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Neuroeconomics as a tool for forecasting consumer behaviour

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Abstract. The study aimed to substantiate the potential of the neuroeconomic approach for analysing the mechanisms underlying consumer behaviour formation and to evaluate its effectiveness in forecasting market reactions. The methodological framework was based on a combination of behavioural and neuroeconomic approaches, alongside the application of elements of theoretical generalisation, statistical, comparative, case study, and SWOT analysis. The results of the statistical analysis established that in 2024, the Ukrainian digital advertising market grew by 35% compared to the previous year, confirming the strengthening role of behavioural digital analytics within the marketing research system. It was determined that the parameters of interaction with a stimulus are formed within the first few hundred milliseconds; specifically, fixation durations of 200-300 ms correspond to cognitive information processing, while the initial allocation of attention within the first 2-3 seconds determines the subsequent perceptual structure. Within the analysis of neuroeconomic methods, it was established that electroencephalography enables the assessment of emotional activation levels and cognitive load, visual tracking facilitates the analysis of attentional structure and the sequence of visual stimulus processing, and multimodal approaches enhance the accuracy of forecasting behavioural reactions through the integration of neural and behavioural indicators. A case study analysis of the Ukrainian consumer market revealed that the traditional marketing approaches employed by ATB-Market and Silpo predominantly focus on analysing turnover, demand structure, and loyalty programmes, whereas COMFY and VARUS utilise behavioural digital analytics and personalised interaction models to adapt digital services to shifts in consumer patterns. It was established that COMFY's e-commerce segment grew by 43% in 2024, accompanied by an update to the website structure and the optimisation of the digital customer journey. The conducted analysis demonstrated that the strengths of neuroeconomic approaches lie in the high accuracy of analysing emotional and cognitive reactions, the capacity to identify non-conscious factors of choice, and the integration of neurodata with behavioural digital analytics, whereas the principal risks are associated with neurodata privacy, algorithmic influence, the complexity of interpreting neurophysiological signals, and the absence of clear regulatory mechanisms. The practical significance of the research lies in expanding approaches to consumer behaviour analysis through the integration of traditional and neuroeconomic methods, thereby enabling an increase in the accuracy of assessing consumer reactions in the digital environment

Keywords: marketing research; cognitive processes; visual tracking; electroencephalography; emotional reactions

INTRODUCTION

The transformation of the consumer market is accompanied by an increasing complexity of decision-making processes, wherein consumer behaviour is shaped not only by rational assessments but also by emotional and cognitive

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reactions. Under these conditions, traditional approaches to demand analysis, which are predominantly based on surveys, demonstrate a limited capacity to reflect the intrinsic mechanisms of choice. The growing role of digital communication channels, the reduction in stimulus interaction time, and the increase in information load are altering the structure of consumer perception, necessitating the use of tools capable of capturing reactions at the moment of their emergence. In this context, neuroeconomics is emerging as an interdisciplinary field that integrates approaches from economics, psychology, and neuroscience, enabling the analysis of behaviour at the level of its formation.

The study by V. Seleznyova (2025) investigates the psycho-emotional aspects of the consumer decision-making process within the context of behavioural economics. The author substantiates that consumer choice is formed under the influence of not only the rational evaluation of alternatives but also the emotional and cognitive reactions that arise during stimulus interaction. The research emphasises that a consumer's emotional state can alter the nature of economic choice and influence behavioural models, even under conditions of identical information about a product or service. This expands the analytical capabilities for forecasting consumer behaviour, as it allows for the consideration of not only declared intentions but also the psycho-emotional factors of decision-making. A similar approach is developed in the research by T. Shepel (2026), where neuroeconomic tools are examined in the context of consumer decision formation amid the declining effectiveness of traditional communication models. The author accentuates that the reduction in interaction time with digital content to 2-3 seconds necessitates a transition to methods capable of analysing consumer sensory and emotional reactions in real time.

The role of neuroeconomic tools in forecasting behavioural reactions is disclosed in the work of T.V. Mitina (2025), which analyses neuroeconomic markers of decision-making under crisis conditions. The author demonstrates that consumer behavioural reactions under uncertainty are shaped by emotional tension, cognitive biases, and shifts in risk perception, which influence economic choice and the nature of decision-making. The study emphasises that the neuroeconomic approach allows for the analysis of consumer behaviour not only through rational evaluation models but also through the mechanisms of emotional and cognitive adaptation to an unstable environment. In the study by N. Chala *et al.* (2021), the neuroeconomic approach is applied to analyse reactions to visual stimuli, enabling the determination of a link between the nature of perception and the subsequent evaluation of an object. The authors established that the level of emotional engagement during interaction with visual stimuli was, on average, 25-30% higher compared to neutral images, confirming the expediency of using neuro-tools in situations where choice is formed under the influence of visual content. The applied dimension of neuroeconomic approaches in the digital environment is examined in the work of O.V. Kifiak *et al.* (2025), which substantiates their use for improving the accuracy of forecasting consumer reactions to digital stimuli. The authors showed that the use of neuroeconomic tools increased the effectiveness of evaluating advertising messages by approximately 20% compared to traditional survey methods.

The analysis of emotional and cognitive reactions has allowed for the refinement of advertising message perception assessments and an increase in the accuracy of their adaptation to target audiences. In the research by T. Povod & H. Zhosan (2025), neuroeconomic tools are considered in the context of building consumer loyalty in the field of science-intensive products, where product complexity complicates the decision-making process. The authors proved that accounting for the perceptual characteristics of innovative goods allows for increasing the accuracy of behavioural reaction assessment and adapting economic forecasting models to the cognitive characteristics of consumers. A separate research stream is associated with the use of neuroeconomic tools in the digital environment and small business. The work of N.V. Karpenko & M.M. Ivannikova (2021) shows that using tools for analysing emotions and behavioural reactions allows for improving the accuracy of consumer decision assessment, even under resource constraints. Concurrently, I. Hnyliakevych & R. Yerushevska (2020) explored the possibilities of using neuroeconomic tools in the online environment, where consumer behaviour is formed within compressed time intervals and depends significantly on visual and information load. The authors established that over 50% of decisions regarding interaction with digital content are made within the first seconds of contact with the stimulus, increasing the importance of attention fixation and emotional reaction methods in forecasting consumer behaviour.

