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SIGNIFICANCE OF EXPLAINABLE ARTIFICIAL INTELLIGENCE (XAI) IN MARKETING

Abstract: Explainable artificial intelligence (XAI) is increasingly crucial due to its extremely important role in modern marketing, as it advances predictive analytics of consumer behavior and analysis of the purchase decision-making process. This paper examines the importance of XAI in marketing, emphasizing its role in improving the effectiveness and efficiency of marketing strategies. By examining the evolution of AI in marketing and the challenges posed by opaque algorithms, this study highlights the transformative potential of XAI in bridging the gap between marketers and consumers. In addition, ethical issues related to the application of XAI are discussed, emphasizing the imperative of conscientious application in order to maintain privacy and consumer trust. Furthermore, possible directions for the use of XAI are explored, with the aim of driving marketing practices in a data-dominated era. This paper highlights the key role of XAI in shaping future trends in marketing research and its implications for businesses operating in a dynamic market environment.

Keywords: Explainable Artificial Intelligence (XAI), Marketing, AI, Consumers

1. INTRODUCTION

In computer science, artificial intelligence (AI) is the process of creating algorithms that can process large amounts of external data and identify patterns and correlations as well as perform tasks that are similar to those performed by human intelligence (UNECE, 2021). AI is a recent technological advancement that can provide intuitive information and data and hence facilitate more precise decision-making. As such, it has helped revolution in many industries and sectors, such as healthcare, transport, education, finances, retail, and others. Its expanding role extends to business and marketing realms whereby it is used to provide instant answers to solve problems that are pertinent and also to achieve insightful perception of consumers, putting it at the forefront of contemporary marketing tactics (Krstić and Maksimović, 2022).

AI models are often superior to conventional algorithms in terms of accuracy and performance as well. However, on some occasions, it can be very difficult to explain the result of a model. While some AI systems may not value the complexity of explaining and justifying algorithmic outputs, in the majority of cases, understanding and defense of the algorithms are compulsory, which is usually a result of legal requirements. Therefore, in industries where such consequences are widespread, interpreting AI models is especially important. Explainable AI (XAI), also known as interpretable AI or transparent AI, is the term that is used to indicate the methods in which the AI solution will be transparent. This helps to enlighten the user regarding the decision-making processes without any technical knowledge. So, XAI works to avoid the "black box" concept case, where outputs and the explanations for the algorithms are kept around unseen to talk with the rationale behind the output (Calvo Martin et al., 2023; ICT & Media, 2023).

In response to businesses' efforts to improve the transparency and understandability of AI systems, the global market for XAI has experienced significant growth. The XAI market is expected to experience a 20.9% growth, reaching a market value of \$16.2 billion by 2028, up from \$6.2 billion in 2023 (Fig. 1) (Markets & Markets, 2023). Prominent entities within the AI domain are allocating resources towards XAI research and development, concurrently with the emergence of specialty companies emphasizing explainability. The need for transparent and accountable AI systems is growing, and the XAI industry is well-positioned to meet this demand.

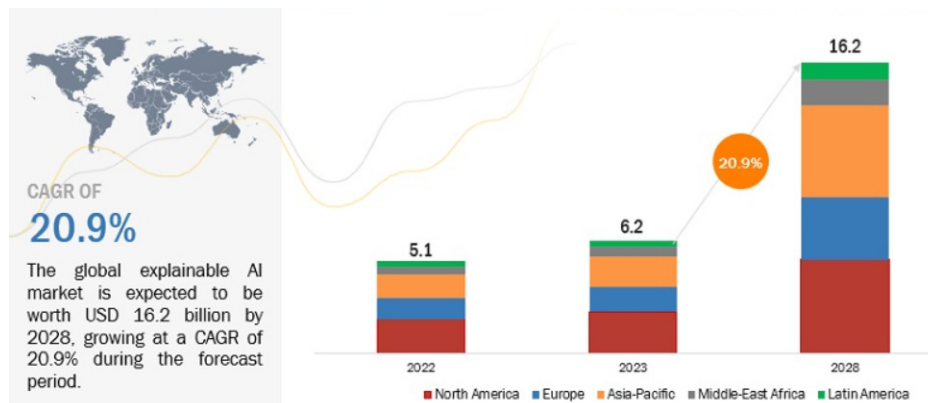


Figure 1: XAI market global forecast to 2028 (USD billion)

