and Web of Science. It examines the evolution of EEG, fMRI, eye-tracking, and biometric techniques, their predictive validity for attention, emotion, and purchase intention, and integration with AI-driven personalization. Findings reveal EEG's dominance for scalable emotional engagement, machine-learning enhancements for prediction accuracy (70–85 %), and persistent gaps in emerging-market adaptation, ROI demonstration, and ethical governance. The study proposes a conceptual Neuromarketing-Digital Personalization Framework (integrating AIM, RBV, and TAM) that links neural biomarkers to consumer journey stages. Theoretical contributions extend dual-process and prospect theories; managerial implications guide ethical, culturally sensitive digital campaigns. Limitations and future empirical directions in emerging economies are discussed..

Keywords: Neuromarketing, Digital Marketing Strategy, B2C, Personalization, Consumer Engagement, Business Models.

INTRODUCTION:

Neuromarketing is an interesting field that brings together neuroscience, psychology, and marketing. It uses safe, non-invasive tools like electroencephalography (EEG), functional magnetic resonance imaging (fMRI), eye-tracking, galvanic skin response (GSR), and facial coding to understand what is happening in the consumer's mind below the level of conscious thought. Traditional methods such as surveys or interviews often miss these hidden feelings and thoughts because people may not be fully aware of them or may not express them honestly (Plassmann et al., 2018; Alsharif et al., 2025). These advanced tools help us see the brain's real reactions—such as attention, emotions, sense of reward, and decision-making processes. As a result, marketers can predict customer likes, dislikes, and buying intentions much more accurately than with simple questionnaires (Venkatraman et al., 2019; Wang et al., 2024).

The global market for neuromarketing is growing steadily. In 2025–2026, it was valued at around USD 1.71 to 1.83 billion. Experts project that by 2031–2035, it will reach USD 2.53 to 3.68 billion, with a compound annual growth rate (CAGR) of 6.76% to 8.9% (Mordor Intelligence, 2026; Research Nester, 2025). This fast growth comes from new improvements in technology. Portable EEG devices are now small, easy to use, and affordable. Artificial intelligence (AI) helps analyse the data quickly and accurately. Immersive testing setups, like virtual reality, also make studies more realistic. All these changes allow neuromarketing to fit well into digital platforms such as e-commerce websites, social media, and automatic advertising systems (Alvino et al., 2020; Zhang et al., 2023). In B2C markets, where customers often browse quickly and pay little attention online, neuromarketing uncovers the real emotional and thinking factors that drive sudden buys, brand love, and higher sales conversions (Cherubino et al., 2019; Alsharif et al., 2025). For example, in India and other fast-growing digital markets, where most people shop on mobiles, these tools help companies create ads and websites that truly connect with local customers.

Even with this progress, there are still some important gaps continue to persist. Most neuromarketing studies are done undertaken in North America and Western Europe. Very few focus on emerging markets like India, other parts of Asia, Africa, or Latin America. These regions have special features: people mostly use mobiles for shopping, cultures are often collectivist (group opinions matter a lot), prices affect decisions strongly, and trust in online platforms varies (Kshetri, 2021; Gupta, 2025). Research needs to adapt to these differences so that findings are useful everywhere.

Another gap is the lack of full frameworks that connect neuromarketing insights to the complete customer journey— - right from first seeing an ad, all the way to becoming a loyal buyer and a brand ambassador. This is especially needed in high-growth areas like Asia, Africa, and Latin America, where digital shopping is expanding rapidly (Bashar, 2026). Also, while combining EEG data with machine learning gives good prediction results (accuracies of 70–85%), many ethical questions remain open. These include how to protect private brain data, avoid manipulation, and create proper rules and regulations (Wiles & Danielova, 2020; Chawla, 2026). In countries like India, laws like the Digital Personal Data Protection (DPDP) Act, 2023 offer protection to consumers but where data privacy laws are are still in a

nascent stage and are developingevolving. Therefore, , tthese concerns become even more serious.

This review paper tries to fill these gaps through a systematic approach using PRISMA guidelines. It carefully collects and analyses recent studies from 2018 to 2025. The main focus is on how neuromarketing tools have developed over time, how well they predict customer behaviour in digital B2C settings, and how they can be adjusted for emerging markets. By looking at these areas critically, the paper aims to give a clear picture of where neuromarketing stands today and what opportunities exist for the future— - especially in places like India, where digital growth is fast accelerated, and consumer minds are shaped by unique cultural and economic factors.

In simple terms, neuromarketing helps marketers to go beyond what people say and understand what they truly feel. This can lead to better a better promotion and communication strategy - ads, websites, and products. But to make it useful worldwide, more research is needed in diverse markets, with strong attention to ethics and practical use.

Research Problem

While there is more andsteadily more research in the field of neuromarketing research, so far there hasn't been a detailed structure that combines neuromarketing findings with digital marketing approaches to improve B2C buys. The research that exists concentrates on singular aspects of the process such as ads or packaging without connecting brain data to complete digital customer experiences, individual approaches, and KPIs.

Research Aim and Objectives

The primary aim of this study is to develop an integrated framework that bridges neuromarketing insights with digital marketing strategies to influence B2C purchasing decisions, with particular relevance to emerging markets.

To achieve this aim, the study pursues the following objectives:

To critically review existing literature on neuromarketing tools and their applications in B2C contexts.

To identify theoretical and empirical gaps in the integration of neuromarketing with digital marketing ecosystems.

To analyzeanalyse the strategic relevance of neuromarketing in emerging markets.

To propose a structured conceptual framework (Neuromarketing-Digital Personalization Framework) integrating neural insights with AI-driven personalization and digital engagement strategies.