The scholarly literature highlights the capabilities of neuromarketing as a tool for analysing emotional and cognitive reactions, as well as its application in digital communications, behaviour management, and loyalty formation. At the same time, existing studies predominantly feature a fragmented examination of individual tools or application areas, whereas the issue of utilising neuroeconomics as a holistic analytical approach to forecasting consumer behaviour in the context of the Ukrainian market remains insufficiently explored. Aspects relating to the integration of neurophysiological data into the marketing analysis system and their use for constructing predictive models remain underrepresented. The aim of this study was to determine the analytical capabilities of the neuroeconomic approach in examining consumer behaviour and to substantiate its use for enhancing the accuracy of forecasting market reactions. To achieve this aim, the following objectives were set: to evaluate the effectiveness of neuroeconomic methods and determine their functional capabilities in consumer behaviour research; to conduct a comparative analysis of traditional and neuroeconomic approaches based on the example of Ukrainian marketing research practices; and to carry out a SWOT analysis

of the development of neuroeconomic approaches in the consumer market, taking into account the technological, economic, and ethical aspects of their use.

MATERIALS AND METHODS

The study was of a theoretical-empirical nature and was based on a synthesis of contemporary scientific approaches to the analysis of consumer behaviour within the neuroeconomic paradigm. To investigate the analytical capabilities of the neuroeconomic approach in studying consumer behaviour, elements of theoretical generalisation, statistical analysis, and analytical interpretation of scientific sources were employed. Within this stage, electroencephalography (EEG), visual tracking, multimodal approaches, and neuromodels based on machine learning were analysed as tools for capturing consumers' emotional and cognitive reactions. The source base of the study comprised scientific publications dedicated to the application of neurobiological methods in marketing research (Phutela *et al*., 2022; Usman *et al*., 2025; Bossaerts & Schultz, 2026). Statistical and analytical materials pertaining to the Ukrainian marketing research market were also examined (IAB Ukraine, 2025). In the process of analysis, economic decisions were considered as the outcome of the interaction between cognitive and emotional processes, which enabled a transition from describing observed behaviour to explaining the mechanisms of its formation. Particular attention was devoted to the analysis of temporal parameters of interaction with a stimulus, changes in the spectral characteristics of EEG signals, and gaze fixation metrics, which allowed for the determination of the specific features of cognitive information processing and the structure of consumers' attention.

A comparative analysis of traditional marketing research and neuroeconomic approaches was conducted by juxtaposing their analytical characteristics, data sources, and practical limitations. Within this framework, an analytical table was developed wherein methods were evaluated according to the criteria of information type, research scale, forecasting accuracy, speed of obtaining results, and cost of application (Chygryn *et al*., 2024; Bansal *et al*., 2025). For the implementation of the case analysis of the Ukrainian consumer market, retail trade enterprises were selected, ensuring the comparability of consumer interaction models and the nature of analytical tool utilisation. The activities of the ATB-Market and Silpo chains, which operate based on mass demand research models, loyalty programmes, analysis of commodity turnover structure, and classical behavioural analytics, served as examples of the application of traditional approaches to consumer behaviour analysis (RAU, 2022). The selection of these cases is determined by their dominant position in Ukraine's retail sector, extensive reach of the consumer audience, and the availability of studies dedicated to the analysis of demand forecasting models and the organisation of goods movement. The cases of COMFY and VARUS companies, which actively employ digital behavioural analytics, personalised user interaction mechanisms, UX optimisation, and analysis of consumer reactions in the digital environment, served as examples of implementing behaviourally-analytical and neuroeconomically-oriented approaches (WebPromoExperts, 2025; Retailers.ua, 2025). The rationale for selecting these cases is linked to the companies' active digital transformation, the use of real-time user behaviour analysis tools, and the integration of behavioural data into the marketing decision-making system. The comparative case analysis was carried out according to the criteria of data sources, type of behavioural information, scale of consumer reach, level of interaction personalisation, speed of obtaining analytical results, and capabilities for forecasting consumer reactions in the digital environment.

To assess the prospects for the development of neuroeconomic approaches in the consumer market, a SWOT analysis was employed, which allowed for the systematisation of the strengths and weaknesses, opportunities, and threats of using neuromarketing tools in marketing research. Within this stage, the ethical, technological, and organisational limitations of using neurophysiological data in business practice were generalised by identifying key risk areas associated with neural data privacy, informed consent, algorithmic influence, and the manipulative potential of neuromarketing. The source base for the SWOT analysis comprised scientific studies in the field of neuroethics, neuromarketing, and neural data regulation (Goncalves *et al*., 2024; Gyori & Gabor, 2025; Singh & Kumar, 2026). During the analysis, various approaches to interpreting neural data privacy, the possibilities of algorithmic processing, and the risks of information asymmetry were juxtaposed, after which these aspects were systematised in the form of a SWOT matrix. The application of this method made it possible to determine not only the applied potential of neuroeconomic tools in digital marketing and e-commerce but also the factors that may limit the scale of their practical application.

