

16**Predictive Analytics and Artificial Intelligence
in Marketing: Implications for Consumer
Purchase Behaviour****Mr. Amit Kapoor^{1*}, Dr. Anurag Maurya², Dr. Manish Kumar³ &
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Abstract

AI (artificial intelligence) and ML (machine learning) technology proliferation has dramatically changed the marketing field with the use of predictive analytics, allowing organizations to decode, anticipate and control consumer purchasing behaviour. This doctoral dissertation provides an in-depth research study on how predictive analytics (powered by AI) systems function in a marketing context, and the many different forms they can take to influence the decision-making processes and outcomes of consumers. The current research was conducted through an integrated review of the peer-reviewed literature published between 2019 and 2025 as well as by reviewing the relevant theoretical frameworks (Theory of Planned Behaviour; Technology Acceptance Model; Information Processing Theory) to synthesise the empirical evidence found in e-commerce, retail, and digital marketing environments. This study shows that many different types of advanced algorithms can produce excellent results at predicting what consumers will purchase (the algorithms include things like gradient boosting such as XGBoost and CatBoost, deep learning architectures such as LSTM, and various forms of recurrent neural networks). Previous research found some predictive algorithms produced results with F1 scores over 0.92 when working on consumer purchase data from large amounts of e-commerce sales transactions. AI personalisation can improve consumer engagement and satisfaction but also create a paradox between privacy and personalisation, resulting in consumers losing trust when they feel that they are being intruded upon by the predictive algorithms. The ethical, regulatory, and transparency considerations surrounding the use of consumer data for the purposes of advertising and marketing to consumers must be examined along with the technical aspects of using predictive algorithms to ensure accuracy and consistency in their application, specifically considering regulations such as the GDPR and CCPA. The findings of this research carry significant implications for India's Viksit Bharat 2047 vision — the Government of India's flagship programme to transform India into a fully developed nation by the centenary of its

independence. As India's digital economy grows rapidly, with over 900 million internet users projected by 2025 and e-commerce revenues expected to reach USD 350 billion by 2030, AI-driven predictive analytics in marketing will play a central role in shaping the consumer economy. Responsible, transparent, and inclusive implementation of predictive marketing systems in Tier Two and Tier Three cities will help to accelerate digital financial access, empower rural entrepreneurs, and support Make in India objectives. Frameworks developed in this research for ethical AI governance and consumer trust-building are directly applicable to the policy context of Digital India, the National AI Strategy (NITI Aayog), and the India AI Mission, each of which identifies AI as a critical enabler of equitable, data-driven economic growth aligned with Viksit Bharat 2047. The evidence suggests that the best uses of predictive analytics in marketing are those combining advanced algorithms and appropriate consumer-centric data governance. The conclusion provides future research options regarding the application of causal methods of inference, the governance of generative AI in consumer analytics, and the cross-cultural elements of predictive marketing acceptance, including a specific focus on emerging markets such as India.

Keywords: Predictive Analytics, Consumer Purchasing Behaviour, Machine Learning, e-Commerce, Viksit Bharat, Digital India.

Introduction

An unprecedented amount of data created by consumers through digital transactions; social media; mobile apps; and IoT devices characterises the current marketplace. When combined with rapid advancements in processing power and algorithmic sophistication, data abundance has accelerated the development of AI-based predictive analytics as a game-changing force in the field of marketing theory and practice. In contrast to the traditional marketing models that are based on demographic segmentation and aggregated historical data, today's predictive systems can predict an individual's behaviour at a high level of detail, thereby facilitating real-time customisation in terms of the types of products recommended, dynamic pricing, and targeted advertising on a large scale.

Predictive analytics applied in marketing utilizes statistical algorithms and machine learning models to provide forecasts about anticipated future consumer actions (in particular, purchasing behaviour) through patterns identified from customer purchase history, transactional history and behavioural data (Ngai et al., 2009; Luo et al., 2019). The academic basis for this area is derived mainly from cognitive psychology, behaviour change and behavioural economics; each of which has contributed to the body of knowledge regarding how consumers collect, process,

and react to information in making purchasing decisions. To businesses, having the ability to accurately anticipate consumer intent will help them to lower their costs of acquiring new customers, manage their inventory more efficiently, and increase their return on their advertising expenditures.