Source: Markets & Markets, 2023

XAI will transform the marketing landscape by introducing transparency and accountability. XAI acts by explaining how AI makes up for its decisions, thus building confidence, improving personalization, reducing bias, maximizing resource allocation, guaranteeing regulatory compliance, and encouraging fruitful cooperation between marketers and AI. Also, using XAI as a tool to provide a marketing strategy to customers will result in increasing consumer engagement and trust. When marketing is undergoing evolution, XAI becomes the key thing to help companies that work on the creation of ethical and impactful advertising.

This paper will focus on the importance of XAI in marketing. The rest of the paper is arranged as follows. The second section presents the basic concepts of XAI. The role of XAI in the marketing domain is shown in the third section. The fourth section presents some of the AI and XAI tools used in consumer behavior' prediction. Ethical considerations and future trends are emphasized in section five. The last section draws conclusions.

2. UNDERSTANDING XAI

Since digital transformation provides access to a massive amount of data, industries have been completely transformed and driven to the widespread use of AI and machine learning (ML) techniques. Despite the fact that AI models are increasingly augmented with predictive power, risks still exist such as unverified bias, incomplete knowledge, and an unforeseen chance of errors. This can have the effect of throwing doubt on the credibility of these models and creating suspicion over how interpretable the results of AI algorithms are. XAI allows people to explain the operation of these algorithms including the underlying ML, neural networks, and deep learning features which improves their trust in these models. The capacity of XAI to identify challenges such as regulatory compliance, trust deficits, and impacts on society has led to an increase in the demand for technology not only from the industry but from the academia too. Therefore, regulations by a number of governments worldwide focus on the transparency and interpretability of AI systems. For example, the General Data Protection Regulation (GDPR) in Europe requires businesses to inform citizens about the AI models' results, highlighting the need to create interpretable AI models in order to comply with legal requirements. The Artificial Intelligence Act (AI Act) was introduced by the European Parliament in 2021 to regulate the use of AI within the EU and create a comprehensive regulatory framework for AI systems. This Act necessitates transparency at all stages and allows human intervention for high-risk systems across the EU and splits the AI applications into groups based on their risk level. Moreover, the European Commission issued Ethical Guidelines for Trustworthy AI in 2019, which include seven main requirements for reliable AI systems. Such guidelines pinpoint on explainability of AI models, advocate for transparency, and set the evaluation scale to detect by which criteria the compliance shall be set (Calvo Martin et al., 2023).

Organizations can have access to the basic AI decision-making processes that can be easily changed by modifying the process with the help of XAI and interpretable ML. Transparency and explainability are the core differences between XAI and AI (Saeed & Omlin, 2023). Even though AI is the term that brings to mind a myriad of technologies developed to reproduce human intelligence, conventional AI systems often hide the process by which the decisions are made. XAI involves the production of AI systems that are transparent and understandable to people, so that people can collaborate and gain trust in AI models (Fig. 2).