To systematise the results of the SWOT analysis and visualise the logic of implementing neuroeconomic tools in marketing research, elements of structural-functional modelling were employed. Based on the generalisation of theoretical approaches, the analysis of the functional capabilities of neuroeconomic methods, and the practice of their application in the Ukrainian consumer market, the author has developed a cycle for the integration of traditional and neuroeconomic approaches in marketing research. The model reflects the sequence of interaction between the stages of behavioural data collection, analysis of consumer reactions, testing of marketing stimuli, and marketing decision-making, taking into account the ethical and technological limitations of using neural data.

RESULTS

Assessing the effectiveness of neuroeconomic methods in the Ukrainian consumer market

The integration of neurobiological data into marketing analysis contributes to the substantiation of managerial

decisions related to product positioning and the formation of consumer demand. In the process of interacting with marketing stimuli, the integration of sensory information with prior experience occurs, shaping individual behavioural patterns (Russo, 2024). In this context, neuroeconomics provides a toolkit for analysing behavioural variability associated with internal cognitive and emotional states (Bossaerts & Schultz, 2026). The analysis of neural activity during interaction with an advertisement, brand, or product enables the identification of the level of engagement, the intensity of the emotional response, and the degree of information memorisation.

Neural indicators can serve as predictors of market outcomes, including the sales of new products (Varga *et al.*, 2021). The use of tools such as EEG, visual tracking, and their combined modifications allows for the simultaneous analysis of attention, emotional activation, and cognitive load. These indicators are formed within the first few hundred milliseconds (ms) after contact with a stimulus, which permits the investigation of subconscious information processing. EEG signals reflect changes in the spectral power of brain waves (alpha, beta bands) associated with the level of engagement and cognitive activity, while visual tracking captures gaze direction, fixation duration, and the sequence of viewing visual elements (Panwar *et al.*, 2024). A gaze fixation duration exceeding 200-300 ms indicates cognitive processing of the stimulus, whereas shorter fixations are associated with superficial perception (Bekenova & Orazgaliyeva, 2025). The main characteristics of the methods are summarised in Table 1.

Table 1. Functional capabilities of neuroeconomic methods in consumer behaviour research

Method	What it measures	Key indicators	Practical application	Limitations
EEG	The electroencephalography method measures the brain's electrical activity arising in response to external stimuli	The key indicators are changes in the alpha and beta brainwave ranges, which reflect the level of emotional activation and cognitive processing	The method is used to assess consumers' emotional responses, their level of engagement, and the perception of advertising messages	The limitation is the complexity of signal interpretation and the need for specialised data processing
Visual tracking	The eye-tracking method allows for the recording of gaze direction and the distribution of a consumer's visual attention	The key indicators are the duration of fixations, which typically exceeds 200-300 ms, and the trajectory of gaze movement between elements of a stimulus	The method is applied to analyse the effectiveness of packaging design, advertising materials, and the structure of visual content	The limitation lies in the impossibility of directly determining a consumer's emotional state
EEG combined with visual tracking	This combined approach involves the simultaneous measurement of neural brain activity and visual attention	The key indicators are the coherence between gaze direction and the level of neural activation, which allows for the assessment of both attention and emotional response	The method is used to enhance the accuracy of consumer choice forecasting and to evaluate reactions to marketing stimuli	The limitations are the high cost of research and the complexity of integrating different data types
Neuromodels (ML)	Neuromodels based on machine learning analyse behavioural patterns using large arrays of neurophysiological data	The key indicators are choice probability, reaction classification, and the forecasting of behavioural outcomes	The method is applied for modelling consumer behaviour and forecasting market indicators	The limitations are the need for significant data volumes and the complexity of building interpretable models

Source: generalised based on N. Phutela *et al.* (2022), G. Bekenova & E. Orazgaliyeva (2025), S.M. Usman *et al.* (2025), T.V. Afonso & F. Heinrichs (2025), B.S. Abdullaeva *et al.* (2025)

An increase in fixation time on visual elements correlates with their prioritisation within the perceptual structure, thereby enabling the use of visual tracking as an indicator of information salience for the consumer. The analysis of EEG signals allows for the identification of an emotional response, thus complementing the results of visual tracking (Phutela *et al.*, 2022). The integration of EEG and visual tracking within a multimodal approach enhances the accuracy of consumer choice forecasting, as it allows for the simultaneous consideration of the direction of attention and the individual's emotional state (Usman *et al.*, 2025). Furthermore, solutions are being developed that allow for the integration of these methods at the hardware level, in particular, the use of EEG to reconstruct eye movements without the application of separate trackers (Afonso & Heinrichs, 2025).

The statistical context for the application of neuroeconomically-oriented approaches in Ukraine is defined by the rapid growth of the digital segment of the consumer market and the increasing role of behavioural analytics within the system of consumer interaction. According to IAB Ukraine (2025) data, in 2024, the Ukrainian digital advertising market grew by 35% compared to 2023, while the average growth of the European market stood at 11.1%. Under such conditions, the most widespread adoption is observed for behavioural-analytical tools whose functionality is associated with the study of the customer journey, digital activity, personalised recommendations, UX optimisation, and the analysis of user reactions in real time. In

contrast to traditional surveys, these approaches allow for the analysis of not only the outcome of a choice but also the process of interaction with the stimulus itself through the recording of clicks, viewing time, sequence of actions, transitions between pages, and the speed of decision-making.

In the practice of Ukrainian digital retail, neuroeconomically-oriented approaches are implemented primarily through behavioural digital analytics, UX research, and personalised interaction models, which make it possible to indirectly assess the attention, reaction, and behavioural patterns of consumers within a digital environment. The practical application of such tools can be observed in the Ukrainian digital retail sector. According to WebPromoExperts (2025), in 2024, the e-commerce segment of the COMFY company grew by 43% year-on-year, with the online channel developing faster than the company's offline segment. As part of its digital transformation, the company implemented a UX-structure update for its website, which was aimed at reducing user losses at the purchase completion stage and increasing conversion rates. It was additionally noted that around 70% of customers begin their product search journey precisely in a digital environment, which elevates the importance of analysing behavioural responses during the process of interaction with an online interface. Similar trends can be traced in the activities of VARUS. The company's internal digital analytics for 2023-2024 revealed changes in the behaviour of online shoppers, in particular, a growing role for mobile orders, demand for ready-made food, and more active use of personalised recommendations and search filters (Retailers.ua, 2025). In response, the company adapted its recommendation algorithms, search structure, and mobile application to reduce the time of user interaction with the service and to improve the convenience of digital purchasing.

