

PRATIK B PUPREDIWAR
DR POORNIMA TAPAS

Identifying and prioritising barriers to neuromarketing adoption: an empirical study of the automotive sector in India using TOE and DEMATEL

Abstract

Research background and purpose: Various companies conduct traditional market research studies to test digital interfaces, product designs, advertisements, etc. This helps them capture customer response and make their offering more relevant. Neuroscience tools like eye tracking, facial coding, EEG (Electroencephalogram) used in market research is neuromarketing. Though neuromarketing has multiple advantages over traditional research like removing interviewer/customer bias, decoding real time emotions, etc. still its adoption among companies has been very limited.

Design/methodology/approach: A qualitative-dominant, multi-method strategy is employed, combining literature review, semi-structured interviews with automotive organizations professional in sales, marketing and product design functions.

Finding: TOE (Technology, Organization, Environment) Framework and Dematel (Decision Making Trial and Evaluation Laboratory) model are implemented to prioritize the barriers to adoption of neuromarketing and understand the causal relationship between them. Top technological barriers of neuromarketing are complex technology and expensive. Top environmental barriers are lesser adoption among peers & competition. And top organization barrier is preference towards traditional methods of market research. The study also gives recommendations on how to overcome barriers of neuromarketing. It has various implications for market research companies, automotive companies and market research associations.

Value added and limitations: This study utilises the research work done by academia and considers the views of automotive industry to enhance industry – academia partnership. If the top barriers identified in this study are overcome, it can increase the spend on neuromarketing and hence increase the revenue of market research companies. It can also benefit automotive companies to test the advertisements and product designs in advance to avoid major cost of failure of going wrong. Though the literature review is global, the study outcomes are based on interaction with automotive company representatives in India. As the concept of neuromarketing is still emerging in India, there could be subjectivity in response from the automotive company representatives met in this study. In future, similar studies can be conducted in various countries and sectors. Larger sample can be also covered including various functions in automotive sector, market research companies and associations like MRSI. This can help in better generalization of the findings.

Keywords: *neuromarketing; Dematel; TOE; automotive; barriers*

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Classification: D21, M3, D9

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1. Introduction

When market research is conducted using neuroscience tools it is termed as neuromarketing. These tools are Eye tracking (ET), Facial coding, Skin Conductance, Electroencephalography (EEG), Functional magnetic resonance imaging (fMRI), etc. Even after 20 years of its familiarization, the global research spent using Neuromarketing is very minuscule and estimated to be less than or equal to ~1% of the insights industry and 3% of market research sector (Mordor Intelligence, 2024). In India, automotive companies spend ~60 million USD on custom market research (Market Research Society of India, 2024). Assuming 1-3% is spent on Neuromarketing, the spend is estimated 0.5-1.5 million USD. Majority of research studies in the past on neuromarketing have taken place in academia as compared to its actual application in the industry. Needs of the industry are diverse; hence, it is critical to study actual application of neuromarketing and scope of improvement from industry point of view (Baños, et al., 2020). This research bridges this gap of academia and industry by speaking to automotive industry experts to understand barriers of adopting neuromarketing.

The automotive industry is one of the major industries globally. India is ranked 4th in the automotive in the world (NITI Aayog, 2025). Neuromarketing has many advantages like it captures real time response, no interviewer or personal bias, high predictability, predicts purchase decisions. With these advantages, it can overcome limitations of traditional research methods like qualitative and quantitative research. Hence in some cases it can complement traditional research methods or replace it. But still its adoption is at nascent stage (Puprediwar & Tapas, 2024). This research unearths the barriers of usage of neuromarketing in automotive sector.

TOE (Technology, Organization, Environment) framework goes past individual viewpoint and considers decision making as an organization (Widuri et al. 2016). This study uses the TOE theory to understand barriers in adoption of neuromarketing. This research also bridges the gap where to best of our knowledge no study has been conducted to understand barriers to adoption of Neuromarketing using TOE framework. One of the Multi-Criteria Decision-Making (MCDM) methods, the Decision-Making Trial and Evaluation Laboratory (DEMATEL) is used to identify the ranking and causal relationship among barriers of neuromarketing. No studies to best of our knowledge have been conducted to understand the ranking and interdependency of barriers of neuromarketing using DEMATEL method.

Objective of the study:

- identify the barriers of implementation of neuromarketing in automotive sector in India
- apply TOE framework to understand if the barriers are technical, organisational or environmental

- identify order of importance of barriers and understand the interdependency among them using DEMATEL
- arrive at the implication for research companies, automotive companies and associations

Research questions:

1. What are the top barriers to adoption of neuromarketing in automotive sector?
2. What is the hierarchy of barriers and causal relationships between them?
3. Which are the barriers that should be overcome first to increase adoption of neuromarketing in market research?

2. Literature review

A detailed search was conducted using the Scopus database using PRISMA framework (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Al-sharif et al., 2022). Search performed using keywords “neuromarketing” resulted into 1,570 documents. Details of the analysis are mentioned in the Figure 1.

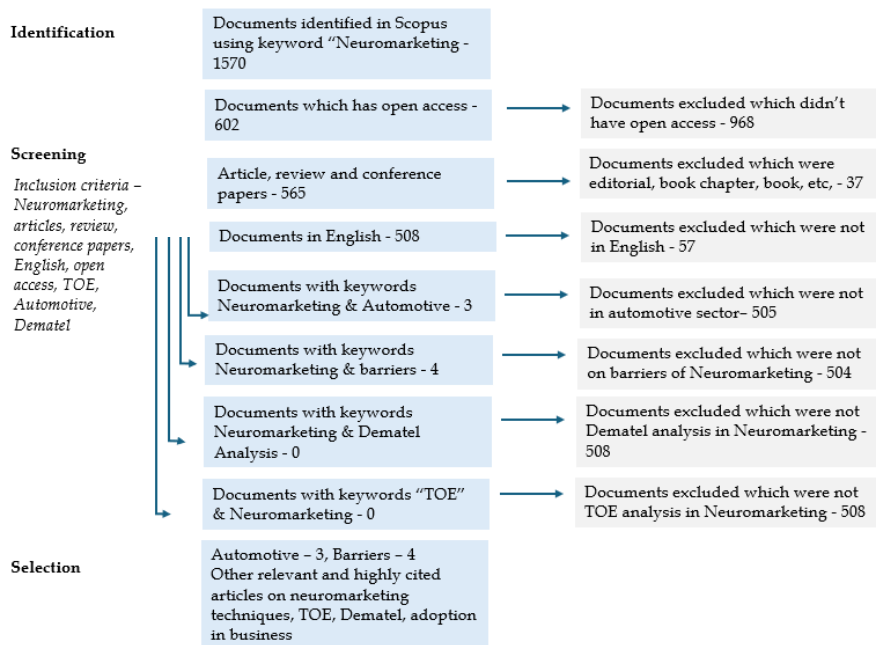


Figure 1. PRISMA analysis

Source: own study

The interest in this topic has surged in since last 5 years. Research on Neuromarketing has been growing and various studies have highlighted its advantages over traditional research methods. These drivers are capturing response real time, no interviewer bias, pure response, high predictability, better understanding of purchase process. When the search was performed in Scopus using key words “Neu-romarketing” and “TOE”, no document was found. Also, the search with key words “Neuromarketing” and “DEMATEL”, resulted in zero document. Search was also done using keywords “Neuromarketing” and “Automotive”. Key gap in the literature related to Neuromarketing is the lack of sector specific ap-plications, particularly in high involvement and high risk purchase domains such as automotive mar-kets. Most influential neuromarketing studies remain method centric, laboratory based, and product agnostic, focusing on generic stimuli or FMCG like contexts. As a result, the complex automotive deci-sion environment characterized by long decision cycles, financial commitment, safety considerations, brand trust, and social identity remains largely underexplored. Few articles have been published in automotive space, but negligible papers have been written where barriers have been identified based on discussion with automotive companies.