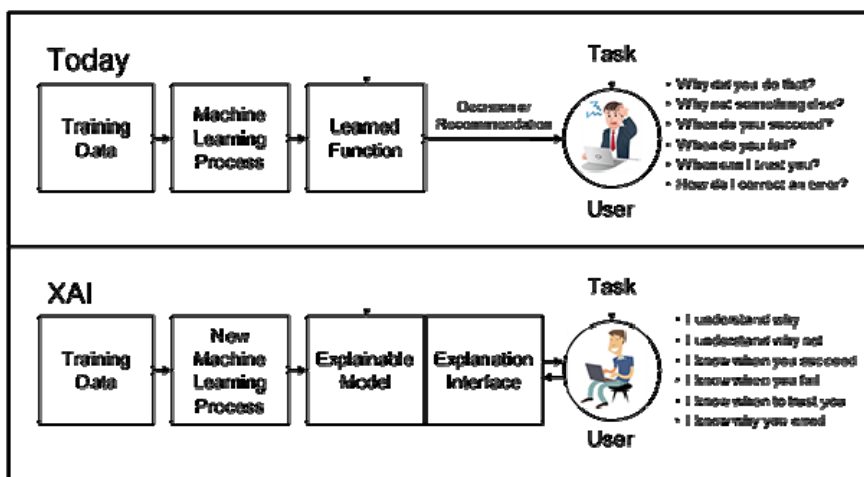


Figure 2: XAI concept
Source: DARPA, n.d.

In AI, the concepts of interpretability and explainability are tightly connected (Vainio-Pekka et al., 2023). Explainability focuses on understanding why this or that decision or prediction was given about a given instance, whereas interpretability deals with understanding why the entire model makes decisions or predictions. In the context of XAI, five pivotal questions arise: — Whom to explain? Why explain? When to explain? How to explain? What is the explanation? (Fig. 3) (Swiss Cognitive, 2021).

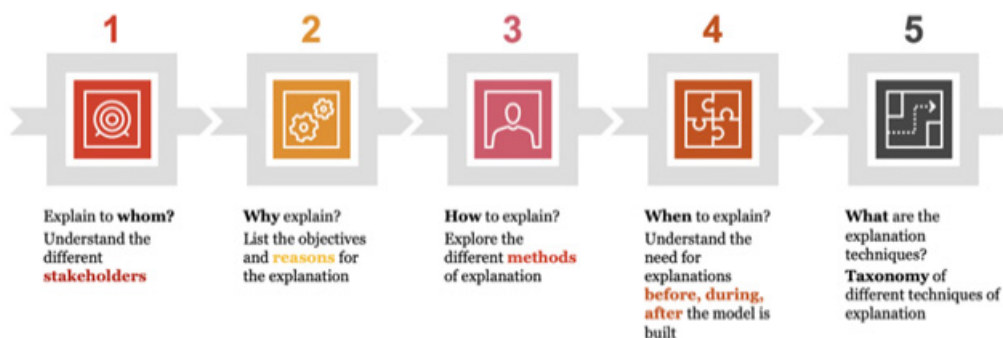


Figure 3: Five key questions to answer when building XAI
Source: Swiss Cognitive, 2021.

For any organization is important to take into consideration the principles of explainability and interpretability of XAI systems in the process design and operation improvement. The XAI framework consists of four elements that aid in the integration of explainability and interpretability (Calvo Martin et al., 2023):

- *Interpretability strategies for AI models:* Three interpretability components form an XAI framework's foundation: bias detection, ongoing model monitoring, and explanation for the model's design and results.
- *Alignment with model risk management (MRM) protocols:* The interpretability of ML models influences all stages of their lifecycle, including MRM. It becomes essential to assess the audit framework, as well as the policies and practices that relate to the model development, monitoring, validation, deployment, and usage, so the integration of XAI components may happen most appropriately.
- *Support from Information technology (IT) infrastructure:* The use of expert IT solutions for designing the features of ML models to be interpretable is a must-have. This comprises data analytics systems, application programming interfaces (APIs), security measures implementations, auditing tools, and the setting of protocols and standards assuring an observance of quality specifications and explainability regulations.
- *Human interaction:* In order to ensure the implementation of XAI it is crucial to consider the human factor. This involves recruiting and retaining staff, implementing training programs, fostering a culture that values understandable ML models, and changing management plans.

The XAI's capabilities are (Holistic SEO, 2023):

- *Model interpretation:* XAI provides insight into AI models' inner mechanisms by evaluating feature influence, clarifying impact, and identifying patterns and decisions.
- *Local explanations:* XAI enables the model users to see inside specific forecasts that a certain set of variables affected the results and also provides a reasoning-based decision-making justification in particular situations.