An additional factor driving the actualisation of neuroeconomic methods is the expansion of e-commerce and online shopping. Under such conditions, visual tracking, EEG, and behavioural digital analytics have practical significance, as they allow for the assessment not only of the fact of a purchase or a click but also of the preceding stages of choice: the distribution of attention, the reaction to an advertising stimulus, the level of engagement, and the likelihood of subsequent conversion. The use of neuromarketing tools in small businesses in Ukraine makes it possible to increase communication efficiency by more accurately determining consumer reactions to marketing stimuli (Chygryn *et al.*, 2024). Neuromarketing acts not as an alternative, but as a complement to traditional approaches, expanding the scope of analysis by accounting for non-conscious behavioural factors (Bansal *et al.*, 2025). The obtained results indicate that in the Ukrainian consumer market, neuroeconomically-oriented approaches are most actively integrated within digital retail through behavioural analytics, UX optimisation, and personalised interaction models. Their practical effectiveness is manifested in the growth of e-commerce conversion rates, reduced user interaction time with the service, and the adaptation of digital platforms to changes in consumer behaviour. The combination of approaches forms a more effective model of marketing research, within which each method is utilised according to its analytical capabilities.

Comparative analysis of traditional and neuroeconomic marketing approaches

Traditional methods provide breadth of coverage and allow for the formation of generalised conclusions regarding consumer behaviour at the macro level. However, at the same time, these methods capture respondents' already-formed perceptions, which limits their ability to reflect the decision-making process itself. Neuroeconomic approaches provide depth of analysis by examining reactions at the moment of interaction with a stimulus. The use of visual tracking makes it possible to determine which elements of an advertisement or packaging attract attention and in which sequence their processing occurs. Traditional approaches to forecasting consumer behaviour in the Ukrainian consumer market are most actively employed by large FMCG retail chains. In the operations of ATB-Market, consumer behaviour analysis is conducted primarily through the examination of demand structure, turnover, price sensitivity, and loyalty programme data. This approach enables the assessment of shifts in mass demand and the adaptation of assortment policy in accordance with purchaser behaviour. Similar tools are utilised by the Silpo chain, which additionally integrates the analysis of digital communications and customer interaction within the digital environment. According to RAU (2022) data, the company actively employs media analytics and digital channels of consumer interaction to evaluate audience behavioural characteristics and communication effectiveness. Concurrently, traditional methods predominantly capture already-formed consumer behaviour after a decision has been made.

Neuroeconomically oriented approaches in the Ukrainian market are implemented primarily through behavioural digital analytics, UX research, and personalised models of consumer interaction. In the practice of COMFY, such tools are employed for the analysis of the digital customer journey, user behaviour on the website, and optimisation of the purchasing process. According to estimates, in 2024 the company's e-commerce segment grew by 43%, which was accompanied by an update of the site's UX structure and an in-depth system audit aimed at increasing conversion and reducing user losses at the checkout stage (WebPromoExperts, 2025). It is additionally noted that approximately 70% of customers begin their product search precisely within the digital environment, which heightens the significance of analysing behavioural reactions during interaction with the online interface. A similar approach is applied in the practice of VARUS, where digital behavioural analytics is used to adapt online services to changes in consumer patterns. According to Retailers.ua (2025), the company's internal

analytics in 2023-2024 revealed a growing role of mobile orders, demand for ready-to-eat food, and more active use of personalised recommendations and search filters. In response, the company adapted its recommendation algorithms, search structure, and mobile application to reduce the time of user interaction with the service and enhance the convenience of the digital purchase. Such approaches allow for the analysis of consumer behaviour directly during interaction with the digital environment, rather than solely after the completion of a purchase. It is expedient to compare these approaches according to the criteria of data type, analytical tools, speed of adaptation to changes in consumer behaviour, and impact on the economic performance of enterprises (Table 2).

Table 2. Comparison of traditional and neuroeconomically oriented approaches based on cases from the Ukrainian consumer market

Criterion	ATB-Market/Silpo	COMFY/VARUS
Primary data type	Turnover, sales, loyalty programmes, demand structure	Behavioural digital analytics, UX data, digital customer journey
Forecasting tools	Demand analysis, media analytics, loyalty programmes	UX optimisation, personalised recommendations, digital tracking
Type of behavioural information	Conscious consumer actions after purchase	User reactions during interaction with the digital environment
Speed of adaptation to demand changes	Lower	Higher due to real-time data analysis
Impact on economic indicators	Stabilisation of demand structure and turnover	Growth of e-commerce, conversion, and digital interaction
Key limitations	Lower flexibility and dependence on already-formed demand	High dependence on digital infrastructure and analytical systems

Source: compiled by the authors based on RAU (2022), Retailers.ua (2025), WebPromoExperts (2025)

Traditional marketing approaches remain effective for assessing mass demand and forecasting stable consumption patterns. Neuroeconomically oriented digital approaches ensure faster adaptation to changes in consumer behaviour and enhance the level of personalisation in interaction. The most pronounced effect of their use is manifested in the development of e-commerce, increased conversion, and the optimisation of the digital customer journey. In the Ukrainian consumer market, neuroeconomic approaches demonstrate the greatest applied value in the spheres of digital marketing, testing of advertising messages, packaging design optimisation, and the analysis of user behaviour in the digital environment. The combination of neurophysiological methods with classical marketing tools forms a more precise model for forecasting consumer choice and allows for increasing the effectiveness of marketing decisions at the stage of their practical implementation.