Most of the articles which have been written on neuromarketing discuss about its techniques and application in understanding emotion, perception, preference of brands or communication among consumers and its future usage. Sectorspecific evidence particularly for pricing sensitivity, advertising effectiveness, customer journey design, and sustainable vehicle adoption is notably limited, constraining organizational confidence and adoption. There is insufficient research conducted which focuses on the feedback of automotive companies who will ultimately use these techniques in marketing or market research. Also, limited studies have been conducted to provide solutions to the barriers to the adoption of neuromarketing in the automotive sector. This research builds on highly cited papers written globally on Neuromarketing. Aldayel et al. (2020) highlights need for bridging the gap between traditional market research, which relies on explicit consumer responses, and neuromarketing research, which reflects the implicit consumer responses. Alsharif et al. (2023) recommend scholars from emerging countries to contribute publications in neuromarketing. Dutta e.t al (2024) in their research on neuromarketing in automotive sector stated that Neuromarketing is not intended to replace traditional market research, but rather to complement it to better understand consumer behaviour. Plakhin et al., (2018) also advocate wide scope neuromarketing application both in manufacturing, retail trade, and education.

There has been research in the past to understand adoption of neuromarketing across sectors from organization point of view. Existing organizational studies indicate that the adoption of neuromarketing remains limited primarily due to low

awareness and poor understanding of its true potential (Baños, et al., 2020). Many organizations perceive neuromarketing as highly technical, difficult to interpret, and disconnected from day to day marketing decisions. This perception is reinforced by the failure of neuromarketing research providers to clearly communicate, quantify, and demonstrate the business value and ROI of neuromarketing insights, particularly in advertising research where speed and cost efficiency are critical. Neuromarketing is also widely viewed as expensive and time consuming, which discourages its use in competitive, budget constrained environments such as automotive marketing. As a result, despite its theoretical promise, neuromarketing remains peripheral to mainstream organizational research practices. However, empirical evidence suggests a positive association between the use of neuromarketing and organizational competitiveness, implying that firms adopting neuromarketing may gain superior differentiation, insight quality, and strategic advantage (Mohsen & Mostafa, 2020). Such comparative evidence is currently lacking in the automotive domain and represents a key opportunity to demonstrate neuromarketing's incremental value in understanding complex, high involvement purchase decisions. Additionally, neuromarketing shows promising relevance for sustainable product growth and promotion, aligning well with the automotive industry's increasing focus on sustainability, EV adoption, and responsible consumption. However, broader organizational adoption will require closer alignment between neuroscientists, neuromarketing practitioners, and marketing decision makers, moving neuromarketing beyond academic experimentation toward practical business integration (Brenninkmeijer et al., 2019).

Review of relevant papers written on TOE helped researchers to understand key factors influencing adoption of new technologies in the organization. Across diverse technologies and contexts, digital marketing, AI, blockchain, and generative AI, the reviewed studies consistently demonstrate the usefulness of the Technology–Organization–Environment (TOE) framework in explaining organizational adoption decisions. Technology Dimension - the studies highlight that adoption is strongly influenced by perceived relative advantage, cost-effectiveness, maturity of the technology, compatibility with existing systems, data quality, and technical complexity (Yoon, C., 2023, Pillai & Sivathanu, 2020). Technologies that are perceived as immature, costly, or poorly standardized (e.g., blockchain in automotive supply chains) face slower adoption, whereas those offering clear efficiency and intelligence gains (e.g., AI in talent acquisition and manufacturing) are adopted more readily (Xu, X et al., 2024). Organization Dimension - organizational factors emerge as critical enablers or barriers. These include, top management commitment, organizational readiness, absorptive capacity, availability of skilled human resources, IT infrastructure, and leadership support (Chatterjee et al., 2021). A recurring theme

is that even high-potential technologies fail to be adopted when organizations lack internal capabilities or strategic alignment. Environment Dimension - environmental pressures such as competitive pressure, vendor support, regulatory clarity, industry standards, and government support play a decisive role. Competitive intensity often accelerates adoption, while regulatory ambiguity and lack of standards slow it down, as observed in blockchain adoption in the automotive industry. Building on these TOE-based adoption studies, this research applies the same theoretical logic to the adoption of neuromarketing within the automotive sector, a context characterized by high-involvement decisions, strong competitive pressure, and increasing technological sophistication.

Recent studies applying DEMATEL in combination with the Technology–Organization–Environment (TOE) framework provide critical insights into how organizations evaluate, prioritize, and respond to adoption barriers in complex and high-involvement contexts. These studies demonstrate that adoption challenges are not independent, but interrelated and hierarchical, necessitating analytical approaches that capture cause–effect relationships among barriers. Across reviewed studies (e.g. Low-Carbon Operations, disruptive technologies), technological barriers consistently emerge as “cause” variables, while economic or operational barriers tend to be “effect” variables. Combining TOE with DEMATEL strengthens theory by positioning barriers within Technology–Organization–Environment categories, and Quantifying interdependencies across these categories (e.g., how technology complexity affects organizational adoption decisions under competitive pressure). Prior studies follow a two-stage expert engagement process: Initial identification and ranking of barriers, Subsequent pairwise influence assessment for DEMATEL (Kumar et. al.,2023, Sharma & Nair 2025).

Based on literature review various barriers of adoption of neuromarketing were found in other sectors. They are mentioned in Table 1. These were ethical concern, not mobile / lab setup requirements, time consuming compared to traditional research methods, expensive, lower sample size, black box, Correlational evidence but not causal evidence and complex to understand.

Table 1. **Barriers of neuromarketing adoption**

Barriers	Explanation	Source
Ethics	Many researchers have raised concerns about ethical standards in consumer neuroscience.	Lim (2018)
Not mobile	As most of the research happens in a lab setup, it is not mobile and can't go where consumers are based.	Lim (2018)
Time consuming	In the era where fast turnaround is needed, neuroscience methods need more time to collect, process and present data.	Panwar (2020)
Expensive	Equipment like EEG and FMRI are expensive and complex.	De Oliveira (2014), Alsharif et al., (2023)
Lower Sample	Consumer neuroscience studies have smaller samples and hence, there are concerns about the size of samples and limited representativeness.	Meyerding & Mehlhose, (2020)
Black Box	Market research firms providing neuromarketing solutions under the name of patented models, refrain from sharing the entire process of data collection, analysis and reporting of insights. Hence, organizations or brands using neuromarketing have limited opportunity to validate the same.	Brenninkmeijer et al. (2019)
Preference towards traditional methods	Brands do not wish to take risks and are more comfortable with tried and tested traditional methods.	Baños, et al. (2020)
Correlational evidence but not causal evidence	Neuromarketing explains the understanding of consumers' brain, not consumer behavior.	Cherubino et al. (2019)
Lack of Expertise / Complex	As it is highly technical and complex hence need neuro experts to explain.	Alsharif et al. (2023)

Source: own study

Based on literature review, it was analysed that neuromarketing research is growing, but its application in market research is limited. It was also important to understand if the barriers identified in literature review are applicable to automotive sector. Authors also tried to understand if there are additional barriers to adoption of neuromarketing. As no paper to best of our knowledge has been written on understanding barriers of neuromarketing using TOE and DEMATEL. It was interesting to analyse hierarchy and interdependency of barriers of neuromarketing using DEMATEL. Also, this paper helps analyse barriers from Technology–Organization–Environment point of view and arrive

at implications using TOE framework. Hence these research helps to bridge multiple research gap and brings together work done so far in academia and analyses automotive industry point of view.