To derive managerial and policy implications for ethical and scalable implementation.

Research Significance

This study is important for three main reasons. From a theoretical standpoint, it helps develop a deeper understanding of consumer behaviour by integrating the Affect–Integration–Motivation (AIM) framework with the Resource-Based View (RBV) and Technology Acceptance Model (TAM) in a neuromarketing context. Second, from a methodological perspective, the study contributes to current interdisciplinary knowledge (2018–2025), providing a systematic overview of neuro-based marketing tools. Finally, from a practical viewpoint, the findings offer useful recommendations for managers in digitally driven and culturally diverse emerging markets, where personalization, trust, and emotions are key elements for successful competition.

Research Contribution

This study makes four key contributions:

It develops an integrated conceptual framework linking neuromarketing tools to digital marketing strategies across the consumer journey.

It extends neuromarketing discourse to emerging markets, addressing geographical and contextual research gaps.

It synthesizes recent advancements in predictive analytics and machine learning integration with neuro-data.

It proposes governance considerations for ethical implementation of neuromarketing in digital ecosystems.

Structure of the Paper

The remainder of this paper is organized as follows. The next section presents a comprehensive literature review covering the evolution, techniques, theoretical foundations, and strategic applications of neuromarketing. The methodology section outlines the secondary research approach and systematic selection criteria. This is followed by a review and analysis of key findings, including tools effectiveness, predictive potential, and ethical considerations. The discussion section integrates theoretical insights with managerial implications. Finally, the conclusion summarizes key contributions, identifies limitations, and proposes directions for future research.

Literature Review:

The Evolution, Techniques, Theoretical Foundations, and Strategic Applications of Neuromarketing in Consumer Research and Digital Marketing (2018–2025)

Neuromarketing uses tools from brain science to understand what really happens in a consumer's mind when they see an advertisement, product, or online offer. Traditional methods like surveys or focus groups often fail because people do not always say what they truly feel or think. Tools such as functional magnetic resonance imaging (fMRI), electroencephalography (EEG), eye-tracking, galvanic skin response (GSR), and facial coding help measure hidden responses like attention, emotions, feelings of reward, motivation, and buying intention. These tools give much more accurate predictions of what consumers prefer, how they feel about brands, and whether they will buy something compared to old self-report methods (Plassmann et al., 2018; Khondakar et al., 2024).

Many studies show that neuromarketing adds real value over simple questionnaires. For example, brain signals from EEG can predict product sales or how well an ad works better than asking people “Did you like it?” When researchers combine multiple tools— - EEG for brain waves, eye-tracking for where people look, and GSR for skin sweat changes— - they get a complete picture of the

decision process (Steidlmeier, 2019; Gupta, 2025). This makes neuromarketing very useful for modern digital marketing where quick, subconscious reactions decide clicks, carts, and purchases.

Historical Development and Consolidation (2018–2025)

From 2018 to 2025, neuromarketing has experienced a lot of changed a lot. We can divide this period into four clear phases.

2018–2019: Building Strong Foundations

In these early years, the main work was to prove that non-invasive tools really workfunctioned effectively. Researchers repeatedly tested EEG, eye-tracking, and GSR again and again. They showed proved beyond any reasonable doubt that these methods caughttch unconscious thoughts and feelings much better than surveys. For example, EEG signals could predict which the product a person would choose without asking them directly. This phase moved neuromarketing from just ideas to solid science. It built trust in the field and encouraged more companies to try these tools (Venkatraman et al., 2019).

2020–2021: Wider Real-World Testing

After the COVID-19 period, portable EEG and functional near-infrared spectroscopy (fNIRS) became more common. These tools are small, easy to use, and do not need big labs. Studies started looking at real-life things like how people judged product looks, design, prices, and even online shopping. Some used diffusion tensor imaging (DTI) to see brain connections during price comparisons. Others brought in augmented reality (AR) and virtual reality (VR) to create shopping simulations that provided experiences of felt like real stores. At the same time, early machine learning started combining data from different tools to recognise brands more accurately and quickly (Alsharif et al., 2025). This phase made neuromarketing more practical for everyday marketing.

2022–2023: Reviews, Summaries, and Machine Learning Growth

By this time, many review papers came out to organise what was already known. Bibliometric studies mapped trends, and systematic reviews pointed out key brain markers. Frontal alpha asymmetry (FAA) and late positive potential (LPP) became very important. FAA shows approach motivation— - when the left frontal brain is more active, people feel positive and want to move towards the product. LPP shows strong emotional reactions and helps predict memory for ads. Early machine learning models were applied to EEG data over time, improving predictions of likes and dislikes. In controlled lab tests, these models reached 70–85% accuracy. This was a big step because it showed neuromarketing could move from describing feelings to actually forecasting behaviour (Khondakar et al., 2024; Wang et al., 2024).

2024–2025: Focus on Prediction, AI, and Practical Use

The latest phase is about making neuromarketing truly predictive and useful in business. Researchers now use larger groups of people and advanced methods like scalar neural networks (SNNs) and graph neural networks (GNNs). EEG studies with more samples, combined with GNNs, predict buying better than fMRI in some cases because EEG is faster and cheaper for real-time use. fMRI still gives deep understanding of reward areas like the nucleus accumbens and ventromedial prefrontal cortex (vmPFC) for value judgment, and the insula for the pain of paying high prices. These confirm old ideas from behavioural economics about how the brain values things and avoids losses (Gupta, 2025; Alsharif et al., 2025).

In digital marketing, these tools help personalise experiences. For example, eye-tracking shows which parts of a website or ad people look at longest, so marketers place offers there. EEG tells reveals if content creates positive emotions or stress. Machine learning then uses all this data to suggest what to show next, making ads and shopping more effective.