The academic literature has not provided a comprehensive synthesis that combines the computational aspects of predictive modelling with the psychological and behavioural dimensions of consumer reaction. This paper will explore three related research questions: (1) What are the most effective AI/machine learning methods for predicting consumer purchase behaviour, and when do they work best? (2) How does AI-based personalisation influence consumer trust/engagement and purchase outcomes? (3) What ethical, legal, or transparency issues affect how effective predictive analytics can be used in marketing, and what implications do these issues present for individual autonomy?

This research holds further relevance when viewed in relation to India's Viksit Bharat 2047 vision documents. Under its Strategy for Artificial Intelligence (AI) (2018) developed by NITI Aayog, AI is defined by the government as a foundational technology for achieving \$5 trillion in economic output; some priority areas outline the government's focus on developing AI driven commercial analytic applications (e.g., predictive analytics). The results presented from the study directly inform this policy agenda by clarifying to policymakers the circumstances in which predictive marketing may be responsibly employed to create empowering experiences for Indian consumers; enable small and medium sized businesses (SMEs); support rapid and equitable digital growth throughout all geographical & demographic segments.

The result of this research enhances the growing body of knowledge at the boundaries of marketing science, information systems, and consumer psychology. The paper synthesizes empirical findings with theoretical frameworks to provide a combination of scholarly insights and managerial implications. Firms that are interested in using predictive analytics will need both forms of evidence (theoretical and empirical) when considering how to use predictive analytics ethically and responsibly.

The remainder of the paper is organized as follows: Section 2 provides a theoretical foundation for the study; Section 3 reviews the various AI and ML methodologies used in predictive consumer analytics; Section 4 discusses the behavioural implications of AI-based personalisation for consumers; Section 5 focuses on ethical, privacy and regulatory issues; Section 6 consolidates previous sections into one unified discussion; and Section 7 concludes with suggestions for future research.

Theoretical Framework

Researchers have explored many different kinds of theories to understand how people make decisions about buying products, explaining how consumers form their intentions to buy, and then translate those into actual purchases.

- **Theory of Planned Behaviour (TPB)**

Ajzen's (1991) Theory of Planned Behaviour (TPB) is one of the most proven approaches to understanding the process through which consumers arrive at their buying decision. TPB proposes that the strongest predictor of a consumer's actual behaviour is their purchase intention, which is influenced by three factors: the consumer's attitude towards the behaviour; the subjective norms that come from social influence; and the perceived ability of the consumer to perform the behaviour. Predictive AI systems influence each of these factors: personalised digital recommendations shape attitudes; social proof mechanisms reinforce subjective norms; and friction-reducing interfaces improve perceived behavioural control.

The integration of TPB and machine learning for predicting social media purchase behavior is highly applicable (Azad et al., 2023). Adding user-generated content and behavioral intention variables as features in supervised learning models greatly improved prediction accuracy. This combination of psychometric theory with computational modelling offers an area with both high theoretical and practical importance.

- **Technology Acceptance Model (TAM)**

One of the ways that businesses look at how to develop artificial intelligence (AI) based advertising and marketing strategies to drive consumers' purchase intentions is through understanding technology acceptance, which looks at technology adoption by measuring how consumers perceive both the usefulness and ease of using those technologies. When consumers evaluate a recommendation system (or predictive interface) offered to them through AI personalisation, the extent to which they accept or reject the system affects their intention to purchase a product or service from that system.

Models based on the Technology Acceptance Model (TAM) have been modified to incorporate trust as a key mediating variable within AI systems. For example, Choung et al. (2022) show that consumer trust in AI mediates the relationship between perceived usefulness and consumers' intentions to adopt behaviours related to the AI. This means that providing consumers with predictive algorithms will not necessarily provide them with confidence when making purchases using those predictive algorithms; consumers will want to know that those algorithms were developed transparently and by a developer who has benevolent intentions for the consumer.

- **Information Processing Theory and Cognitive Load**

According to Simon (1955), cognitive limitations define the level of rationality available to consumers – bounded rationality restricts the cognitive processes involved in making a consumer's choice. In terms of the consumer decision making process, consumers are choosing what information they attend to, encode, and retrieve to make their choice. AI predictive systems have the potential through the filtering and curation of a consumer's environment to impact how consumers process information, thereby reducing the cognitive load of consumers while also facilitating more personalised experiences (Chen et al., 2025).

Algorithm-driven curation may create a filter bubble effect for consumers resulting in limited exploration and diversity of choice; this creates an ethical issue that links cognitive psychology to marketing ethics.