- *Global explanations:* XAI aids in obtaining deep insights into model behavior that is able to explain not only specific decisions but also patterns and rules that govern the model's behavior in general.
- *Rule extraction:* Part of the complexity of some AI models is captured using explanations in the form of rules or decision trees that humans can understand.
- *Visualization:* XAI utilizes graphics to exemplify decision-making processes or feature importance.
- *Counterfactual explanations:* XAI works in a direction to give users insight into the variables that are driving the results of AI model decisions, therefore it generates other hypotheses that explain specific outputs.
- *Estimating uncertainty:* XAI supplies probabilities of possible situations and the level of uncertainty of AI predictions allowing us to measure prediction uncertainty. This is the way to determine whether AI system outputs are acceptable or not for the users.

2.1. Benefits and challenges of XAI

The advantages of XAI include (Holistic SEO, 2023; Verma & Ainapur, 2021):

- *Enhanced Transparency:* XAI guarantees that the AI decisions are transparent, providing users with clear explanations that enable them to understand the reasons for the outcomes and what aspects a particular solution is based on.
- *Accountability and Responsibility:* AI models cannot be 100% correct, which implies the need to have someone who would handle mistakes themselves and have others be accountable for mistakes. This will optimize the system as a whole.
- *Minimizing the Effect of Model Biasing:* XAI can help achieve this by identifying the factors of bias in the decision-making processes that exhibit biased behavior and then facilitating corrective actions to establish unbiased AI systems.
- *Reducing the Cost of Mistakes:* Incorrect anticipation causes serious harm to decision-sensitive fields. Controlling the result outcomes and identifying the core of the cause improves the model.
- *Model Debugging and Improvement:* XAI techniques afford the data scientist the ability to look within the existing model and possess the knowledge of influence factors in order for them to identify and fix flaws in AI. This in turn improves the performance and reliability of the model.
- *Promoted Trust and Acceptance:* XAI enables users to understand the inner workings of AI and the decision-making process, boosting their perceptions of insight and recommendations coming out from AI, therefore increasing user acceptance.
- *Regulatory Compliance:* XAI makes companies comply with legal requirements that obligate the explanations in AI-made decisions. This leads to the proper regulation in sectors where there is the application of ethical and legal norms.
- *User Empowerment:* Through XAI, people will have more control over how AI technology can assist them in their decision-making processes, by gaining an insight into why the recommended actions or judgments were influenced.

Challenges related to XAI are (Adadi & Berrada, 2018; Kenfront, 2023; Saeed & Omlin, 2023):

- *Absence of a common definition of explainability:* The development and assessment of explanation techniques are extremely complicated because of a lack of a common definition of explainability.
- *Accuracy-explainability compromise:* Complex models are able to provide accuracy at the cost of interpretability, while simpler models offer feasible explanations but suffer from accuracy drawbacks.
- *Privacy:* Revealing the model's inner workings might result in sensitive data leaks.
- *Computational costs:* In order to fully understand the explanations provided by the ML models, additional computations are needed which implies that using XAI in real-world scenarios can be challenging.
- *Absence of data:* For the model to explain its working correctly, setting it with data available for its training is necessary. However, providing such information to the public could not be practicable because it can be mostly proprietary or confidential.
- *Difficulties with Tools:* AI models are described through various tools. Some XAI tools are complex and hard to use and are intended for specific model types or datasets. These tools also have problems with coverage and scalability.

3. THE ROLE OF XAI IN MARKETING

In the present fast-moving business society, efficient marketing strategies are one of the main factors that determine whether a company becomes a success or failure. In the marketing domain, traditional approaches have successfully worked before, but with the ongoing changes in customer behavior and trends, creativity is required. The answer is XAI. Unlike a black box which is typically the way traditional AI works, XAI endeavors to bridge the gap between complex units of computations and human understanding. Its critical task is to increase transparency, and that people can follow and understand why AI makes certain decisions. Hence, XAI becomes a game-changer for the marketer as it

provides the needed transparency to trace through complex AI algorithms. The value of XAI is that it can visualize and interpret the components of the marketing campaigns thereby enabling businesses to enhance their performance, forecast consumer trends, make informed marketing decisions, and maintain positive relationships with their customers. XAI has the power to revolutionize marketing strategies by facilitating faster and more precise data analysis and offering instantaneous insights into customer preferences. Hence, XAI reshapes marketing strategies by enabling marketers to navigate AI-driven campaigns with transparency and accuracy. This makes it possible to create targeted advertisement campaigns that are tailored to the needs and preferences of customers. With transparent operations, products, and services, transparent businesses gradually gain more customer loyalty, advocacy, and sales. Transparency is thus recognized as a critical component in building consumer trust (Abbas, 2023; Voleti, 2023).