While prior studies have identified a range of barriers to neuromarketing adoption, a critical examination reveals both convergence and divergence in findings. There is broad agreement across the literature that technological barriers, particularly cost, complexity, and the need for specialized expertise, represent significant challenges to adoption (Lim, 2018; Alsharif et al., 2023). These barriers are consistently highlighted as restricting widespread implementation, especially in resource-constrained environments. However, the relative importance of other barriers varies across studies. For instance, while some research emphasizes ethical concerns and privacy issues as critical inhibitors (Brenninkmeijer et al., 2019), other studies including industry focused research suggest that such concerns are less influential compared to practical constraints such as cost, interpretability, and return on investment. This divergence indicates that ethical concerns, although theoretically important, may not be immediate drivers of organizational decision-making.

Similarly, methodological limitations, such as small sample sizes and reliance on correlational evidence, are frequently cited in academic literature (Cherubino et al., 2019). However, these concerns are not consistently perceived as critical barriers by practitioners, who often prioritize factors such as usability, cost, and ease of integration into existing workflows. This suggests a gap between academic critique and industry priorities. Another point of divergence lies in organizational and environmental barriers, which are relatively underexplored in earlier neuromarketing studies. While prior research acknowledges issues such as lack of awareness and vendor opacity, there is limited emphasis on factors such as peer adoption, benchmarking, and ecosystem maturity, which are critical in shaping adoption decisions in industries characterized by high risk and capital intensity. Overall, the literature tends to treat adoption barriers descriptively and in isolation, without systematically examining their relative importance or interdependencies. This highlights the need for a structured framework that not only categorizes barriers but also identifies their causal relationship. This gap is addressed in the present study through the integration of TOE and DEMATEL approaches.

Dominant work in neuromarketing originates from Spain, UK, Italy, USA and China. India is emerging, but much work is conceptual or hybrid. Adoption barriers in India may differ with vendor maturity, procurement constraints, data/privacy concerns, internal capability gaps, and proof-first culture. This research proposes a contextualized adoption framework that accounts for India specific organizational and environmental conditions. Neuromarketing overall is growing fast, but automotive-specific work is extremely limited. Only a handful researches on topics like UX, emotion prediction, or generic automobile consumers. Most work is method-driven (EEG/ET/GSR/fNIRS),

lab-centric, and consumer-response centric studies. Organizational adoption papers in other sectors highlight awareness, ROI ambiguity, and complexity but automotive decision-makers' viewpoints are missing. Negligible research conducted to analyse how do automotive companies evaluate, trust, and decide to adopt neuromarketing. This research helps understand adoption barriers and drivers from OEM/automotive ecosystem stakeholders' point of view. Contextualize adoption in India's automotive ecosystem, where budgets, vendor maturity, compliance concerns, and speed expectations differ.

TOE is widely used in AI/blockchain/genAI adoption studies. Negligible TOE-based neuromarketing adoption study is conducted so far. This research proposes and validates a TOE-based barrier framework for neuromarketing in automotive. In future replicable model can be used in studies in other geographies or other sectors. In future replicable model can be used studies in other geographies or other sectors. In the research conducted in the past, barriers to adoption of neuromarketing are mostly listed descriptively (ethics, cost, sample size, black box, lack of expertise). DEMATEL is used in other adoption contexts to identify cause vs effect barriers but is almost absent in neuromarketing adoption literature. This research bridges the gap by identifying which barriers are root causes (driving others) and which are downstream effects. It also understands the interdependencies between barriers. This research will provide market research companies deliver an actionable roadmap to improve adoption of Neuromarketing by solving these 2–3 cause barriers first.

One of the most repeated organizational barriers is failure to demonstrate value and ROI. There's little work establishing incremental validity on what neuromarketing adds beyond surveys/FGDs/concepts. Studies done so far discuss tools and ethics, but not implementation playbooks. Firms struggle with highly technical, hard to interpret and wondering where it fits in workflow. This research unearths the barriers of adoption of neuromarketing in automotive sector in India. Also suggests solutions to overcome the barriers. This research has business implications for both market research companies, research & neuromarketing associations and automotive companies. Opportunity for this research:

- build the first TOE framework for neuromarketing adoption in automotive,
- use DEMATEL to identify cause–effect barriers, ranking what must be solved first,
- revenue and business implication for market research and automotive companies.

3. Methods

The Research Onion (Saunders, 2012) and its different layers can be used as guideline to explain research process (Hengsborg, K. 2015). In one of the seminal papers on research onion, Melnikovas (2018) suggest, research onion for formulating methodology

and creating research design. Using research onion, this study adopts a pragmatic philosophy and an abductive approach to explore the adoption of neuromarketing in the Indian automotive sector. A qualitative-dominant, multi-method strategy is employed, combining literature review, semi-structured interviews with automotive organizations, expert-based DEMATEL analysis to model interrelationships among adoption barriers, and interviews with market research firms and neuroscientists to identify feasible solutions. This layered methodology enables a comprehensive understanding of adoption drivers, structural barriers, and actionable pathways for neuromarketing integration in automotive marketing practice.

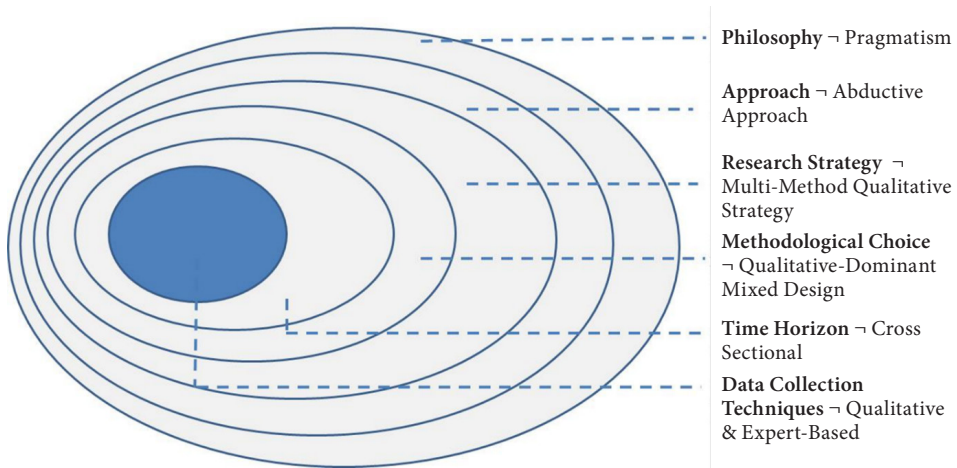


Figure 2. **Research Onion analysis**

Source: own study

Qualitative interviews with industry practitioners were used to refine, extend, and contextualize these concepts in the Indian automotive setting. There are ~60 key automotive companies in India. They can be segmented by type of vehicle manufactured – Cars, Two wheelers, Commercial vehicle and Tractors. This has a combination of India origin and foreign origin companies. Sampling techniques provide a range of methods that enable you to reduce the amount of data you need to collect by considering only data from a subgroup rather than all possible cases. Stratified sampling was used for selection of companies. This helps in making sure the responses are collected from each stratum. Zahraee (2016) in study to lean manufacturing in automotive sector used stratified sampling to conduct research