SWOT analysis of the development of neuroeconomic approaches in the consumer market

The use of neurophysiological data in marketing research presupposes their inclusion in models for forecasting consumer behaviour. In such models, neural indicators reflect the internal state of the consumer, whereas behavioural indicators capture the outcome of decision-making. Combining neural signals with behavioural data increases the accuracy of predicting online choice, as it accounts for both the user's actions and their reaction to the information environment (Chawla *et al.*, 2026). The expansion of neuromarketing's analytical capabilities is accompanied by the formation of new ethical constraints related to access to the consumer's internal states. Unlike traditional marketing research, neurotechnologies allow for the capture of reactions that are not subject to conscious control, thereby altering the nature of the interaction between the company and the consumer. In this context, the boundary of permissible intervention in the decision-making process becomes a key issue. Neuromarketing is capable not only of analysing but also potentially influencing behaviour through the stimulation of emotional and subconscious reactions (Singh & Kumar, 2026).

One of the most contentious problems is the issue of neural data privacy. Neurophysiological indicators reflect not only a reaction to a specific stimulus but can also contain information about individual characteristics, including anxiety levels, propensity for risk, or emotional states. The use of machine learning algorithms in neuromarketing creates risks of uncontrolled utilisation of such data, especially in cases of their integration with other sources of information (Goncalves *et al.*, 2024). The problem of informed consent also acquires a more complex nature in the case of neuromarketing research. Formally obtaining consent does not guarantee the consumer's awareness of precisely which processes are subject to analysis and how the obtained data will be used. In this context, attention is drawn to the information asymmetry between the researcher and the respondent, which complicates ensuring full transparency of the research (Gyori & Gabor, 2025). The issue of the manipulative potential of neuromarketing is of particular significance. Employing knowledge of the neural mechanisms of decision-making makes it possible to increase the effectiveness of marketing stimuli; however, at the same time, it creates a risk of purposefully influencing subconscious processes. To systematise the main ethical constraints of neuromarketing, it is expedient to highlight the key risk areas (Table 3).

Table 3. Ethical limitations of using neuromarketing in business practice

Area	Nature of the problem	Practical manifestation	Potential consequences
Privacy of neural data	Collection and processing of data reflecting the consumer's internal states	Formation of detailed behavioural profiles based on neural signals	Violation of confidentiality and risk of unauthorised data use
Informed consent	Respondent's limited understanding of the nature of the research	Formal agreement without awareness of the scope of data collection	Decrease in the level of trust in research
Manipulation of behaviour	Using knowledge of subconscious reactions to influence choice	Personalised stimuli that amplify emotional reactions	Reduction in the autonomy of decision-making
Algorithmic influence	Integration of neural data with AI models	Automated targeting based on neuro-profiles	Intensification of information asymmetry
Lack of regulation	Low level of normative control	Use of technologies without clear standards	Growth of ethical and legal risks

Source: compiled by the authors based on M. Hsu (2017), M. Goncalves *et al.* (2024), L.A. Gyori & M.R. Gabor (2025), K. Singh & A. Kumar (2026)

The privacy of neural data constitutes a foundational level of risk, as it defines the boundaries of access to an individual's internal characteristics. Informed consent reflects the procedural dimension that ensures the legitimacy of data collection. Manipulative potential and algorithmic influence form the applied level, associated with the utilisation of acquired information in marketing practices. The absence of clear regulatory mechanisms amplifies all the aforementioned risks, creating conditions for their scaling. An additional dimension of ethical constraints is linked to the concept of neurorights, which envisages the protection of mental privacy, cognitive liberty, and the psychological integrity of the individual. In turn, research in the field of neuroethics emphasises the necessity of preserving individual autonomy amidst the advancement of neurotechnologies (May, 2023). Consideration of the ethical factor defines the boundaries of permissible use of neurobiological methods, and non-compliance with these boundaries diminishes trust in neuromarketing practices and heightens the risk of regulatory restrictions.

The development of neuroeconomic approaches in marketing research is accompanied by the simultaneous expansion of analytical capabilities and the intensification of ethical, technological, and organisational challenges. The use of neurophysiological methods provides a deeper analysis of consumer behaviour; however, it necessitates the consideration of risks related to the confidentiality of neural data, algorithmic influence, research costs, and the absence of clear regulatory mechanisms. Concurrently, the development of digital marketing, AI-driven analytics, and multimodal research creates new opportunities for integrating neuroeconomic tools into marketing research practice. For a comprehensive assessment of the prospects for employing neuroeconomic methods in the consumer market sector, it is expedient to systematise the key advantages, limitations, potential opportunities, and risks of their practical implementation. Taking into account technological, economic, and ethical aspects enables the identification not only of the applied potential of neuromarketing but also of the factors that may constrain the scale of its use in marketing research and the digital environment (Table 4).