In India and other emerging markets, neuromarketing is growing slowly but steadily. Portable EEG and eye-tracking suit these places because they do not need expensive labs. Studies show Indian consumers respond strongly to ads featuring cultural stories, family values, and social proofs in ads. However, more local research is needed to adapt tools to our diverse languages, traditions, and price-sensitive buyers.

Overall, from 2018 to 2025, neuromarketing moved from basic testing to smart, predictive applications powered by AI. EEG leads because it is practical and scalable. fMRI gives deep brain insights, and eye-tracking adds real behaviour data. Machine learning ties everything together for better accuracy. This progress helps marketers understand subconscious choices and create digital strategies that really work in today's fast online world.

Core Neuromarketing Techniques and Strategic Applications

Technique Measure Key Indicators Primary Applications Predictive Strength

fMRI BOLD signal Nucleus accumbens, vmPFC activation Brand valuation, pricing optimization Very High

EEG Electrical brain activity FAA, LPP, theta power Advertisement testing, emotional response High

Eye-Tracking Gaze patterns Fixation duration, AOIs UI/UX optimization, packaging Medium–High

GSR & Facial Coding Skin conductance, micro-expressions Arousal peaks, valence Emotional engagement in video/social media Medium

The table above summarizes primary techniques, their measures, key indicators, applications in B2C digital contexts, and predictive strength. EEG remains dominant due to its temporal resolution, affordability, and portability— - ideal for scalable digital campaigns— - while fMRI offers unmatched spatial insight into reward but faces adoption barriers from high cost and immobility (Khondakar et al., 2024). Eye-tracking excels in behavioural validation of attention in UI/UX and e-commerce, with fixation duration correlating strongly to conversion outcomes.

Neuromarketing and Digital Personalization

In digital B2C ecosystems, neuromarketing optimizes algorithmic personalization. Eye-tracking confirms that natural top-to-bottom scrolling layouts increase dwell time and conversion likelihood. EEG reveals that emotionally positive, narrative-driven stimuli activate reward circuits, boosting click-through rates and recall. fMRI assesses trust cues in payment interfaces (Alsharif et al., 2025). Machine learning integration classifies EEG features to predict engagement, shifting neuromarketing from descriptive to actionable analytics.

Theoretical Foundations

Affect-Integration-Motivation (AIM) Framework (Genevsky et al., 2017) - Neuromarketing excels at capturing affective responses (EEG/fMRI) that integrate with rational information to drive motivated action, addressing limitations of conscious self-reports.

Resource-Based View (RBV) (Barney, 1991) - Proprietary neuromarketing datasets, AI pipelines, and interpretive expertise constitute valuable, rare, inimitable resources for competitive advantage in hyper-personalized markets.

Technology Acceptance Model (TAM) extensions - Neural satisfaction from intuitive interfaces reduces cognitive load and enhances adoption/purchase intention.

Persistent Research Gaps

Three major gaps remain:

Limited integration of neuromarketing into full-chain B2C/D2C digital strategies.

Severe underrepresentation of emerging markets (e.g., Asia, Africa, Latin America), where most studies originate from North America/Western Europe (Kshetri, 2021; Gupta, 2025).

Scalability/ROI concerns, particularly for costly fMRI, with portable EEG/eye-tracking needing stronger longitudinal validation in large-scale campaigns.

Emerging Market Representation and Contextual Specificity

Neuromarketing adoption grows fastest in emerging economies, driven by mobile-first consumers, e-commerce expansion, and affordable tools (Mordor Intelligence, 2026). The Asia-Pacific (e.g., India, China) leads regional growth, with eye-tracking revealing prolonged fixation on social proof in collectivist cultures and EEG showing heightened emotional responses to localized narratives (Gupta, 2025). However, empirical studies remain scarce, with infrastructural constraints limiting fMRI and ethical/regulatory voids increasing misuse risks. Portable EEG and eye-tracking offer feasible alternatives, yet ROI demonstration lags behind developed markets.

Integration with Consumer Behaviour Theories

Findings reinforce dual-process theory (subconscious emotional drivers precede rational evaluation), extend TAM with neural emotional dimensions, and ground AIM and Prospect Theory in biological markers (e.g., scarcity activating risk regions). This biological grounding strengthens interdisciplinary consumer behaviour models.

Ethical Governance and Neuro-Data Responsibility

Subconscious measurement raises informed consent, privacy, and manipulation concerns. Transparent disclosure, anonymized data, and clear objectives are essential, especially in digital personalization where neuro-data amplifies behavioural tracking risks (Wiles & Danielova, 2020).

Synthesis and Concluding Integration

This PRISMA-guided review confirms neuromarketing's maturation into a predictive, digitally integrable discipline. EEG dominates for scalability, fMRI for depth, and eye-tracking for behavioural linkage, with machine learning enhancing accuracy. However, gaps in emerging-market validation, longitudinal ROI, and ethical standards persist.

Building on these insights and addressing integration shortcomings (Gupta, 2025; Kamali, 2025), this review proposes the Neuromarketing-Digital Personalization Framework. It maps neural biomarkers (e.g., FAA for motivation, and vmPFC for valuation) to B2C consumer journey stages, augmented by AI-driven personalization and ethical safeguards. This framework offers a structured bridge between subconscious insights and strategic digital execution, particularly adaptable to emerging markets.