with automotive companies. In this study, strata were based on type of vehicle manufactured – Cars, Two wheelers, Commercial vehicle and Tractors. Then the mail was sent to all company representatives. Representatives were from Product development, Sales, Marketing and Market Research department of Automotive companies. They were also the decision makers for the type of market research to be conducted, and research methods to be used for the same. Mail was sent to the company email address or the representatives company email address, whichever was available. First mail was followed by 2 reminders. Representatives from 15 companies agreed for in-depth interviews. 15 qualitative in-depth interviews conducted along with few close-ended questions. In depth interviews is one of the most effective techniques in qualitative research (Ullo & Mardones, 2017) and helps in deep diving into personal experiences instead of general observations or opinions and beliefs (King, 2012). Few interviews conducted face to face, and few were conducted online. The approximate length of the interview was one hour. The key objective of the qualitative interview was to validate the barriers of neuromarketing found in literature review and evaluate if additional barriers existed in the mind of automotive companies.

Table 2. **Sample covered in qualitative phase**

Research units	Number of interviews
Two-wheeler manufacturers	5
Four-Wheeler manufacturers	5
Commercial vehicle Manufacturers	3
Tractor Manufacturers	2

Source: own study

In the second step, the mail was again sent to all 60 automotive company representatives. Mail was sent to the company email address or the representatives company email address, whichever was available. First mail was followed by 2 reminders. 25 market research and marketing professionals from automotive sector in India replied to this email. 15 participants were same that were interviewed in step 1 and additional 10 were interviewed. Details are mentioned in Table 3. The main objective of the survey was to understand top barriers identified from literature review and qualitative research in the step one. Sample covered and measurement scale of evaluation is mentioned below in Table 4.

Table 3. **Sample covered in quantitative phase**

Research units	Number of interviews
Two-wheeler manufacturers	8
Four-Wheeler manufacturers	9
Commercial vehicle Manufacturers	5
Tractor Manufacturers	3

Source: own study

Table 4. **Measurement scale for evaluation**

Evaluation score	Extent of impact of barrier on adoption of neuromarketing
1	Insignificant
2	Minor
3	Moderate
4	Major
5	Very Significant

Source: own study

In the step three, out of the 25 participated in step 2, those were selected who have considered or used neuroscience in market research. Rationale for selecting those participants was, they were clear about barriers and drivers of neuromarketing in a better way as they were not only aware but considered or used it. 15 such participants were interviewed for DEMATEL analysis. Details are mentioned in Table 5.

Table 5. **Sample covered for Dematel analysis**

Research units	Number of interviews
Two-wheeler manufacturers	6
Four-Wheeler manufacturers	6
Commercial vehicle Manufacturers	2
Tractor Manufacturers	1

Source: own study

The DEMATEL (Decision-Making Trial and Evaluation Laboratory) method was employed for data analysis. Dematel gives the hierarchy of importance among the barriers and relationship among them. To conduct Dematel analysis, top 10 barriers from step 2 were explained to the experts. Then they were asked to rate the influence of one barrier over the other on 5-point scale mentioned in Table 6.

Table 6. Extent of influence scale for Dematel analysis

The extent of the influence	Indication
No influence	0
Very low influence	1
Low influence	2
High influence	3
Very high influence	4

Source: own study

Experts were given example as shown in the below:

- (1). Based on your expertise, if you believe that A has “No influence” on C, please fill in “0” in the box and if A has “High influence” on C, please fill in “4”.
- (2). Based on your expertise, if you believe that B has a “Very High influence” on C , please fill “4” in the box.
- (3). 3) If you believe that C has ‘Very low influence” on A and B, then fill “1” in the box. Illustration of the same in mentioned in the Table 7. (Uday, et al., 2025).

Table 7. Illustration of extent of influence of barriers

The main influence (cause) \ Affected by (effects)	A	B	C
	A	B	C
A	The effect of A on A does not need to be filled in	0	3

B	2	The effect of B on B does not need to be filled in	4
C	1	1	The effect of C on C does not need to be filled in

Source: Uday, et al. (2025)

Given the exploratory nature of the study and the emerging status of neuromarketing adoption in the Indian automotive sector, a purposive and stratified sampling approach was adopted. Rather than focusing on large sample sizes, this study prioritizes depth, relevance, and decision-making authority of respondents. Participants were selected based on two key criteria: (1) involvement in marketing, product development, or market research functions, and (2) direct responsibility or influence in selecting research methodologies. The sample was stratified across automotive segments (two-wheelers, passenger vehicles, commercial vehicles, and tractors) to ensure representation of diverse market dynamics. Although the sample size is relatively small, it is consistent with prior qualitative and DEMATEL-based studies where expert judgment and domain expertise are considered more critical than sample volume for deriving meaningful insights.

All interviews were conducted with the consent of participants, were either audio-recorded or detailed notes were taken during the interaction. Recorded interviews were subsequently transcribed for analysis to ensure accuracy and completeness of responses. For interviews where recording was not permitted, expanded notes were prepared immediately after the discussion to capture key insights. To ensure confidentiality and anonymity, respondents were informed that their identities, company names, and individual responses would not be disclosed in the study. Data were anonymized during transcription and analysis. Participation in the study was voluntary, and respondents were assured that their inputs would be used solely for academic research purposes. The data collection was conducted over the period of June 2025 to October 2025, allowing sufficient time for follow-ups and ensuring representation across different automotive segments. These steps were taken to ensure ethical compliance, data quality, and reliability of the research findings.

4. Results

Based on qualitative discussions in the step 1, authors validated the barriers identified in the literature review and unearthed additional barriers of neuromarketing. The additional barriers are mentioned in the Table 8 below.

Table 8. **Additional barriers of neuromarketing adoption**

Barriers	Explanation
Limited to large organization	Neuromarketing research is limited to large organizations as they have a variety of projects and large market research budget. Small companies prefer to do basic research first with traditional research methods.
No benchmarks	When market research is conducted using traditional market research methods like quantitative methods, the scores from current study are compared with studies done in the past. It is used by research companies and organizations to benchmark it across sector. Many neuroscience companies do not have such benchmarks to be compared.
No standard process	The process of analysis and reporting of the neuromarketing data is also not very standard and varies from company to company.
Never heard from peers or competitors	Never or rarely heard from industry peers using neuromarketing.
Believability of neuromarketing effectiveness	Companies lack belief in the effectiveness of neuromarketing in terms of unbiased data collection, capturing emotional response, high predictability as compared to traditional research methods.
Can't be used in all types of research	Neuromarketing can't be used in studies like customer satisfaction, brand equity or pricing studies. It can complement traditional research at the max.

Source: own study

Interviews conducted in the step 2 helped to get the top barriers of neuromarketing. This was done considering the response of 25 participants. Using average score for each barrier and top 10 barriers were selected. Similar approach of ranking barriers was followed by Sharma & Nair (2025) to identify barriers of Circular Economy Practices in the Automotive Industry. Top barriers were then used for DEMATEL Analysis. Also, these barriers were categorized as technological, organizational and environmental barriers using TOE framework. Top barriers identified in step 2 are mentioned in Table 9.