Table 4. SWOT analysis of the development of neuroeconomic approaches in the consumer market

Strengths	Weaknesses
High accuracy of analysis of consumers' emotional and cognitive responses	High cost of equipment and conducting research
Possibility of detecting unconscious factors of consumer choice	Limited sample sizes compared to traditional research
Enhancement of the effectiveness of advertising messages and digital interfaces	Complexity of interpreting neurophysiological signals
Increased accuracy of forecasting consumer behaviour	Need for specialised experts and software
Integration of neural data with behavioural digital analytics	Limited accessibility of neuromarketing technologies for small businesses
Opportunities	**Threats**
Development of personalised digital marketing	Violation of consumers' neural data privacy
Integration of neuroeconomic methods with AI and Big Data	Manipulative influence on consumers' subconscious reactions
Enhancement of the effectiveness of e-commerce and UX design	Absence of clear legal regulatory mechanisms
Expansion of the use of multimodal research in business	Formation of information asymmetry between the company and the consumer
Formation of new market segments for marketing analytics	Risks of uncontrolled use of machine learning algorithms

Source: developed by the authors based on M. Goncalves *et al.* (2024), S.M. Usman *et al.* (2025), L.A. Gyori & M.R. Gabor (2025), N. Chawla *et al.* (2026), K. Singh & A. Kumar (2026)

The SWOT analysis indicates that the development of neuroeconomic approaches in the consumer market is accompanied by the simultaneous expansion of analytical capabilities and the increase of ethical and technological risks. The strengths of neuromarketing are associated with the high accuracy of researching behavioural reactions and the possibility of analysing unconscious decision-making mechanisms, while the key limitations relate to the cost of research, the complexity of interpreting neural data, and the limited accessibility of technologies. The greatest potential for development is emerging in the sphere of digital marketing, personalised communications, and the integration of neurophysiological methods with artificial intelligence systems. At the same time, the absence of clear regulatory mechanisms, the risks of manipulative influence, and the problems of neural data protection reinforce the need for the formation of ethical standards for the use of neuroeconomic tools in marketing practice. The generalisation of the SWOT analysis results allows the logic of implementing neuroeconomic approaches in the Ukrainian consumer market to be presented as a sequential cycle of marketing decision-making (Fig. 1).

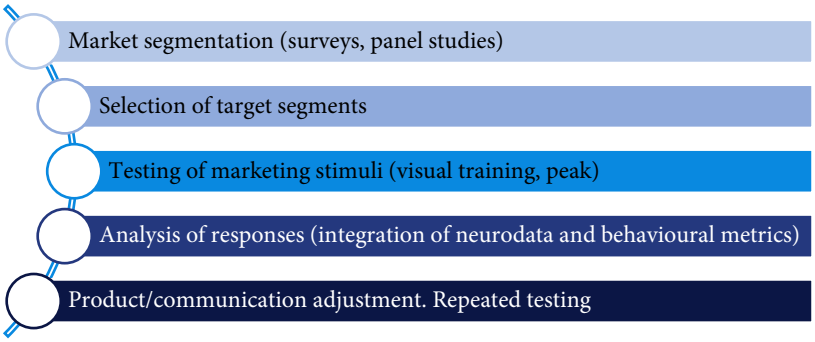

Figure 1. The cycle of integration of traditional and neuroeconomic approaches in marketing research in the context of the Ukrainian consumer market

Source: developed by the authors

The development of neuromarketing in Ukraine should be expediently linked to the training of specialists capable of interpreting neurophysiological data, as well as to the implementation of standards for their use. It is advisable to employ a combined research model, wherein traditional methods are used for market segmentation and target audience identification, while neuroeconomic tools are applied for testing specific marketing stimuli. Such an approach avoids cost overruns and ensures the method's alignment with the set objective. For companies with limited budgets, a rational choice is the selection of targeted neuromarketing studies instead of full-scale projects. The optimal tasks involve testing advertising mock-ups, website interfaces, packaging, and the placement of key elements, where even minor changes can influence consumer behaviour. In the digital environment, it is expedient to integrate the results of visual tracking with user behaviour analytics (clicks, dwell time, conversion). At the same time, to enhance the reliability of results, it is necessary to combine neural data with classical metrics. The use of neuro-instruments without subsequent verification on larger samples limits the possibility of generalising results and increases the risk of erroneous managerial decisions.

DISCUSSION

The obtained results demonstrated that the effectiveness of neuroeconomic approaches in the Ukrainian consumer market is most pronounced in the digital environment, where user behaviour is formed within short time intervals and depends on the speed of visual information processing. The conducted statistical and comparative case analysis made it possible to establish that traditional marketing instruments remain effective for assessing mass demand and analysing already-formed consumer behaviour, whereas neuroeconomically oriented approaches provide the capability to capture reactions directly at the moment of interaction with a stimulus. In this context, it is appropriate to juxtapose the findings of the conducted study with international scientific approaches to evaluating the opportunities and limitations of neuroeconomic methods in forecasting consumer behaviour.

The research by M. Pšurný *et al.* (2024) is dedicated to studying the factors influencing consumer perception in the online environment, using EEG and visual tracking. The authors established that neurobiological methods allow for the objectification of consumers' unconscious reactions, particularly in areas where traditional approaches are insufficiently precise. This correlates with the results of the statistical analysis, which revealed an increase in the role of the digital environment in shaping consumer reactions. Specifically, the 35% growth of the Ukrainian digital advertising market in 2024 and the 43% development of the COMFY e-commerce segment confirm that digital channels create the greatest scope for applying instruments for capturing users' attention, reactions, and behavioural patterns.

Simultaneously, the work of A. Bazzani *et al.* (2020) provides a systematic review of the application of EEG in marketing research. It was proven that EEG is one of the most accessible and informative neurobiological methods

due to its high temporal resolution and relatively low cost; however, it requires specialised signal interpretation and a controlled experimental environment. Within the framework of the conducted study, this thesis is corroborated through the identified functional capabilities of EEG, in particular its ability to register changes in the spectral power of alpha and beta bands associated with cognitive engagement and emotional activation. Concurrently, the SWOT analysis results showed that the complexity of interpreting neurophysiological signals and the need for specialised experts remain substantial limitations for the practical use of EEG in the consumer market.