- **The Personalisation-Privacy Paradox**

A theoretical tension in the marketing literature on AI is the personalisation-privacy paradox — consumers want personalised experiences but do not want their data collected to enable that personalisation (Awad & Krishnan, 2006; Saura, 2024). This paradox is examined through privacy calculus theory, which posits that data disclosure decisions are determined by a computation of benefits against privacy costs, combined with prospect theory, which states that individuals are more sensitive to losses than gains.

AI and Machine Learning Methodologies in Predictive Consumer Analytics

In the last decade, there have been numerous paradigm shifts in the methodological development of AI-based predictive analytics for marketing purposes. The first generation of systems used mostly collaborative-filtering algorithms and basic regression-type models. Currently, many different types of machine-learning architectures exist in marketing.

- **Classical Machine Learning Approaches**

Machine learning utilizes four basic algorithms to forecast consumer behaviour (predictive analytics) logistic regression, decision tree, Random Forest (RF), and Support Vector Machine (SVM). The algorithms are simple to understand and can be executed on a computer very quickly.

Lin (2025) provides an excellent comparison of multiple machine learning (ML) models (SVM, XGBoost, CatBoost, and BPANN) to predict the shopping activity of many consumers who buy online. CatBoost outperformed all other models with an ROC AUC of 0.985, and XGBoost achieved a F1 score of 0.92. The feature importance analysis revealed that the two features (attributes) that were most influential in predicting consumer purchase behaviour were page views and time-on-page. Khandokar et al. (2023) used the same methodology of evaluating the

performance of a gradient-boosting classifier vs. a single model for predicting the intention of an online buyer to purchase.

- **Deep Learning and Neural Network Architectures**

Deep learning approaches have changed how we understand consumer behaviour by enabling accurate prediction of complex, nonlinear relationships in high-dimensional data. RNN and LSTM networks are particularly suited for modelling sequential consumer behaviour data — including clickstream, browsing history, and purchase sequences.

Chaudhuri et al. (2021) found that deep neural networks outperformed logistic regression, decision trees, random forests, SVM, and ANNs at predicting actual e-commerce purchases, attributing the superior performance to the dense network structure's ability to identify complex patterns from platform engagement and customer characteristics.

More recent architectures provide enhanced capabilities. Liu and Hu (2025) proposed the RL-Trans framework (Deep Reinforcement Learning [DQN] combined with Transformers) which continuously adapts to changes in consumer behaviour based upon consumer profiles and transactional history, propagating personalised interests through high-dimensional feature space.

- **Generative AI and Synthetic Data Augmentation**

Generative AI models — including Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Transformer-based large language models — enable new frontiers of consumer behaviour analytics through synthetic data generation, counterfactual simulation, and unstructured data extraction. Sondari et al. (2025) conducted a systematic review of 117 Scopus-indexed articles on AI and consumer behaviour, confirming the growing role of generative AI in marketing analytics, while recommending additional investigation into practical real-world deployment in marketing channels.

- **Predictive Features and Data Sources**

The effectiveness of marketing AI tools depends directly on the variety and quality of data they receive. New features beyond traditional RFM metrics include: clickstream and dwell time metrics, social media interactions, geographic and temporal variables, device and channel metadata, sentiment analysis of reviews, and psychographic profiling. Wen et al. (2023) demonstrated that multi-behavioural trendiness (MBT) and product popularity (POP) features derived from clickstream data can achieve purchase intent prediction with $F1 = 0.9031$ for anonymous customers.

Behavioural Implications of AI-Driven Personalisation and Predictive Marketing

- **Personalisation and Purchase Intention**

Personalisation — tailoring marketing material, recommended products and pricing for individual consumers — is the main commercial output of predictive analytics systems. Previous research has broadly documented the positive correlation between effective personalisation and purchase intention, mediated through relevance perceptions and cognitive ease.

Advanced recommender systems and machine learning algorithms create different product recommendations, email content, and advertisements based on browsing history, previous purchases, and psychographic information, to increase customer satisfaction, repurchase behaviour, and brand loyalty. Structural equation modelling studies have established that AI-enabled personalisation in social media marketing positively influences trust, perceived usefulness, and engagement (Sondari et al., 2025).

- **The Role of Trust in AI-Mediated Purchase Decisions**

Trust is a multi-dimensional construct linked to online shopping, satisfaction, and consumer loyalty. Choung et al. (2022) established that trust in AI technology significantly predicts adoption intentions, and that perceptions of competence, benevolence, and integrity are key dimensions of AI trust. An empirical study of 650 Greek consumers (Miltiadou et al., 2025) confirmed that trust and ethical perceptions are key determinants of consumer acceptance of predictive marketing, and that transparency mechanisms significantly enhance acceptance and conversion rates.