The main advantages of XAI in marketing can be summarized as follows (Mishra, 2023; Abbas, 2023; Clark, 2023):

- *Effective resource allocation:* Many marketing companies experience difficulties in the process of allocating resources efficiently. XAI can support them in achieving this goal, hence resulting in the highest return on investment (ROI).
- *Increased customer trust:* Through XAI, marketers are enabled to provide customer-oriented targeting for products they offer, which above all builds up trust toward them and promotes relationships between customers and companies.
- *Optimized marketing campaigns:* XAI helps marketers enhance the efficiency of their marketing activities by giving feedback on their offerings and experiences, which, in turn, allows them to carry out more productive branding tests.
- *Adherence to legislation:* As data privacy regulations are oftentimes changing, marketers have to make sure to keep up with new guidelines.
- *Improving AI Insight Comprehensibility:* A complicated task for marketers with limited knowledge of technology might be to make sense of the AI-generated findings. This is the reason why an effective way of presenting the outcome must be a format that is easily understood and comprehended by the readers (i.e., effective explanations, summaries, and visualizations).
- *Optimizing Personalization:* XAI plays a key role in the growth of personalized marketing. XAI allows marketers to refine their strategies by explaining the reasons for the recommendation of products, targeting ads, and content.
- *Mitigating Bias and Discrimination:* With their campaigns, which may have resulted in data stereotyping due to ML models, marketers may unintentionally create unfair treatment of particular groups. XAI enables marketers to discover how AI algorithms make their decisions which results in exposing and addressing these biases.
- *Promoting Collaboration Between Humans and AI:* XAI facilitates collaboration between marketers (humans) and AI systems. In this collaboration, human creativity, intuition, and domain expertise are added to AI abilities.

While there are enormous benefits that come with XAI, XAI in the marketing domain faces several challenges (Mishra, 2023; Telligent, 2024):

- *Technical Complexity:* The biggest obstacle to XAI implementation in marketing is the complicated technicality that comes with the creation and utilization of transparent AI algorithms. To design XAI models for a particular domain, such as marketing, cooperation between data science, ML engineering, and AI personnel is mandatory. Only by possessing adequate knowledge and resources, marketers can successfully deal with such challenges and implement XAI to achieve a variety of business objectives.
- *Integration with Current Systems:* Including XAI within existing marketing workflows and systems can be quite challenging as it requires integration with different tools and technologies.
- *Interpretability vs. Performance Trade-off:* Achieving a compromise between the AI models' performance on one side and the transparency and interpretability on the other side is another challenging task. Although complex models have less transparency, high-degree interpretable models may produce low precision.
- *Data Quality and Bias:* XAI models are called for the data in decision-making; consequently, biased or poor-quality data may produce biased marketing results.
- *Privacy Concerns:* Using personal data in marketing campaigns that include XAI, raises privacy and ethical concerns.
- *Regulatory Compliance:* The ever-changing regulations require marketers to stay informed and compliant.
- *Education and Training:* Many marketers do not possess the knowledge and skills necessary to understand and utilize the recent technological advancements, such as XAI, in their campaigns. Hence, for XAI to be fully utilized in marketing, marketers need to attend seminars, courses, and trainings to gain the required skills and knowledge.

Based on performed research, it is obvious that XAI has great potential for use in the marketing domain, particularly for consumer segmentation, predictive targeting, ad targeting, optimization, content creation, etc. Having in mind that the use of XAI in marketing will grow, companies must invest in this domain and work on overcoming challenges that stand in the way of XAI's widespread use in marketing.