The neurobiological underpinnings of neuroeconomics are systematised through the lens of functional magnetic resonance imaging in the work of C.A. Mallio *et al.* (2024). The research focus is directed towards the capacity of neuroimaging to identify neural correlates of economic decision-making, in particular the activation of structures associated with value formation and risk processing. This directly corresponds to the theoretical foundation of the present study, wherein consumer choice is examined as the outcome of an interaction between the cognitive and emotional systems of the brain. Although the practical application of MRI in marketing research remains constrained by its cost and complexity, its theoretical contributions form the conceptual basis for interpreting the results of less resource-intensive methods, notably EEG and visual tracking. Concurrently, the study by F.J. Otamendi & D.L. Sutil Martín (2020) is devoted to measuring the emotional effectiveness of advertising through the analysis of consumers' facial reactions. The level of engagement, emotional valence, and attention are formed prior to the conscious evaluation of an advertising message and can be quantified using neurobiological tools. This correlates with the findings of the first subsection, where it was determined that neuroeconomic methods possess applied significance for assessing the preliminary stages of choice, notably the allocation of attention, the reaction to a stimulus, and the probability of subsequent conversion. In digital retail, this logic manifests itself through the necessity of optimising interfaces, checkout systems, and personalised communications prior to the moment of purchase completion.

According to A.C. Martinez-Levy *et al.* (2022), neuromarketing tools have been applied to investigate the unconscious perception of message framing in non-commercial advertising. The manner in which information is presented significantly influences the level of emotional engagement and memorability, even in the absence of differences in the substantive content of the messages, a phenomenon not reflected in respondents' answers in traditional surveys. In the results of the present work, a similar logic is traced through the comparative case analysis of COMFY and VARUS, where the effectiveness of consumer interaction is linked not only to product assortment or price but also to the structure of the digital customer journey. Thus, neuroeconomically oriented approaches enable the analysis not only of the content of an offering but also of the manner in which it is perceived by the user within a specific digital environment.

A method for measuring the strength of brand associations through the analysis of the N400 component of the EEG signal, enabling the assessment of congruence between a brand and its image in the consumer's mind, was proposed by F. Camarrone & M.M. Van Hulle (2019). The focus was placed on the effectiveness of single-trial measurements. The correlation with the present study lies in the confirmation of EEG's capability to detect neural responses associated with the evaluation of marketing stimuli, even in situations where respondents' verbal answers do not reflect their genuine attitude towards the brand. This aligns with the results of the comparative analysis, where traditional approaches were identified as effective for analysing mass demand but less suitable for studying consumer response at the moment of contact with a stimulus.

A bibliometric analysis of 497 articles from EEG research in the field of consumer behaviour spanning 2002-2022 was presented by researchers A. Costa-Feito *et al.* (2023). As a result, leading thematic clusters and promising directions were identified, notably the integration of EEG with augmented reality technologies, artificial intelligence, and multimodal studies. Comparison with the results of the present study confirms a general trend towards combining neurophysiological methods with digital behavioural data. The current state of research on the role of eye movements in the decision-making process was summarised, and a conceptual framework for integrating eye-tracking data into computational models of choice was proposed by C.-C. Ting & S. Gluth (2024). The authors demonstrated that the distribution of fixation time between alternatives directly influences the probability of their selection, reflecting the process of attention formation and value assessment. This conclusion directly correlates with the results of the present study, where it was established that fixation durations exceeding 200-300 ms correspond to cognitive processing of the stimulus, and the initial allocation of attention determines the subsequent structure of perception. By contrast, S. Kakaria *et al.* (2023) focused on a systematic analysis of the application of heart rate variability as a physiological indicator in marketing research. The paper substantiated the methodological prospects for incorporating autonomic indicators into multimodal approaches to enhance the accuracy of measuring consumers' emotional responses. This is consonant with the obtained results regarding the advantages of combining different types of data, since the present work demonstrated that the integration of EEG, visual tracking, and digital behavioural analytics expands the possibilities for predicting consumer choice. Simultaneously, the SWOT analysis indicated that the expansion of multimodal research is accompanied by increasing costs, complexity of interpretation, and the need for specialised software.

M. Ćirović *et al.* (2024) investigated neuroscientific methods for rethinking approaches to communication in the field of sustainable development. Traditional forms of

conveying information about brands' environmental responsibility do not generate a sufficient level of consumer emotional engagement, whereas neurobiologically grounded approaches to message construction significantly enhance communication effectiveness. The obtained results are consistent with this conclusion in a broader context. Even in domains where the substantive component of a message is clear and understandable, the level of engagement and memorability is determined by the nature of the emotional activation, which traditional marketing methods are incapable of capturing. Within the framework of the present study, this thesis correlates with the conclusion regarding the limitations of traditional methods in capturing reactions that occur prior to the completion of conscious evaluation. This is most practically manifested in digital communications, where the effectiveness of interaction depends on the structure of the message, the speed of attracting attention, and the stimulus's ability to retain the user within the customer journey.

The comparison of the results of the present study with international scholarly sources provides grounds to assert that the neuroeconomic approach cannot be regarded as an alternative to traditional marketing methods, as it constitutes their functional complement, expanding analytical capabilities at the level of unconscious behavioural mechanisms. The experience of European researchers demonstrates that effective prediction of consumer choice necessitates the integration of neurophysiological signals, behavioural data, and contextual information into a single multimodal analytical system. The Ukrainian case confirms these conclusions: the growth of the digital market, the expansion of e-commerce, and the reduction in the time of consumer interaction with an advertising stimulus generate a demand for tools capable of analysing reactions in real time. This allows for the assertion that the further development of neuroeconomic approaches in Ukraine is only possible under the condition of combining technological modernisation of marketing research, the training of specialised professionals, and the establishment of ethical standards for the use of neurophysiological data.