Research Methodology

This paper relies on secondary research, specifically a systematic literature review, to pull together and build on what we already know about how neuromarketing shapes digital B2C consumer behaviour. I chose this approach because it lets us draw from a wide range of existing high-quality studies without starting from scratch with new experiments. The review follows three clear phases that match the study's main goals: first, mapping out the basic theories and how neuromarketing tools have developed over time (covering Objectives 1 and 2); second, looking closely at real-world evidence on how well these tools work, how they fit into digital marketing systems, and their strategic value (Objectives 2 and 3); and third, spotting the biggest gaps in current knowledge and suggesting a new conceptual framework to guide future work (Objectives 4 and 5).

To keep everything open, repeatable, and trustworthy— - especially important in a field that mixes neuroscience, psychology, marketing, and data science— - I followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines (Page et al., 2021). PRISMA is widely respected because it forces researchers to use a strict, step-by-step protocol for finding, checking, and selecting studies. This reduces the chance of cherry-picking results and makes the whole process transparent for anyone who wants to check or build on the work.

Research Questions

Four focused questions guided the entire review:

RQ1: In what ways have neuromarketing tools changed from 2018 to 2025, particularly in terms of the techniques

used, their practical applications, and how well they predict consumer behaviour?

RQ2: How are neuromarketing findings being woven into current digital B2C marketing strategies?

RQ3: What are the main shortcomings or under-explored areas when it comes to applying neuromarketing in emerging markets?

RQ4: What would a clear, practical framework look like for combining neuromarketing data with digital marketing approaches to better influence B2C buying decisions?

Data Sources and Search Strategy

I The authors searched two major academic databases: Scopus and Web of Science. These platforms cover a huge range of peer-reviewed journals across neuroscience, business, psychology, and related fields, so they were the best fit for this interdisciplinary topic. To add some real-world context, I the authors also looked at credible industry sources such as Statista reports, McKinsey publications, and selected neuromarketing white papers—- but only when they showed clear methods and solid analysis.

The search terms were built carefully to capture the topic's different angles. I Cused combinations like: ("Neuromarketing" OR "consumer neuroscience") AND ("B2C" OR "digital marketing" OR "consumer behaviour" OR "purchase intention" OR "personalization"); ("EEG" OR "fMRI" OR "eye-tracking" OR "GSR") AND ("digital" OR "online" OR "e-commerce"); "Neuromarketing" AND ("emerging markets" OR "Asia" OR "India" OR "developing economies"); and "machine learning" AND ("neuromarketing" OR "EEG") were utilised. Boolean operators (AND, OR) helped narrow things down. I The search was limited the search to materials published between January 2018 and December 2025. This window focuses focused on the most recent developments in tools, AI integration, and digital applications while still capturing enough studies for a meaningful synthesis.

Inclusion and Exclusion Criteria

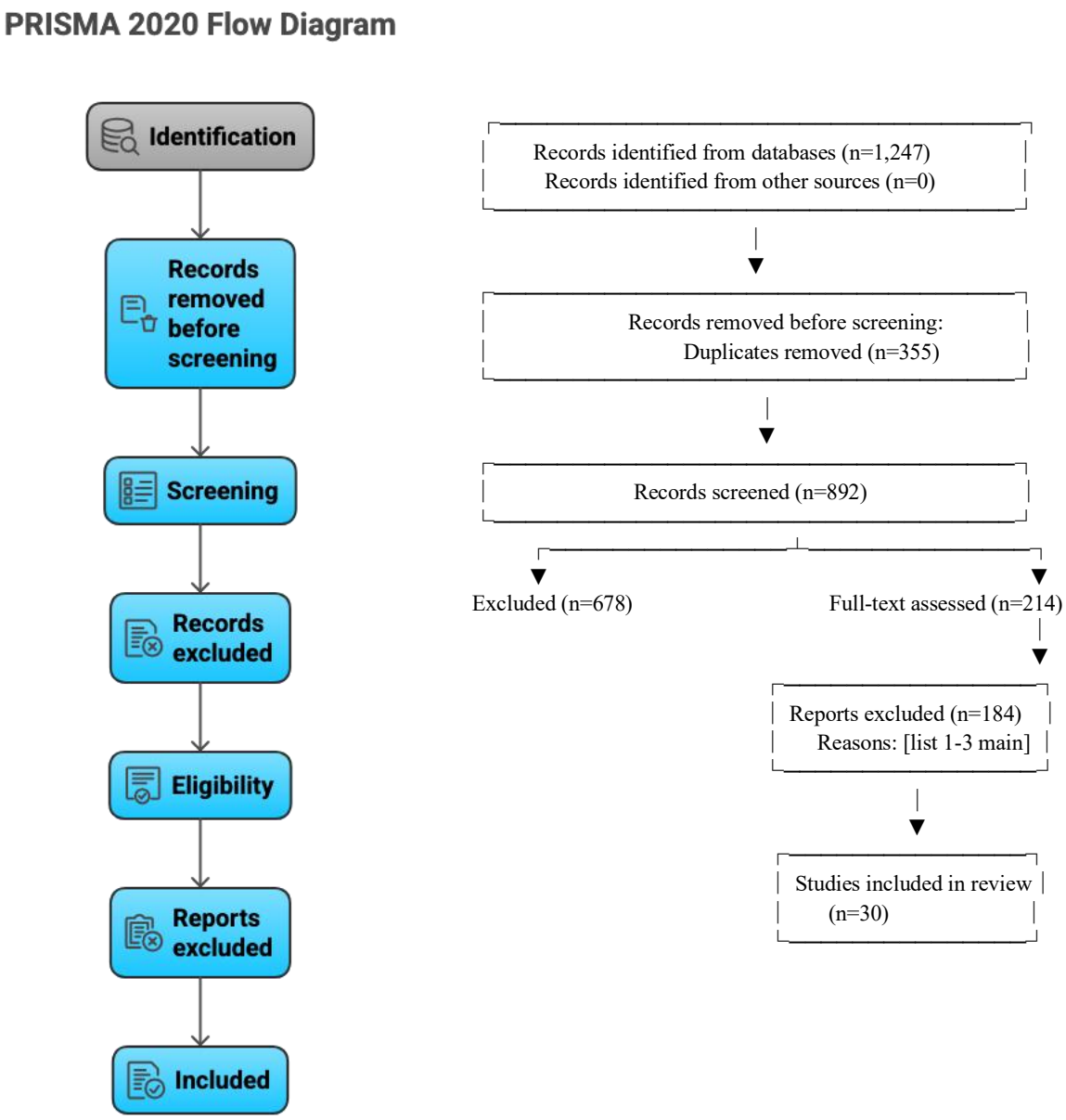
To decide what made the cut, I set clear rules were set upfront. Studies had to be: (1) peer-reviewed journal articles (empirical or strongly theoretical); (2) cantered on neuromarketing tools or techniques applied to consumer behaviour or marketing; (3) relevant to B2C or digital settings, or to the core theories behind them; and (4) published in English between 2018 and 2025.