- **Over-Personalisation and Consumer Reactance**

While personalisation drives relevance, over-personalisation — using personal data in an excessive or invasive manner — can trigger consumer reactance and backlash. Brehm's (1966) psychological reactance theory posits that consumers seek to protect their autonomy when they believe it is being constrained. In marketing contexts, perceived surveillance through hyper-targeted advertising ("ad stalking") causes consumers to reject messages and avoid brands.

Cloarec et al. (2024) demonstrated through a transformative privacy calculus framework that positive emotions correlate with greater data sharing willingness, while perceived privacy violations reduce trust in personalised advertising. Dynamic personalisation thresholds that are not carefully calibrated can accumulate to create a sense of excessive targeting, resulting in backlash effects.

- **Predictive Analytics and Consumer Decision Architecture**

With the rise of predictive analytics-based marketing, the way consumers' choice architecture has fundamentally changed. From an algorithmic perspective,

the systems used to determine the order of products displayed to a consumer and their associated prices limit what can be chosen by that consumer and raises important concerns regarding how these decision-making tools affect consumer autonomy and the fairness of competition for all brands, as well as how ethical it is for a machine to nudging towards a purchase via artificial intelligence (AI) operations. Trust and authenticity in the consumer's eyes have become central to the body of research in AI marketing that is conducted on younger, digital-savvy consumers.

Ethical, Regulatory, and Transparency Considerations

- **Data Privacy and the Regulatory Landscape**

Consumer data is a crucial part of predictive marketing systems; however, the amounts and levels of detail associated with said consumer data cause significant privacy concerns. Some relevant regulatory changes include the General Data Protection Regulation (GDPR, EU, 2018) and California Consumer Privacy Act (CCPA, 2020). These two regulatory changes have imposed significant levels of responsibility upon companies with respect to their collection of consumer data and algorithmic profiling.

Truong et al. (2023) found in their systematic review of ethics in digital marketing that companies can increase the credibility of their collection of consumer data and a consumer's willingness to share their data with an organisation through transparent data handling practices. The migration to using first-party data sources and privacy-focused machine learning approaches such as federated learning and differential privacy represents an effective corporate response to the decline of third-party cookies.

- **Algorithmic Transparency and Explainability**

The ethical issue of predictively marketing with AI (Artificial Intelligence) is complicated by the use of highly effective black-box models that sometimes make it difficult, if not impossible, to explain the basis for decisions that are made using this kind of algorithm. The European Union's General Data Protection Regulation (GDPR) gives individuals a legal right to receive an explanation for decisions that are made using automated systems. As a result, making algorithms transparent is both an ethical imperative and legal requirement.

The term Explainable AI (XAI) describes the study of developing interpretability in algorithmic techniques while ensuring that model performance does not decrease. Examples of this type of consumer analytics include SHAP (Shapley Additive Explanations), LIME (Local Interpretable Model-Agnostic Explanations). These two methodologies allow marketers and regulators to understand which factors had the largest impact on predictions of consumers' likelihood to purchase.

The results of a study conducted by Ozkurt (2024) demonstrated that consumers felt confident in AI-driven decision-making frameworks due to transparency created through XAI, and as a result, demonstrate that explainability is an effective way to generate consumer trust, which has financial implications for the company marketing its products.

- **Algorithmic Bias and Fairness**

Historical consumer data predictive models contain the biases that already may exist within those data sets. Market behaviours based on protected attributes can reflect disparate outcomes for demographic groups based on a consumer's race, gender or ethnic national origin. In other words, utilizing predictive models that contain biases in your data could be considered indirect discrimination and contradict ethical processes as well as potentially violate anti-discrimination regulatory laws. In the European Union, the development and implementation of fairness-aware machine learning frameworks are becoming ever more accepted as both an ethical necessity and a required function of EU AI governance.

- **Consumer Autonomy and the Manipulation Boundary**

Utilizing AI to drive predictive marketing systems allows for highly personalized experiences through the use of consumer data to shape purchasing decisions. While there is a fine line between acceptable persuasion and deceptive manipulation, there are serious consequences for consumers when systems exploit cognitive biases in order to maximize conversion rates in the short term, which leads to a loss of autonomy over purchasing decisions in addition to undermining the moral underpinnings of eCommerce. Respecting consumer cognitive autonomy as a part of predictive marketing will become an increasingly established principle in the global development of emerging AI governance frameworks.