Table 9. Ranking of barriers and TOE categorization

Barriers of neuromarketing	Score	TOE categorization
Lack of neuromarketing provider	3.9	Environmental
Expensive	3.8	Technical
Lesser adoption among peers or competitors	3.4	Environmental
Preference towards traditional methods	3.3	Organization
Complex technology	3.2	Technical
Believability of neuromarketing effectiveness	3.2	Organization
Limited to large organization	3.1	Organization
Small sample	2.5	Technical
Time consuming	2.5	Technical
Ethical concern	2.1	Environmental
Can't be used in all types of research	1.8	Organization
Not mobile	1.5	Technical
No benchmarks	1.4	Technical
No standard process	1.3	Environmental
Black box	1.2	Technical
Correlational evidence but not causal evidence	1.1	Technical

Source: own study

To understand direct relationship between barriers, Fontel and Gabus scale from 0 to 4 was used (Kazemi et.al, 2025). 0 indicates no influence, 1 very low influence, 2 low influence, 3 high influence and 4 very high influence. For each barrier, its influence of other barrier was captured. As same barrier example “Lack of Neuromarketing providers” can’t have influence on its own, it is rated as 0. Top 10 barriers identified in step 2 were coded from C1 to C10. They are mentioned below in Table 10.

Table 10. **Coding of barriers**

Barriers of neuromarketing adoption	Code
Complex technology	C1
Small sample	C2
Time consuming	C3
Preference towards traditional methods	C4
Limited to large automotive companies	C5
Expensive	C6
Lack of neuromarketing providers	C7
Ethical concern	C8
Lesser adoption among peers or competitors	C9
Lack of belief in effectiveness of neuromarketing	C10

Source: own study

Mean or Average matrix was arrived at by taking the average of response of all experts (15) for influence one barrier C1 has on other barrier C2, similarly C1 on C3 till C10. This can be represented as an equation below (Dikmen & Taş , 2018), (Kazemi et.al, 2025)

$$a_{-ij} = \frac{1}{H} \sum_{k=1}^H X_{ij}^k$$

a_{-ij} – Average influence of factor i on factor j.

i = influencing barrier (e.g. Complex Technology), j = affected barrier (e.g. Preference towards Traditional Methods)

H is number of experts (15).

X_{ij}^k represents the rating of kth expert on the degree to which factor i influences factor j.

The average matrix arrived for all factors in Table 11.

Table 11. Mean or Average Matrix - Initial Direct-Relation Matrix

Mean Matrix (A)	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
C1	0.0	1.6	2.4	2.2	1.4	2.6	2.7	0.6	0.7	0.9
C2	0.8	0.0	0.1	2.6	0.6	0.7	0.3	0.2	0.2	1.6
C3	0.8	2.2	0.0	2.1	1.1	1.9	0.9	0.2	0.4	0.2
C4	1.3	0.6	0.2	0.0	1.0	1.3	2.1	0.2	1.8	2.0
C5	0.3	0.1	0.1	0.6	0.0	1.0	0.7	0.4	0.9	0.7
C6	1.0	2.8	1.1	2.4	1.9	0.0	0.9	0.1	0.7	0.8
C7	1.3	0.6	0.9	2.1	1.0	1.8	0.0	0.2	1.1	0.9
C8	0.0	0.0	0.1	1.2	0.3	0.1	0.4	0.0	0.3	0.7
C9	1.0	0.4	0.3	2.2	1.4	0.7	1.2	0.8	0.0	2.1
C10	1.1	0.9	0.8	2.4	1.6	0.3	0.9	0.2	1.1	0.0

Source: own study

Matrix A is converted to Normalized Direct Relations Matrix using the formula and presented in Table 12.

$$B = m \times A$$

$$m = \min [1 / \max_i (\sum_j a_{ij}), 1 / \max_j (\sum_i a_{ij})]$$

m - Normalization coefficient

Table 12. Normalized Direct Relations Matrix

Matrix B	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
C1	0.000	0.087	0.137	0.124	0.081	0.143	0.149	0.031	0.037	0.050
C2	0.043	0.000	0.006	0.143	0.031	0.037	0.019	0.012	0.012	0.087
C3	0.043	0.124	0.000	0.118	0.062	0.106	0.050	0.012	0.025	0.012
C4	0.075	0.031	0.012	0.000	0.056	0.075	0.118	0.012	0.099	0.112
C5	0.019	0.006	0.006	0.031	0.000	0.056	0.037	0.025	0.050	0.037
C6	0.056	0.155	0.062	0.137	0.106	0.000	0.050	0.006	0.037	0.043
C7	0.075	0.031	0.050	0.118	0.056	0.099	0.000	0.012	0.062	0.050

C8	0.000	0.000	0.006	0.068	0.019	0.006	0.025	0.000	0.019	0.037
C9	0.056	0.025	0.019	0.124	0.081	0.037	0.068	0.043	0.000	0.118
C10	0.062	0.050	0.043	0.137	0.087	0.019	0.050	0.012	0.062	0.000

Source: own study

Indirect Influence Matrix (ID) or total relationship matrix arrived using the formula

$$ID = D(I - D)^{-1},$$

where I represent the identity matrix, and D is the normalized direct relations matrix. The scores for indirect influence are mentioned in Table 13.

Table 13. Indirect Influence Matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
C1	0.090	0.185	0.192	0.293	0.186	0.247	0.247	0.059	0.121	0.152
C2	0.088	0.044	0.039	0.217	0.085	0.089	0.079	0.027	0.060	0.139
C3	0.101	0.183	0.041	0.228	0.131	0.172	0.121	0.032	0.081	0.089
C4	0.137	0.098	0.064	0.133	0.138	0.151	0.193	0.036	0.157	0.184
C5	0.048	0.038	0.028	0.089	0.038	0.088	0.073	0.035	0.076	0.072
C6	0.121	0.214	0.104	0.260	0.179	0.085	0.132	0.030	0.102	0.128
C7	0.133	0.101	0.095	0.232	0.133	0.172	0.082	0.034	0.120	0.124
C8	0.021	0.018	0.019	0.101	0.042	0.029	0.050	0.007	0.040	0.062
C9	0.114	0.083	0.062	0.231	0.151	0.109	0.143	0.063	0.063	0.185
C10	0.116	0.103	0.081	0.234	0.150	0.091	0.123	0.033	0.117	0.072

Source: own study

Generation of the Influential Relation Matrix and Map (Summing the Rows and Columns and Construct the Causal Diagram) was performed. To construct the causal diagram, as illustrated in Figure 2, we calculate the sum of the rows (r) and the sum of the columns (c) of the overall relationship matrix for each barrier. Then, we calculate r+c and r-c. Details are in Table 14.

Table 14. Indirect Influence Matrix

	r	c	r+c	r-c
C1	1.77	0.97	2.74	0.80
C2	0.87	1.07	1.94	-0.20
C3	1.18	0.72	1.90	0.46
C4	1.29	2.02	3.31	-0.73
C5	0.59	1.23	1.82	-0.65
C6	1.35	1.23	2.59	0.12
C7	1.23	1.24	2.47	-0.02
C8	0.39	0.35	0.74	0.03
C9	1.21	0.94	2.14	0.27
C10	1.12	1.21	2.33	-0.09

Source: own study

Using r-c we are arrive at which factors are cause and effect. If the value of r- c is positive, then it is the cause and if it negative then it is effect. Details of cause and effect are in Table 15.

