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THE EVOLUTION OF THE CONSUMER: FROM HUMAN DECISION-MAKERS TO ALGORITHMIC CONSUMERS, DIGITAL TWINS, AND SYNTHETIC CONSUMERS

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Abstract: *This article follows the evolution of the consumer concept from traditional models based on the observation of human behavior to advanced digital representations based on artificial intelligence. Through a conceptual analysis of the literature on consumer behavior, digital footprints, algorithmic consumers, digital twins and synthetic consumers, the article proposes an evolutionary framework that explains the progressive transformation of the consumer into a digital entity capable of being modeled, simulated and anticipated. The findings highlight that the development of Big Data, Machine Learning and Large Language Models is fundamentally changing the way researchers and organizations understand, measure and predict consumer behavior. The article discusses the theoretical, managerial and ethical implications of this transformation, including issues of decision autonomy, data privacy, and algorithmic transparency.*

JEL classification: D11, M31, O33, D83.
Key words: consumer evolution, algorithmic consumer, digital twins, synthetic consumers, digital footprint.

1. INTRODUCTION

Over the last two decades, digital innovation has fundamentally reshaped the way organisations acquire, process and exploit consumer information. The widespread adoption of the Internet, smart devices, digital platforms and artificial intelligence has generated unprecedented amounts of behavioural data, enabling organisations to analyse, anticipate and influence consumer

decisions with a level of precision that traditional research methods could not achieve. In this context, the consumer has become one of the most valuable data sources of the digital economy, and its conceptual representation has evolved with the development of information technologies and advanced analysis tools (Hornik & Rachamim, 2025; Theodorakopoulos et al., 2026).

For decades, the study of consumer behavior has been dominated by patterns centered on the human individual, analyzed through economic, psychological, and sociological theories. From the classic model of "Homo Economicus" (Mill, 1848; Persky, 1995), which implied the existence of a rational actor capable of maximizing utility and making decisions based on complete information, to the perspectives developed by behavioral economics, the research mainly aimed at understanding the mechanisms underlying human decision making. Recent advances in Big Data, artificial intelligence and predictive analytics have expanded consumer representation beyond simple behavioural observation, making it possible to build models capable of simulation and prediction.

Contemporary organisations increasingly rely on digital footprints, transaction histories, online activities and platform interactions to construct sophisticated behavioural profiles of individual consumers. These developments led to the emergence of the concept of "Algorithmic Consumer", defined by Gal & Elkin-Koren (2017) as a consumer whose decisions are assisted or even replaced by algorithms capable of identifying, selecting and executing consumer actions autonomously. Thus, algorithms are no longer used solely to recommend products or services; they have become active participants in the consumer decision-making process.

At the same time, recent research has introduced concepts such as Digital Shadow, Consumer Digital Twin and Synthetic Consumer, reflecting increasingly sophisticated forms of digital consumer representation. If Digital Shadow is a digital reflection of consumer behavior based on unidirectional data flows, Consumer Digital Twin introduces a dynamic and synchronized digital representation of the consumer, able to integrate and update information from multiple sources to simulate and predict future behavior (Sepasgozar, 2021; Hornik & Rachamim, 2025). More recently, the development of generative models and systems based on Large Language Models (LLMs) has made possible the emergence of Synthetic Consumers, digital entities capable of reproducing and simulating human behaviors in complex experimental and decision-making contexts (Toubia et al., 2025).

Although existing literature provides important contributions on consumer behavior, digital footprints, Algorithmic Consumers, Digital Twins, and Synthetic Consumers, these concepts are typically analyzed separately. Current research does not yet provide an integrative conceptual framework to explain how consumer representation has evolved from traditional models based on human behavior observation to complex digital representations built with the help of artificial intelligence and predictive modeling technologies.

This paper develops an integrative conceptual framework describing how consumer representation has progressively evolved alongside advances in digital technologies and artificial intelligence. It connects traditional consumer theories with Algorithmic Consumers, Consumer Digital Twins and Synthetic Consumers, illustrating the main stages of this evolution while discussing its managerial, societal and ethical implications, together with future research opportunities.