4. AI TOOLS FOR PREDICTING CONSUMERS' BEHAVIOR

Predictive analytics is defined as the use of large data sets and the application of algorithms to predict consumer preferences. With this proactive approach, companies get an opportunity to more accurately direct their strategies and hence ensure the right mix of promotional activities and engagement with their consumers. Predictive analytics is based on historical data and provides companies with better business decisions in terms of basing their business principles on implementing a proactive strategy instead of a reactive marketing strategy (GG Insights, 2024). Predictive analytics and AI analytics automate data analysis to make predictions using AI tools and algorithms. When AI analytics automate data collection and processing, companies improve the decision-making process that determines a company's business success. Some of the tools and platforms mentioned that can help carry out the prediction of consumer behavior based on AI are (Dowling, 2023): *Amazon SageMaker*, *IBM Watson*, *Microsoft Azure Machine Learning*, *DataRobot*, *H2O.ai*, *Salesforce Einstein*, *Python*, and *R programming*. Other considerations required to be taken into account while choosing a tool or platform should reflect an individual firm's requirements and scalability, as well as integration and ease of use. The following AI tools for researching consumer needs and demands are predicted to be the most important in 2024 (Oranie, 2024):

- *Amazon Polly Analytics* - allows users to convert text to speech according to their preferences.
- *Google Cloud AutoML Tables* - with the help of engineering automation and adequate customization methods, it encourages the development of ML models.
- *SurveyMonkey* - contains AI-powered survey tools used to collect and analyze consumer data.
- *Medallia Experience Cloud* - with the help of this tool, companies collect, analyze, and respond to the data they receive from consumers through various customer contact points.
- *Qualtrics CustomerXM* - enhances customer experience management. Thanks to AI, more effective analysis is acquired to keep the customers engaged and personalize experiences.
- *SAS Customer Intelligence* - ML and AI together gather insights on customer data for the purposes of promoting higher customer engagement and loyalty.
- *Adobe Analytics* – uses AI to analyze consumer behavior and provide a personalized customer experience using differentiated digital channels.
- *Hootsuite Insights* - provides AI-powered social media analysis to better understand consumers and increase their engagement.
- *Reltio Customer 360* – thanks to this tool, the management of consumer data is facilitated, which is supported by appropriate AI analytics, all with the aim of offering end consumers personalized experiences on all digital channels.
- *Sprinklr Experience Cloud* - simplifies the management of social networks through appropriate solutions based on AI, which consequently results in offering solutions for better understanding and interaction with end users.

4.1. Types of XAI Tools

XAI tools are software and systems that allow human insight into the decision-making process of algorithms developed based on AI. Their main mission is to create more reliable and trustworthy AI systems in this respect. On the basis of recommendations from some open-source XAI tools and frameworks (Maaian, 2024; Dvivedi et al., 2023), some instruments are put forward:

- *Explainable AI Toolkit (XAITK)*: This should be an all-around toolkit mainly targeting the comprehension of ML models by both researchers and developers. Features such as the After Action Review for AI (AARfAI) for systematic analysis of AI reasoning processes, the Bayesian Teaching for XAI for human-centered frameworks, frameworks for creating counterfactual explanations, datasets with multimodal explanations, misinformation detection tools, and techniques for creating psychological models and natural language explanations and psychological models for a range of applications are all included.
- *Shapley Additive Explanations (SHAP)*: It is an ML and AI technique with a focus on explaining the outputs of the model, with particular emphasis on XAI. The Shapley values determine the average marginal contributions of the features and identify the possible combinations of 'coalitions' a feature can take part in, explaining complex models involving many features, both discrete and continuous variables.
- *Local Interpretable Model-agnostic Explanations (LIME)*: It provides simple explanations that an observer can understand for predictions made by complex models. Its key features include compatibility with any ML model, no matter its complexity; focusing on explaining individual predictions, while ensuring relevance; generation of interpretable proxy models that can be substituted for complex models; quantitative measures of feature impact through the display of scores, called feature importance scores; and generation of configuration and customization options for the user to modify things like the sampling strategy and surrogate model selection.
- *"Explain Like I'm 5" (ELI5)*: It is a library covering everything needed from ML and visualization to debugging. It enables to get visualization and analysis of all model predictions. An API enables one to know

and debug the behavior of models, built-in support for almost every popular framework and package—in one place.