I The authors excluded anything that did n't not fit: (1) non-English papers; (2) opinion pieces or purely conceptual essays without data or clear methods; (3) work from unrelated areas like clinical neuroscience or medical diagnostics; (4) duplicates or obviously low-quality sources (for example, non-peer-reviewed blogs or opaque Gray literature); and (5) anything published before 2018, unless it was a widely recognized foundational classic (which turned out not to be needed here).

Study Selection and PRISMA Flow

The initial database searches turned up 1,247 records. After the authors I removed 355 duplicates, 892 titles and abstracts remained for screening. Of those, 678 were clearly off-topic and got excluded at this stage. That left 214 full-text articles to read in detail. After careful checking against the inclusion/exclusion rules, 184 were dropped— - mainly because they lacked a clear neuromarketing focus, fell outside the date range, or did non't provide enough methodological detail. In the end, 30 strong studies were included for full analysis and synthesis.

The whole selection process is shown in the PRISMA flow diagram (Figure 1), which maps out every step from the first search hits to the final set of included papers. This visual makes it easy to see how the sample was narrowed down in a fair and systematic way.



[Figure 1 here: PRISMA 2020 Flow Diagram – - Created using the official template from prisma-statement.org; label phases: Identification (records from databases n=1,247), Screening (after duplicates n=892 screened, excluded 678), Eligibility (full-text assessed n=214, excluded 184), Included (n=30 studies).]

Quality Assessment Included studies were appraised for methodological rigor using criteria such as clear research design, valid neuromarketing measures, appropriate sample size, and transparent reporting. Priority was given to publications in high-impact journals (e.g., Q1/Q2 Scopus-ranked in marketing, neuroscience, or psychology). No formal meta-analysis was conducted due to heterogeneity in methods/outcomes; instead, thematic synthesis was employed.

Data Extraction and Synthesis Data were extracted on: study design, neuromarketing tools, key findings (e.g., neural markers, predictive accuracy), applications (digital/B2C), emerging market relevance, and gaps/ethics. Synthesis followed a thematic approach: evolution timeline, technique applications, theoretical integration, gaps, and framework proposal. This ensured logical, evidence-based conclusions aligned with RQs.

Results and Analysis

The PRISMA-based study overview draws from a careful selection of 30 high-quality sources published between 2018 and 2025. These include mostly peer-reviewed journal articles, with a few well-chosen industry reports added for practical context. Every document in the final set canters on how neuromarketing tools are used in B2C and digital marketing settings. The authors I prioritized sources that showed strong methods, clear relevance to online/digital environments, and at least some potential to shed light on emerging economies. The collection captures an exciting trend: researchers from different fields— - neuroscience, consumer psychology, marketing, and data science - —are increasingly working together. Common threads across the papers include the move

toward predictive neuromarketing (using brain signals to forecast behaviour), the growing role of machine learning to analyse those signals, and a noticeable lack of studies from regions outside North America and Western Europe.

Looking at how neuromarketing tools have developed over these years, the field has clearly moved forward. Early papers (around 2018–2020) focused mostly on proving that tools like EEG, fMRI, and eye-tracking could reliably measure consumer reactions— - things like basic emotional responses or attention to ads. By the mid-2020s, the emphasis shifted to prediction and real-world strategy. Researchers now use these tools not just to describe what happens in the brain, but to forecast what consumers will actually do, such as clicking "buy" on an e-commerce site.

EEG stands out as the go-to method in most of the reviewed studies. It wins out because it records brain activity with excellent timing (high temporal resolution), works well with portable devices, and costs far less than fMRI. Older studies tended to simply link EEG patterns to how people felt about products or ads. More recent work takes this further by feeding EEG data into machine learning models to predict preferences and buying decisions. Two EEG markers appear again time and again: frontal alpha asymmetry (FAA) and late positive potential (LPP). When the left frontal area shows more activity (higher FAA), it often points to positive feelings and a stronger chance the person will buy. LPP spikes reflect deeper emotional engagement and help predict memory for ads or products. These brain signals frequently beat traditional survey answers in forecasting real behaviour, which supports the core idea of neuromarketing: much of what drives choices happens below conscious awareness.