Table 15. Coding of barriers into cause and effect

Barrier	Barrier details	r-c	Cause / Effect
C1	Complex technology	0.80	Cause
C2	Small sample	-0.20	Effect
C3	Time consuming	0.46	Cause
C4	Preference towards traditional methods	-0.73	Effect
C5	Limited to large automotive companies	-0.65	Effect
C6	Expensive	0.12	Cause
C7	Lack of neuromarketing providers	-0.02	Effect
C8	Ethical concern	0.03	Cause
C9	Lesser adoption among peers or competitors	0.27	Cause
C10	Lack of belief in effectiveness of neuromarketing	-0.09	Effect

Source: own study

Using $r+c$ we arrive at ranking of the barriers. Higher the $r+c$ bigger is the barrier and higher impact on lesser adoption of neuromarketing. Ranking of barriers are mentioned in Table 16.

Table 16. **Ranking of barriers**

Barrier	Barrier details	$r+c$	Ranking
C1	Complex technology	2.74	2
C2	Small sample	1.94	7
C3	Time consuming	1.90	8
C4	Preference towards traditional methods	3.31	1
C5	Limited to large automotive companies	1.82	9
C6	Expensive	2.59	3
C7	Lack of neuromarketing providers	2.47	4
C8	Ethical concern	0.74	10
C9	Lesser adoption among peers or competitors	2.14	6
C10	Lack of belief in effectiveness of neuromarketing	2.33	5

Source: own study

Now to understand the causal relationship between barriers, an appropriate threshold value is necessary to obtain a suitable impact relations map. Threshold value of this data is 0.1099174. This is calculated using the formula $\alpha = (\sum \text{all elements in total relation matrix}) / (n \times n)$ where n = number of factors (barriers/variables). This threshold value is subtracted from each value in Indirect Influence Matrix table. If the value is negative, then barrier in first column has no impact on corresponding barrier in the same row. If it is positive, then that barrier has impact on corresponding barrier in the same row. Influence of each barrier on another is detailed out in Table 17.

Table 17. Influence of barriers

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
C1	-0.02	0.08	0.08	0.18	0.08	0.14	0.14	-0.05	0.01	0.04
C2	-0.02	-0.07	-0.07	0.11	-0.02	-0.02	-0.03	-0.08	-0.05	0.03
C3	-0.01	0.07	-0.07	0.12	0.02	0.06	0.01	-0.08	-0.03	-0.02
C4	0.03	-0.01	-0.05	0.02	0.03	0.04	0.08	-0.07	0.05	0.07
C5	-0.06	-0.07	-0.08	-0.02	-0.07	-0.02	-0.04	-0.08	-0.03	-0.04
C6	0.01	0.10	-0.01	0.15	0.07	-0.02	0.02	-0.08	-0.01	0.02
C7	0.02	-0.01	-0.02	0.12	0.02	0.06	-0.03	-0.08	0.01	0.01
C8	-0.09	-0.09	-0.09	-0.01	-0.07	-0.08	-0.06	-0.10	-0.07	-0.05
C9	0.004	-0.03	-0.05	0.12	0.04	-0.001	0.03	-0.05	-0.05	0.07
C10	0.01	-0.01	-0.03	0.12	0.04	-0.02	0.01	-0.08	0.01	-0.04

Source: own study

Above table show C1 has no impact on C8 as the value is negative but impact on C2 as the value is positive. To understand the importance, causal relation and which factors to focus, causal relationship diagram is drawn by putting r+c value for each barrier on Y axis and r-c value for each barrier on X axis. Single direction line is from one barrier to another if that barrier has impact on another barrier. e.g. C1 has impact on C2 but C2 doesn't have impact on C1 hence single direction line. C1 has impact on C9 and C9 has impact on C1 hence bidirectional line is drawn. Then vertical line is drawn on x axis from the midpoint and horizontal line on y axis. Factors below the horizontal line are effect and above are cause. Barriers to the right of vertical line are important and to the left are less important. The barriers which are in top right quadrant are the barriers which are cause and are very important. Hence need to be overcome first. Causal relation and importance of barriers is explained in figure 3. The results show that technological barriers such as complexity (C1) and cost (C6), along with environmental factors like peer adoption (C9), are part of the cause group. This implies that these barriers act as root drivers influencing other organizational barriers such as lack of belief in effectiveness and preference for traditional methods. In contrast, organizational barriers such as preference for traditional methods (C4) and limited adoption by firms (C5) fall into the effect group, suggesting that they are consequences of deeper technological and environmental constraints rather than independent drivers. This interpretation highlights that addressing root technological

barriers can create a cascading positive impact on multiple downstream barriers, thereby accelerating neuromarketing adoption.

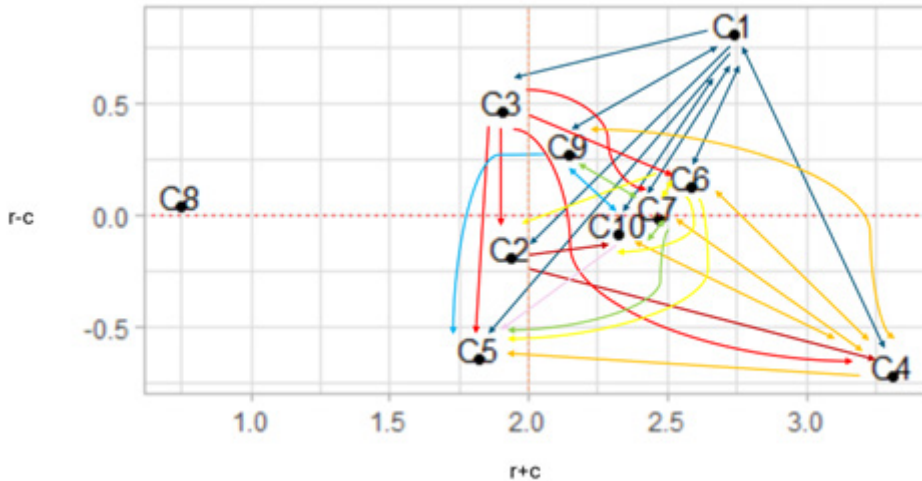


Figure 3. Causal relation and importance of barriers

Source: own study

5. Discussion

Objective of this study is to understand order of importance of barriers of adoption of neuromarketing and causal relationship between them. Literature review was done to understand the barriers of adoption of neuromarketing across sectors. These barriers were ethical concern, lab setup requirements, higher time consuming compared to traditional research methods, expensive, lower sample size, black box, correlational evidence but not causal evidence and complex to understand. This was then validated through qualitative research to understand if these barriers hold true for automotive players and if there any new barriers. Automotive companies confirmed these barriers and highlighted additional barriers like limited to large organization, no benchmarks, no standard process, never heard from peers or competitors, lack of believability of Neuromarketing effectiveness and can't be used in all types of research.