- *InterpretML*: Built upon the interpretability techniques incorporated into state-of-the-art ML, InterpretML is a novel open-source package. The key features include the integration of state-of-the-art ML interpretability techniques, exploring individual predictions to explain the results of specific decisions, user-friendliness by an open, unified API set, a wide range of explainers and techniques with interactive visuals for flexibility and customizability, and comprehensive capabilities for exploring model attributes such as performance, global, and local features.

When discussing XAI, a comprehensive understanding of the goals, careful consideration of the type of ML model, performance and scalability requirements, visualization and reporting capabilities, user-friendliness, and community support are all crucial components that have to be considered for every AI system (Maayan, 2024).

5. ETHICAL CONSIDERATIONS AND FUTURE TRENDS

Predictive analytics has great benefits for marketing, but best practices should be followed, considering ethical implications. Protection of the customers' information has to be first and foremost because privacy issues arise when marketers use predictive algorithms and personal data. To alleviate the concerns about privacy, marketers must assure consent and transparency in the procedures of data collection and usage. Providing secure solutions is the only way to ensure the privacy of the customers' data. Moreover, predictive analytics must be managed carefully and with no underlying discrimination practices, making sure the algorithms and models don't reinforce prejudices or stereotypes. Consumers develop higher trust if predictive analytics is used clearly and transparently, and biases are reduced through regular audits, algorithm evaluations, etc. Marketing researchers also should be ready for and interested in mitigating any adverse effects related to XAI and, at the same time, equipped with the capabilities of monitoring and tracking all decisions made via XAI. While customers have control over their data and messages to which marketing is applied, marketers must respect customer autonomy. It is important to comply with all of the laws, regulations, and consumer protection laws as well as data protection laws, so marketers can ethically use XAI in marketing. It is of immense importance to stay updated about changing regulations since marketing is changing all the time. Predictive analytics revolutionizes marketing through insights into consumer behavior, campaign optimization, and fact-based decision-making. Companies that implement this ethically and responsibly will retain their competitive edge in an ever-changing marketing scene (GG Insights, 2024; Vainio-Pekka et al., 2023).

Predictive analytics is hence very likely to boost the strategies in marketing with XAI, especially as the data-driven marketing era advances. It is then expected that XAI will result in enhanced creativity, real-time decision-making, hyper-personalized customer experiences, and better personalization. Moreover, it will enhance further prospects of ongoing learning and development, combining with emerging technologies, and keeping moral and open marketing practices. Hence, if fully established, XAI can change marketing completely to bring in a new level of personalization, scalability, and efficacy from the rapidly changing data-driven marketing area to create campaigns with higher success rates, stronger coherence, and more ethical practices.

6. CONCLUSION

Improved predictive capabilities, thanks to AI techniques, have found use in most industries. This, however, emphasizes that it is very important to explain AI model outputs, and XAI is very much needed, more so in sensitive industries such as energy, healthcare, finance, and security. XAI's goal is to increase the interpretability of AI models through very innovative methods.

The widespread use of AI in marketing has turned customer interaction into a new paradigm. XAI enables campaigns tailored to each person's preferences and behaviors. Through correct targeting and quick delivery of messaging, XAI will contribute significantly to enhanced customer satisfaction and loyalty, which leads to customer retention and revenue growth.

Therefore, XAI can revolutionize marketing strategies by enabling data-driven decision-making and improving the customer experience. It helps in fostering trustworthiness and reliability through interpretability and explainability features, providing clarity on decision processes. XAI is predicted to change the industry landscape in the future when it becomes more popular and gets used widely within marketing, where data analytics' undiscovered value unleashes. Therefore, marketers should start making use of XAI as soon as they can if they want to prosper in the AI era.

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