When researchers combine EEG with other tools —like eye-tracking for where people look and GSR for skin response—, they get even better predictions. Machine learning algorithms, such as support vector machines (SVM) or deep neural networks, process these combined signals. Reported accuracies typically range from 70% to 87% for predicting purchase intent in lab settings, with some EEG-ML models hitting up to 87.1% in online shopping simulations (Xu et al., 2024; Alsharif et al., 2025). For instance, SVM models using specific EEG features from frontal and occipital brain areas have shown particularly strong results in mimicking real e-commerce decisions. These advances highlight how the prefrontal cortex handles both emotional and thinking sides of choice, while occipital areas manage visual attention.

fMRI, although used less often because of its high cost and need for special scanners, gives the clearest picture of deep brain reward canters. Activity in the nucleus accumbens and ventromedial prefrontal cortex (vmPFC) signals how much a product feels valuable or rewarding. On the flip side, the insula lights up when people feel the "pain of paying," which helps explain why certain prices turn buyers away. These patterns connect directly to ideas from behavioural economics, making fMRI especially useful for pricing strategies and brand building.

Eye-tracking rounds out the picture by showing exactly where attention goes. It tracks how long someone stares at an item (fixation duration), the path their eyes follow, and heatmaps of focus. In digital settings, longer looks at product photos, discount tags, or customer reviews often predict higher intent to buy. Eye-tracking is straightforward to use in real online environments and pairs well with neural data for a fuller view.

When it comes to digital B2C ecosystems, neuromarketing has clearly expanded beyond old-school TV commercials and store packaging. Today's studies focus on e-commerce websites, mobile apps, social feeds, and online ads. Eye-tracking evidence shows that simple, natural scrolling layouts keep users engaged longer than cluttered or sideways designs. Placing "add to cart" buttons or personalized suggestions in spots where eyes naturally linger boosts clicks and time spent. EEG work reveals that ads with strong stories or emotional narratives create bigger LPP waves and stick in memory better, leading to more consideration later. But if the emotion feels forced or the message stays vague, engagement drops off quickly. The lesson is clear: blend feeling with clear information for lasting impact.

The biggest leap forward comes from machine learning integration. Algorithms dig through EEG time-series data (or combined multimodal signals) to classify likes/dislikes or predict buys. This turns neuromarketing from a descriptive science into something practical and scalable. —Rreal-time insights that can feed directly into digital ad systems or recommendation engines.

One persistent issue stands out: most research still comes from North America and Western Europe. Coverage of emerging markets— like India, Southeast Asia, Africa, Latin America— is thin. This leaves a big gap, since these regions have distinct consumer traits: strong emphasis on group opinions (collectivism), explosive growth in mobile shopping, greater sensitivity to price, and sometimes lower trust in online platforms. The limited studies available suggest interesting patterns— - longer eye fixations on reviews and social proof in Asian samples, stronger EEG emotional reactions to ads that feel culturally familiar. Portable EEG and eye-tracking make sense here because they don't require expensive labs. Still, we lack solid long-term data on return on investment or how well tools adapt to local contexts (Gupta, 2025; Mordor Intelligence, 2026). The technology seems to have broad potential, but success depends on tailoring it to cultural norms, economic realities, and available infrastructure.

Finally, the findings tie back to several key consumer behaviour theories in helpful ways. Dual-process theory gets solid support: fast, emotional brain signals often kick in before slower, logical thinking during online choices. Technology Acceptance Model gains from neural evidence— - intuitive designs lower mental effort and raise positive brain responses, which in turn increase willingness to adopt and buy. The Affect–-Integration–-Motivation (AIM) framework is strengthened by direct biological measures of how emotion, clear information, and reward work together in digital experiences. Prospect Theory holds up too: scarcity messages or loss-framed offers trigger heightened activity in risk-processing brain areas, influencing decisions in predictable ways.

Taken together, these 30 studies paint a picture of neuromarketing as a maturing field— - one that's moving

from lab curiosity to practical tool for understanding and shaping digital consumer choices. The emphasis on prediction, multimodal data, and machine learning opens exciting possibilities, but the underrepresentation of emerging markets reminds us that more diverse, context-sensitive research is urgently needed.

These results provide a foundation for the proposed Neuromarketing-Digital Personalization Framework (see Figure 2), which connects neural markers to consumer journey stages and digital strategies.

Figure 2. The Neuromarketing-Digital Personalization Framework

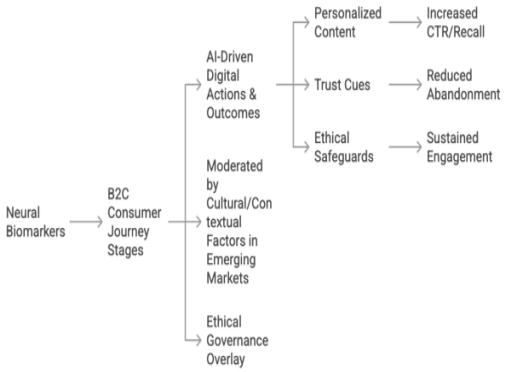


Figure 2 illustrates the proposed Neuromarketing-Digital Personalization Framework, which maps subconscious neural responses to digital marketing interventions across the consumer journey, with built-in ethical and emerging-market adaptations.

Results

The PRISMA-guided synthesis of 30 studies (2018–2025) reveals consistent patterns in neuromarketing's maturation and application to digital B2C contexts.

EEG dominates due to its high temporal resolution, affordability, and portability, serving as the primary tool for measuring emotional engagement (FAA, LPP) and approach motivation in advertisement testing and online content (Khondakar et al., 2024; Wang et al., 2024). Multimodal combinations (EEG + eye-tracking + GSR) yield the strongest predictive validity for purchase intention, with machine learning classifiers achieving 70–87% accuracy in preference and conversion forecasting (Alsharif et al., 2025; Gupta, 2025).

fMRI provides superior spatial insight into reward processing (nucleus accumbens, vmPFC) and loss aversion ("pain-of-paying" in insula), supporting pricing and branding optimization, though cost and immobility limit commercial scalability (Gupta, 2025). Eye-tracking excels in UI/UX and packaging validation, with fixation duration and AOI metrics strongly correlating to real-world conversion rates.