The findings of this study both confirm prior neuromarketing literature and extend it by identifying context-specific barriers in the Indian automotive sector. Consistent with earlier studies (e.g., Lim, 2018; Alsharif et al., 2023), technological barriers such as high cost, complexity, and the need for specialized expertise are validated as significant

inhibitors of adoption. Similarly, previously identified concerns related to small sample sizes, time consumption, and lack of transparency (“black box” perception) were also confirmed through automotive industry interviews. However, this study identifies several barriers that are more pronounced or unique in the automotive context. Unlike generic neuromarketing literature, where awareness is often assumed, automotive firms in India exhibit a strong preference for traditional research methods, driven by risk aversion and long-standing reliance on established methodologies. Additionally, lack of peer adoption and absence of industry benchmarks emerged as critical environmental barriers, reflecting a “proof-first” culture in the automotive sector where firms hesitate to adopt new methods without demonstrated success in competing organizations.

Another distinguishing finding is the importance of vendor ecosystem limitations, including lack of neuromarketing providers and absence of standardized processes. While prior research acknowledges vendor-related constraints, this study shows that these factors play a more critical role in emerging markets such as India, where ecosystem maturity is still evolving. Furthermore, the DEMATEL analysis extends prior literature by identifying causal relationships among barriers, demonstrating that technological barriers (complexity and cost) act as root causes influencing organizational barriers such as lack of belief in effectiveness and preference for traditional methods. This causal hierarchy has not been explicitly examined in prior neuromarketing studies, particularly in sector-specific contexts. Overall, while the study confirms the general barriers identified in global neuromarketing literature, it contributes by contextualizing these barriers within the automotive sector in India and identifying additional, industry-specific constraints that influence adoption decisions.

A key distinguishing finding of this study is the importance of peer adoption and benchmarking as a barrier. While relatively underemphasized in prior neuromarketing literature, similar patterns have been observed in manufacturing and automotive contexts, where firms prefer to adopt technologies only after proven success among competitors. This “proof-first” approach is particularly evident in India, where organizations prioritize demonstrated ROI before committing to new technologies. Furthermore, the identification of causal relationships among barriers through DEMATEL provides additional insight beyond prior studies, which typically treat barriers in isolation. The study shows that technological barriers act as root causes influencing organizational perceptions and environmental constraints, a finding that is consistent with TOE-based adoption research in other industries. Overall, while the study confirms several globally recognized barriers to neuromarketing adoption, it extends the literature by contextualizing these within the Indian automotive sector and by integrating cross-industry insights to better understand adoption dynamics.

Figure 4 summarises the ranking of barriers and mentions whether it is a cause or an effect in the TOE framework. Figure 3 also shows that, on priority technological barriers like complex technology and expensive, environmental barrier – lesser adoption among peers & competition needs to overcome as they are top barriers and impact other barriers as well.

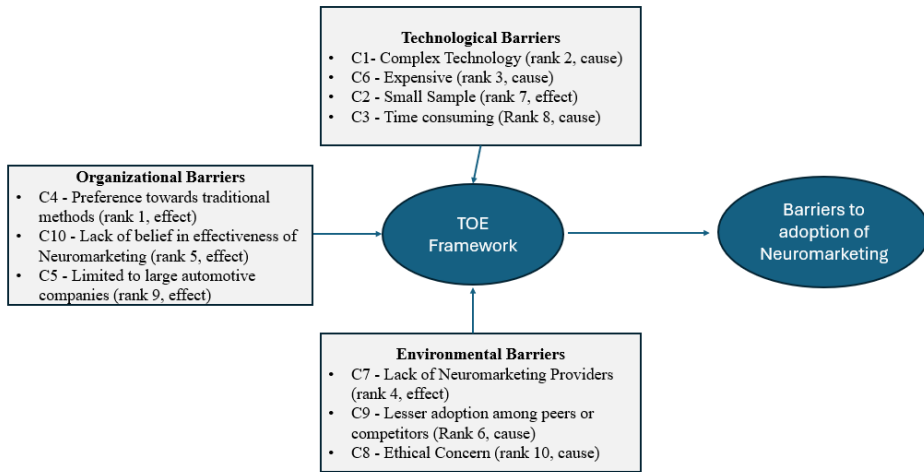


Figure 4. Barriers in TOE framework

Source: own study

Discussion with automotive players revealed that they find neuromarketing to be a complex technology. It is difficult for them to understand the methods like EEG, Eye tracking and Facial coding. Even they find data collection, its analysis and final output difficult to understand. This technological barrier ranks number 2 and impacts multiple other barriers. Neuromarketing being expensive compared to traditional research is another top barrier which needs to be resolved. It ranks 3rd among all barriers and impacts multiple other barriers. Automotive players feel, neuromarketing is expensive as it uses technologies like EEG and Eye tracking. Also, they feel it is expensive as it needs specialists to do the data collection and analysis. Other barriers like small sample size and time-consuming rank low in the importance hence can be prioritized later.

Technological barriers such as high cost and complexity have been widely reported as major adoption challenges in neuromarketing studies across regions including Europe and North America (Lim, 2018; Alsharif et al., 2023). Similar barriers are

also observed in the adoption of emerging technologies such as artificial intelligence and blockchain across industries, where perceived complexity and cost hinder organizational uptake. The present study confirms these findings in the automotive context, where complex neuroscientific tools and perceived high investment continue to limit adoption.

Dematel analysis shows that preference towards of market research is topmost barrier in an organization. And it gets affected by other barriers like complex technology, expensive, lesser adoption among peers, etc. Automotive companies prefer traditional market research over neuromarketing because they think Neuromarketing is complex to understand. On the other hand, they have been doing quantitative and qualitative research for long time, hence don't find traditional research to be complex. They also feel neuromarketing is relatively expensive to conduct compared to traditional research methods. It is primarily due to the assumption that it includes technical equipment like EEG and needs expert neuroscientist. Preference towards traditional research is also due to lesser adoption of Neuromarketing among competition and peers. They feel they don't want to take the risk and be the first one to experiment with it. When they hear from peers and case studies, they become more comfortable to adopt that technology. Another barrier which is also among the top barrier is lack of belief in effectiveness of neuromarketing. It also has causal relationship with barriers like C1 – complex technology, C2 – small sample, C4 – preference towards market research, C6 – expensive, C7 – lack of neuromarketing providers. Out of these C1 and C6 are the causes. Automotive companies feel neuromarketing is complex, hence they have never tried to deep dive into its data collection, analysis and reporting process. Their lack of awareness or exposure to this led to lack of belief in its effectiveness. Also, as they feel Neuromarketing is expensive leading to the belief that it can't be used in different kinds of studies. Also, small sample covered in neuromarketing as compared to traditional methods leads to the belief that it is not representative of their customers and hence not effective.

Organizational barriers identified in this study, particularly the preference for traditional research methods, are also aligned with findings from digital marketing and AI adoption studies, where organizations exhibit resistance to change and reliance on established practices. However, this tendency appears to be more pronounced in the automotive sector due to its risk-averse decision-making culture and high financial stakes associated with product and marketing decisions.

Lack of neuromarketing providers has emerged as 4th topmost barriers from Dematel analysis. It has a causal relationship with C1, C3, C4, C6, C9, C10. Complex Technology (C1) surely results in lesser number of companies getting into the space of providing neuromarketing services and solutions. Neuromarketing needs equipment, neuroscientists, expert marketing professionals and labs. As the investment is high in this setup, it leads to lack of neuromarketing providers. Also, as it takes higher

time (C3) to conduct a neuromarketing study, a client may drift towards traditional methods which can give result in quick turnaround time. Higher time also means longer time cost and investment in lab, neuroscientist and expert researchers. Hence, leading to lesser neuromarketing providers. Being expensive (C6) leads to higher initial investments from the service providers and lesser adoption by automotive companies. Hence this can lead to lesser companies providing neuromarketing solutions. Dematel analysis also shows that lesser adoption of neuromarketing among peers and competition is ranked 6th among the barriers. Ethical concern ranks last among the barriers and doesn't have a causal relationship with any barriers. Hence it can be deprioritised for time being.