CONCLUSIONS

The research established that neuroeconomic methods possess applied significance for the analysis of the Ukrainian consumer market, as they allow for the capture not only of consumers' conscious evaluations but also of early emotional and cognitive reactions to marketing stimuli. Visual tracking, EEG, multimodal methods, and digital behavioural analytics provide the capability to investigate the allocation of attention, the level of engagement, emotional activation, and the probability of subsequent choice. Statistical indicators of the development of Ukraine's digital market, in particular the 35% growth of the digital segment in 2024, confirm the increasing importance of tools capable of analysing consumer behaviour within short cycles of interaction with an advertising or digital stimulus. In this context, fixation durations exceeding 200-300 ms, the first 2-3 seconds of interaction with visual content, and the combination of neural signals with behavioural data acquire significance as indicators for predicting consumer choice.

A comparative analysis of traditional and neuroeconomically oriented marketing approaches demonstrated their functional complementarity within the system of predicting consumer behaviour. Traditional methods remain effective for assessing mass demand, analysing product turnover, segmenting audiences, and studying the socio-economic characteristics of consumers; however, their analytical capabilities are limited to capturing already-formed behaviour and respondents' conscious evaluations. Neuroeconomic approaches provide a deeper level of analysis owing to the possibility of investigating reactions at the moment of interaction with a stimulus, thereby enabling the assessment of attention, emotional activation, cognitive load, and the probability of a subsequent behavioural response. The findings of the case analysis of the Ukrainian consumer market indicated that neuroeconomically oriented approaches are most actively integrated into digital retail through behavioural analytics, UX optimisation, and personalised models of consumer interaction. Drawing on the cases of COMFY and VARUS, it was established that the use of digital tracking, customer journey analysis, and behavioural data enables a swifter adaptation of digital services to shifts in consumer patterns, an increase in conversion rates, and a reduction in user interaction time with online platforms. At the same time, the cases of ATB-Market and Silpo confirmed that traditional marketing instruments remain more effective for stabilising demand structures, analysing sales, and evaluating the behaviour of large consumer audiences.

The SWOT analysis demonstrated that the development of neuroeconomic approaches in the consumer market combines high analytical potential with a range of technological, economic, and ethical constraints. The strengths include precision in analysing emotional and cognitive reactions, the capacity to identify non-conscious factors of choice, and the integration of neurodata with digital behavioural analytics. Conversely, the weaknesses remain the high cost of research, limited sample sizes, the complexity of interpreting neurophysiological signals, and the need for specialised professionals. The principal threats are associated with the privacy of neurodata, manipulative influence, algorithmic targeting, and the absence of clear legal regulatory mechanisms. The greatest opportunities for further development are emerging in the fields of personalised digital marketing, e-commerce, digital analytics, and multimodal research. The limitation of the study lies in the absence of empirical verification of the established dependencies on specific consumer samples and the dependence of the interpretation of neurophysiological indicators on experimental conditions. Prospects for further research are linked to conducting empirical comparisons of traditional and neuroeconomic

methods on identical samples, the quantitative assessment of their accuracy in predicting behaviour, and the development of models for integrating neurophysiological and behavioural data within the digital environment.

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CONFLICT OF INTEREST

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Нейроекономіка як інструмент прогнозування споживчої поведінки

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Анотація. Метою дослідження було обґрунтування потенціалу нейроекономічного підходу для аналізу механізмів формування споживчої поведінки та оцінювання його ефективності у прогнозуванні ринкових реакцій. Методологічну основу роботи становило поєднання поведінкового та нейроекономічного підходів із застосуванням елементів теоретичного узагальнення, статистичного, порівняльного аналізу, методу case study та SWOT-аналізу. На основі результатів статистичного аналізу встановлено, що у 2024 році український ринок цифрової реклами зріс на 35 % порівняно з попереднім роком, що підтверджує посилення ролі поведінкової цифрової аналітики в системі маркетингових досліджень. Визначено, що параметри взаємодії зі стимулом формуються протягом перших кількох сотень мілісекунд; зокрема, тривалість фіксації у 200-300 мс відповідає когнітивній обробці інформації, тоді як первинний розподіл уваги протягом перших 2-3 секунд визначає подальшу структуру сприйняття. У межах аналізу нейроекономічних методів доведено, що електроенцефалографія дає змогу оцінити рівні емоційної активації та когнітивного навантаження, візуальний трекінг (айтрекінг) сприяє аналізу структури уваги та послідовності обробки зорового стимулу, а мультимодальні підходи підвищують точність прогнозування поведінкових реакцій завдяки інтеграції нейрофізіологічних та поведінкових показників. Аналіз конкретних ситуацій на українському споживчому ринку виявив, що традиційні маркетингові підходи, які застосовують «АТБ-Маркет» і «Сільпо», переважно зосереджені на аналізі товарообороту, структури попиту та програм лояльності, тоді як «COMFY» та «VARUS» використовують поведінкову цифрову аналітику та персоналізовані моделі взаємодії для адаптації цифрових послуг до змін у споживчих патернах. Встановлено, що сегмент електронної комерції «COMFY» у 2024 році зріс на 43 %, що супроводжувалося оновленням структури вебсайту та оптимізацією цифрового шляху клієнта. Проведений аналіз продемонстрував, що сильними сторонами нейроекономічних підходів є висока точність аналізу емоційних і когнітивних реакцій, здатність виявляти неусвідомлені чинники вибору, а також інтеграція нейроданих із поведінковою цифровою аналітикою, тоді як основні ризики пов'язані з конфіденційністю нейроданих, алгоритмічним впливом, складністю інтерпретації нейрофізіологічних сигналів та відсутністю чітких регуляторних механізмів. Практичне значення дослідження полягає в розширенні підходів до аналізу споживчої поведінки шляхом інтеграції традиційних і нейроекономічних методів, що дає змогу підвищити точність оцінювання реакцій споживачів у цифровому середовищі

Ключові слова: маркетингові дослідження; когнітивні процеси; візуальний трекінг; електроенцефалографія; емоційні реакції