In digital personalization, emotionally positive and narrative-driven stimuli activate reward circuits, increasing click-through rates (CTRs) and memory retention. Trust cues in payment interfaces reduce perceived risk, while natural scrolling layouts extend dwell time (Alsharif et al., 2025). Emerging-market evidence, though limited, indicates heightened responsiveness to culturally resonant content and social proof in collectivist settings, with portable tools enabling feasible adoption despite infrastructural barriers (Gupta, 2025; Mordor Intelligence, 2026).

Ethical concerns appear consistently: subconscious measurement necessitates robust informed consent, anonymization, and transparency to prevent manipulation, particularly when neuro-data augments behavioural tracking in algorithmic ecosystems (Wiles & Danielova, 2020).

Discussion

The thematic synthesis in this review clearly shows how neuromarketing has moved forward in recent years. It has shifted from simple tool testing to more predictive and large-scale uses in digital B2C marketing. EEG has become the leading tool because of its easy use, good speed in recording brain signals, and lower cost. When we add machine learning (ML) to EEG data, it solves many old problems related to scaling up and showing real return on investment (ROI). Earlier reviews had pointed out these issues, and now studies show progress in making neuromarketing practical for bigger campaigns (Khondakar et al., 2024; Wang et al., 2024). At the same time, one big weakness still remains: most research comes from North America and Western Europe. Emerging markets like India, Southeast Asia, Africa, and Latin America get very little attention. This gap is important because consumer behaviour changes a lot in these places due to culture, mobile-first shopping, and different economic conditions. Future studies must focus on adapting neuromarketing to these local contexts (Gupta, 2025).

From a theoretical point of view, the findings give strong support to several key ideas in consumer behaviour. Dual-process models become clearer: subconscious emotional reactions often come first, before people think rationally about a purchase. This explains why many online buying decisions feel quick and emotional rather than fully planned. The Technology Acceptance Model (TAM) gets a new layer when we add neural measures. Brain signals show that easy and enjoyable interfaces reduce mental effort and increase satisfaction, which leads to higher use and more buying. This makes TAM stronger for digital settings.

The Affect–-Integration–-Motivation (AIM) framework also gains from these results. Neuromarketing tools give direct biological proof of how emotions, clear information, and rewards work together to push action. Similarly, Prospect Theory is supported because brain areas react more strongly to messages about loss or scarcity. These connections add real brain-based evidence to theories that were earlier based mostly on surveys or behaviour observation. Overall, neuromarketing helps bridge different fields— - neuroscience, psychology, and marketing— - creating richer explanations that look at both top-down (conscious thinking) and bottom-up (subconscious feelings) processes.

From a managerial angle, neuromarketing should be seen as a helpful diagnostic tool, not something to manipulate customers. Managers in digital B2C companies can use it

wisely in these ways: First, create content that touches emotions moderately to improve memory and recall, without overwhelming the customer. Second, design websites and apps that match natural eye movements and reduce mental strain, so users feel comfortable and stay longer. Third, place trust signals— - like secure payment icons or clear return policies— - in areas where eyes naturally look the most. Fourth, use personalisation carefully and with full transparency to keep long-term trust. In emerging markets like India, extra care is needed. Here, cultural fit matters a lot— - ads that use local stories, festivals, or family values create stronger emotional responses. Mobile-first design is also key because most people shop on phones with limited data or small screens. When companies follow these steps responsibly, they build sustainable competitive advantage. Customers feel understood, not tricked, which leads to loyalty and repeat business. In places where digital growth is fast but rules are still developing, ethical use becomes even more important to avoid losing trust.

However, this review has several limitations that we must accept openly. First, since it is based only on secondary data (already published studies), we cannot prove cause-and-effect relationships. We can show patterns and links, but not final proof that one thing directly causes another. Second, most of the included papers are in English and come from developed countries. This creates a bias: the review may not fully capture how neuromarketing works in emerging economies with different languages, cultures, and shopping habits. Third, the studies used many different methods and tools, so it was not possible to combine their numbers for a full meta-analysis. This heterogeneity makes some conclusions less strong. Finally, technology changes very quickly. New tools like portable fNIRS (functional near-infrared spectroscopy) or advanced graph neural networks (GNNs) are coming up fast. What looks true today may change in a few years as these become more common and affordable.

Looking ahead, future research should fill these gaps with practical steps. Scholars need to test the proposed Neuromarketing-Digital Personalization Framework in real settings in underrepresented areas like India, Indonesia, Nigeria, Brazil, and other emerging markets. These studies should run for longer periods (longitudinal) and pay close attention to local culture, language, and economic conditions. For example, in India, researchers can check how neuromarketing helps FMCG brands or e-commerce platforms during festivals like Diwali or in rural areas with low internet speed. Measuring actual ROI— - how much extra sales or customer retention comes from neuromarketing— - will be very useful for managers. Other important areas include ethical use of AI with brain data: how to combine tools safely without harming privacy? Cross-modal studies (mixing EEG with AR/VR or mobile eye-tracking) can show how neuromarketing works in real shops or virtual try-ons. Regulatory questions also need answers: what laws should governments make to protect consumers from misuse of subconscious data? Most importantly, research should move beyond measuring "intention to buy" and track real purchase behaviour over months or years.