Integrated Discussion

This study aims to synthesise evidence about AI-powered predictive analytics and their use in marketing and the ways in which they affect consumer behaviour considering both technical advances in machine learning systems and complex, context-dependent impacts of AI on consumers.

While there are multiple integrated themes that arise from this assessment, three are highlighted.

First, effectiveness of predictive analytics at influencing purchasing behaviour is not solely a function of algorithmic sophistication; algorithms such as CatBoost and deep LSTM networks achieve high levels of predictive accuracy in experimental conditions but also have many influences on how well they will perform in a real-world business setting, including level of consumer trust in predictive analytics, perceived transparency of predictive analytics, and consumer's perceptions regarding

whether or not personalised marketing is perceived to add value or feel intrusive (Lin 2025; Liu & Hu 2025).

Second, traditional theories used to explain human decision making – TPB, TAM, IPT, and the personalisation-privacy paradox – remain relevant when interpreting consumer reactions to AI-based marketing strategy. The study by Azad et al (2023), which uses TPB constructs as input to machine learning models, is an example of this integrative framework and demonstrates a new methodology for theory-based predictive modelling for further development.

Third, new regulations and ethical standards are emerging quickly. GDPR, CCPA, and the EU's AI Act have set the foundation for a governance model that incentivises data practices to be consumer-centric and transparent. Proactive alignment of predictive analytics capabilities with these legislative standards and ethical frameworks will enable businesses to create a competitive advantage through effective use of predictive analytics.

The deployment of AI-based predictive marketing can revolutionise India's Viksit Bharat 2047 agenda through positively changing the way we use and share our data, and thus allowing us to all participate in inclusive digital commerce. NITI Aayog's National Strategy for Artificial Intelligence (2018) and the IndiaAI Mission (2024) already identify consumer value-added AI applications as key areas of advancement. Ethically deployed predictive analytics with proper data governance under the Government of India's Digital Personal Data Protection Act (DPDPA, 2023) will allow us to gain more access to digital financial inclusion, and it will also enhance the growth of D2C brands by enabling millions of first-time digital consumers to use their technology in Tier 2 and Tier 3 cities.

In addition, the global AI for e-commerce market is currently valued at USD 4-6 billion (2022) and will continue to fuel investment in predictive marketing capabilities until it reaches USD 18-22 billion by 2032. In this fast-changing, rapidly evolving technological market there is an extraordinary burden on scholars and practitioners to develop and implement ethical frameworks that protect consumer interests while promoting an environment for innovation to occur in the short and long term.

Conclusion and Future Research Directions

The Dissertation Study explores the rapidly changing environment of AI-based predictive analytics in marketing, including its effect on consumer purchase behavior. By integrating the computational, behavioral, and ethical perspectives, a greater understanding of this area is yielded than can be achieved by looking at individual disciplinary perspectives.

The main contribution of this work is to develop an empirically validated theoretical framework for defining the circumstances that influence whether predictive

analytics will enhance or detract from both consumer purchase behavior & marketing performance. The framework includes four pillars on which the findings will be built: 1) the algorithmic capabilities of AI systems; 2) consumer trust; 3) transparency; and 4) regulatory compliance.

The analysis provides several areas for further research including: 1) conducting longitudinal studies that measure how consumer responses to AI personalization change over time; 2) using causal inference methods to relate predictive analytics interventions to purchasing outcomes; and 3) examining the governance and marketing applications of generative AI as an important research area that has not been examined extensively.

To establish the limits of the outcomes achieved from Western consumer populations will require more than just cross-culturally being able to study the personalisation/ privacy paradox. There may, for instance, be structural differences in India's (a high-context culture) community norms related to data sharing and trust in digital systems versus the community-centric norms generally found in low-context cultures such as Western countries. In addition, future research should look into developing AI predictive marketing strategies that will reach the diverse and massive segments of India's population — for instance, urban millennial consumers versus rural first-time digital users — while also supporting Viksit Bharat 2047's objectives on inclusive development.

Collaborative interdisciplinary research between marketing scholars; computer scientists; legal scholars; and ethicists will be required to develop the conceptual frameworks, methodological tools, and other governance mechanisms needed for the effective regulation of predictive marketing systems. Protecting consumer autonomy through responsible governance of predictive marketing systems while facilitating innovation and productivity from the use of AI in marketing require collaborative efforts among researchers in these fields. India's unique opportunities to provide original, globally significant research in this area will increase substantially between now and 2047, given its high levels of digitalisation; its large and diverse consumer base (compared with many other nations), and its leading-edge policy on AI.

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