From an environmental perspective, barriers such as lack of neuromarketing providers and ecosystem maturity are comparable to challenges observed in emerging markets for other technologies, including AI and blockchain. Prior studies indicate that limited vendor support and absence of standardized practices slow adoption in industries with evolving technological ecosystems. This is strongly reflected in the Indian automotive sector, where neuromarketing provider availability remains limited.

6. Conclusions

Though concept of neuromarketing was introduced 2 decades back, its adoption in the corporate world has been very limited. Neuromarketing has many advantages over traditional research methods still various barriers exist in the mind of corporates. This is the unique study which used TOE framework and Dematel analysis to prioritize the barriers to adoption of Neuromarketing and understand the causal relationship between the barriers. Hence this study gives clear direction to market research companies, automotive companies and associations like ESOMAR and NMSBA which barriers must be addressed on priority. This study also utilises the research work done by academia and considers the views of automotive industry to enhance industry – academia partnership. It can lead to increase in the adoption of Neuroscience in conducting market research to understand the customer response in a better way. If the top barriers identified in this study are overcome, it can increase the spend on neuromarketing and hence increase the revenue of market research companies. It can also benefit automotive companies to test the advertisements and product designs in advance to avoid major cost of failure of going wrong.

The study is based on a relatively small sample of respondents from the automotive industry in India. Although purposive and stratified sampling ensured representation across different vehicle segments, the findings may not fully capture the diversity of perspectives within the broader automotive ecosystem or across other

industries. Future research with larger and more diverse samples could enhance the generalizability of the results. The DEMATEL analysis relies on expert opinions to assess the degree of influence among barriers. While the selected respondents were experienced professionals with relevant domain expertise, their evaluations are inherently subjective and may be influenced by individual perceptions, experiences, and organizational contexts. Although reliability checks and aggregation methods were applied, the potential for subjective bias cannot be entirely eliminated. For analytical feasibility, the study focuses on the top 10 barriers identified through ranking. While this approach is consistent with prior DEMATEL-based research and helps reduce complexity, it may exclude lower-ranked barriers that could still have contextual relevance. Future research could explore alternative approaches to include a broader set of factors.

Purpose of this study is to understand causal relationship between barriers of neuromarketing and ranking of the same. This will help market research companies prioritise which barriers to focus resulting into increase in its adoption. The implications of the study can be seen through TOE (technological, organizational and environmental) framework. Technological barriers must be primarily focused by neuromarketing providers and neuroscientists. Organizational barriers must be overcome by decision-making stakeholders in automotive companies in partnership with market research companies. And environmental barriers need to be taken up by organizations / associations like MRSI (Market Research Society of India) and NMSBA (Neuromarketing Science & Business Association)

From Dematel analysis, top barrier in technology is complexity of Neuromarketing. The providers of Neuromarketing need to explain to the business stakeholders in simple term how the data is collected, analysed and reported. They must invite business stakeholders to attend the fieldwork when the neu-romarketing studies take place. They must also explain in simple term how the data is analysed as many automotive companies feel it is a black box. Neuromarketing companies can make the output of Neuromarketing very similar to traditional research methods to which business stakeholders are already comfortable with. Another top barrier of adoption of Neuromarketing is it being expensive. Neu-romarketing providers can explain to business stakeholders how Neuromarketing is more efficient in understanding the deeper emotions of customers and has added advantage over traditional methods. Hence it commands a bit premium, like when you go a surgeon compared to a general physician. They can prepare a case studies of comparison of effectiveness as compared to traditional research methods and show the additional ROI. All the techniques of Neuromarketing are not equally expensive. Neuro-marketing can be introduced to clients through methods such as AI, facial coding, eye tracking and then EEG analysis. Initially they can package it with larger traditional research studies as an additional module or as a value-added service.

Preference towards traditional research methods is the topmost barriers of adoption of Neuromarket-ing from Dematel analysis. Our analysis show it is affected by multiple other barriers including technological barriers. Once technological barriers of complexity and expensiveness are overcome, neuromarketing providers needs to position neuromarketing as complementary to traditional research than a competition. Multiple studies like communication testing and product design research can be complemented as package with traditional research. Neuromarketing companies can also offer Neuromarketing studies as pilot study to show its effectiveness. The key decision makers in the automotive companies also need to play an important role in adoption of neuromarketing in market research. They need to partner with neuromarketing providers to facilitate the seminars and presentations with top management on how neuromarketing can be used in market research studies. They can make some small provisions in research budget to conduct a pilot or proof of concept using neuromarketing. Smaller neuromarketing providers can also partner with already established large market research companies to complement market research projects with neuromarketing. Research companies to explain in which studies neuromarketing has an edge over traditional research methods and reasons for the same. This will help decision makers in automotive companies think about neuro when they conduct market research studies in that domain, e.g. communication testing, logo testing, car colour / design testing, etc.

One of the topmost environmental barriers identified in this study is lack of neuromarketing providers. Here the organizations / associations like MRSI (Market Research Society of India) and NMSBA (Neuromarketing Science & Business Association) can play a big role. They need to create a list of certified neuromarketing providers on their website for clients to have easy access when they plan to conduct research using neuroscience. Also, during various conferences and seminars they must keep a session on neuromarketing and its adoption among various businesses. They can also invite speakers from other countries like US and Spain where adoption of neuromarketing is very high and share real case studies. They can organize panel discussions and promote more collaboration among academic institutions, neuromarketing companies and corporates.

In India automotive companies spend ~60 million USD on custom market research (MRSI, 2024). Using global norms, if 1-3% of market research spend is on neuromarketing, the spend is estimated to be 0.5-1.5 million USD. Based on discussion with automotive companies, if the barriers identified in the studies can be overcome, they might double the spend on neuromarketing. Hence, it can reach to 2-6% of their total spending on market research. This will result in 1 – 3 million USD for neuromarketing providers in India as compared to current 0.5-1.5 million USD revenue. The total advertising spend by automotive companies in India is estimated to be around 700-800 million USD (exchange4media, 2025). Also ~10 billion USD is

spent in engineering and research and development (R&D) in the automobile sector in India. Past studies have shown, adjustments in vehicle design and advertisements using neuromarketing insights increased consumer interest and sales. Tata Motors found that dynamic car shapes and vibrant colours (like red and blue) tested using neuromarketing elicited stronger emotional connections, prompting a 25% higher purchase intention among potential buyers (Prabhu, 2024). Hence even automotive companies can save millions of dollars by testing designs and advertisements in advance. This study can help research companies to focus on key barriers of neuromarketing, overcome them and help automotive companies increase the effectiveness of product design and advertisements.

Authors' contribution

P.P.: article conception, theoretical content of the article, research methods applied, conducting the research, data collection, analysis and interpretation of results, draft manuscript preparation. **P.T.:** article conception, theoretical content of the article, research methods applied, analysis and interpretation of results, draft manuscript preparation

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors did not use Generative AI and AI-assisted technologies in the writing process.

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