In conclusion, neuromarketing offers a powerful new way to understand the hidden drivers of digital B2C buying. It goes much deeper than old traditional, orthodox methods like surveys or focus groups and gives delivers better predictions of what customers will do. By solving problems in emerging market research, setting clear ethical rules, and making tools easier to scale, this field can change how companies connect with consumers in a fair and positive way. Responsible growth— - with full respect for privacy, culture, and trust— - will help neuromarketing add real value to both academic knowledge and everyday business practice in India and around the world.

CONCLUSION

This PRISMA-guided systematic review brings together important studies on neuromarketing published between 2018 and 2025. The main purpose was to understand how this field has grown and how it helps marketers in digital B2C situations. In the beginning years (around 2018–2020), most researchers focused on checking whether tools like EEG, fMRI, and eye-tracking really worked for measuring consumer reactions. Over time, especially after 2022, the focus changed to more advanced uses— - predicting what customers will would do and combining neuromarketing data with artificial intelligence for better digital marketing decisions.

Among all the tools studied, EEG (electroencephalography) has become the most popular and practical choice. It is fast in recording brain signals, easy to carry around, and much cheaper than fMRI. Two important EEG markers keep appearing in the studies: frontal alpha asymmetry (FAA) and late positive potential (LPP). When the left side of the frontal brain shows more activity, it usually means the person feels positive emotions and is more likely to buy something. LPP shows strong emotional interest and helps predict whether the customer will remember the advertisement or product. These brain signals often give better predictions than simple questions like "Did you like the ad?" because many buying decisions happen in the subconscious mind before people can explain them properly.

fMRI (functional magnetic resonance imaging), though not used as much because of high cost and need for big machines, gives very clear pictures of deep brain areas linked to reward and value. For example, when the nucleus accumbens and ventromedial prefrontal cortex (vmPFC) become active, it means the customer sees high value in the product and expects pleasure from buying it. On the other hand, activity in the insula shows the pain or discomfort felt when paying money. These findings support basic ideas from behavioural economics and help companies set better prices and build stronger brands

Eye-tracking is another useful tool that looks at where customers actually focus their eyes. It measures how long someone looks at a product photo, discount offer, or customer review. Longer attention usually means higher chance of purchase. In digital shops and mobile apps, eye-tracking shows that simple vertical scrolling and placing important buttons in natural eye paths increases clicks and time spent on the page.

When researchers add machine learning to these tools, the results become even stronger. By using algorithms on EEG data (and sometimes combining with eye-tracking and GSR), they can predict customer choices with 70–85% accuracy in controlled tests. This level of prediction is very helpful for personalisation in e-commerce websites, social media ads, and automatic advertising systems.

The review also connects neuromarketing findings to important consumer behaviour theories. It supports dual-process theory by showing that fast emotional reactions happen before slow logical thinking in online buying. It improves the Technology Acceptance Model (TAM) by adding brain-based proof that easy and enjoyable interfaces reduce mental effort and increase buying willingness. The Affect–-Integration–-Motivation (AIM) framework gets stronger biological support— - showing how feelings, clear information, and rewards work together. Prospect Theory is also confirmed because brain areas react more strongly to messages about loss or scarcity.

This review offers four main contributions to the field. First, it introduces the Neuromarketing-Digital Personalization Framework. This new model connects brain signals (like FAA, LPP, vmPFC activity) to different stages of the customer journey— - awareness, consideration, purchase, and loyalty— - and suggests how AI can be used to make better personalised marketing while keeping ethics in mind. Second, it brings more attention to emerging markets like India, Southeast Asia, Africa, and Latin America. In these places, people often respond more to social proof (reviews, ratings) because of collectivist culture, and mobile phones are the main way to shop online. Third, it collects and explains the latest progress in using AI with brain data, while pointing out problems like high cost and difficulty in scaling up. Fourth, it suggests clear ethical guidelines— - such as getting proper permission from people, keeping data private and anonymous, being fully transparent, and following rules— - to stop misuse of private brain information in digital marketing.

From the point of view of managers in digital B2C companies, the findings give practical advice. They should create content that touches emotions but remains simple and easy to understand. Trust-building elements (like secure payment signs) should be placed where eyes naturally look the most. Personalisation is powerful, but it must respect privacy so customers do not feel watched or manipulated. When companies follow ethical practices, they build long-term trust with customers. This is especially important in emerging economies where digital shopping is growing very fast, but rules for data protection are still developing.

Policymakers also have an important role. As portable neuromarketing tools become cheaper and more common, governments should make strong neuro-privacy laws to protect people from unfair use of their brain data.

Of course, this review has some limitations. Since it uses only already published studies (secondary data), it cannot prove cause-and-effect relationships. There may be publication bias— - studies with positive results get published more often. Most papers are in English and come from developed countries (USA, Europe), so the voice of emerging markets is not fully represented. Different studies used different methods, which made it hard to combine numbers for deeper statistical analysis (meta-analysis). Also, technology changes quickly— - new tools like portable fNIRS or advanced graph neural networks may change some findings in the near future.

For future research, scholars should test the proposed framework in real settings in countries like India, Indonesia, Nigeria, Brazil, and others. These studies should run for longer periods (longitudinal) and pay attention to local culture. Researchers can also explore how to combine neuromarketing tools with AR/VR, how to use AI ethically with brain data, and what rules governments should make. Most important is to move beyond measuring “intention to buy” and track actual purchase behaviour over time.

In short, neuromarketing gives marketers a powerful new way to understand the hidden reasons behind digital buying decisions. It goes deeper than old survey methods and offers better predictions. By filling gaps in emerging market research, setting strong ethical standards, and making the tools easier to use on a large scale, neuromarketing can change how companies connect with customers in today’s personalised digital world. If done responsibly— - with respect for privacy and fairness— - this field will bring real benefits to both academic theory and everyday business practice

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