The originality of this study lies in integrating several research streams that have largely evolved independently into a unified conceptual perspective. By bringing these concepts together, the paper offers a broader understanding of how consumer representation has changed in response to advances in artificial intelligence and digital technologies.

2. THE EVOLUTION OF CONSUMER REPRESENTATION

Consumer representation has been one of the fundamental concerns of economic and marketing literature, constantly evolving as understanding of human behavior and technological development progressed. From classic economic models based on perfect rationality to complex digital representations built through artificial intelligence, the concept of the consumer has gone through a continuous process of transformation.

From the perspective of modern marketing, the consumer is simultaneously influenced by cultural, social, personal and psychological factors, which contributes to the complexity of consumer behavior and the difficulty of anticipating its decisions (Solomon, 2020).

The first approaches were influenced by the Homo Economicus model, derived from classical and neoclassical economics. It describes a completely rational individual, able to process all available information and always select the alternative that maximizes personal utility (Mill, 1848; Persky, 1995). In this perspective, the consumer is considered a predictable economic actor, whose decisions are based solely on logical assessments of costs and benefits. Although

this model was the basis of early economic theories, it was criticized for oversimplifying human decision-making.

A significant change was made by Herbert Simon, who introduced the concept of bounded rationality, arguing that individuals operate under conditions of incomplete information and limited cognitive ability, that is, the consumer will never have sufficient information, and time and resources (most often of a financial type) are limited. Instead of permanently aiming at maximizing utility, consumers often choose options that are sufficiently satisfying to achieve their goals, a process that Simon (1955) defines by the term satisfying. This perspective was an important step in bringing theoretical models closer to the reality of human behavior.

A complementary perspective is provided by evolutionary psychology, which suggests that many contemporary consumer behaviors originate from adaptive mechanisms developed for survival, social status and belonging to social groups (Taheran et al., 2024).

The development of behavioral economics later revealed that consumer decisions are influenced by numerous heuristics and cognitive biases. Kahneman & Tversky (1979) demonstrates that individuals do not always evaluate alternatives in a strictly rational manner, but instead use mental shortcuts that facilitate information processing, but that can lead to systematic errors of judgment. These contributions are complemented by the model of the two systems of thought proposed by Kahneman (2011), according to which decisions are the result of the interaction between an intuitive, fast and automatic system (System 1) and an analytical, slow and deliberative system (System 2).

In the same direction, Ariely (2008) argues that consumer irrationality is not random, but follows relatively predictable patterns, influenced by the decision-making context and the way alternatives are presented. At the same time, Cialdini's research (2009) demonstrates the role of social influence and persuasion principles in shaping consumer behavior. Principles such as reciprocity, social proof, authority or scarcity demonstrate that consumer decisions are strongly influenced by the social environment and the context in which they are taken.

Recent research shows that the study of consumer behavior has evolved from approaches focused solely on individual decision making to insights that include consumer experience, brand relationships, digital media, and the impact of emerging technologies on consumption (Lim et al., 2023).

The development of the Internet and digital technologies has generated a new stage in the evolution of consumer behavior and representation. The emergence of e-commerce, social networks, mobile devices and digital platforms has made the consumer an active participant of the digital ecosystem. At this stage, the concept of Digital Consumer is emerging, characterized by the frequent use of digital technologies for information, communication, evaluation of alternatives and procurement (Oumaima & Lamari, 2024). Unlike the traditional consumer, the digital consumer constantly interacts with the online environment and generates significant amounts of data through his daily activities.

This transformation is associated with the shift towards the Marketing 5.0 paradigm, where digital technologies and artificial intelligence are used to create personalized experiences and better understand consumer behavior (Kotler, Kartajaya & Setiawan, 2021).

These interactions lead to the emergence of the concept of digital footprint, defined as the totality of digital traces generated by users in the online environment, including browsing history, searches performed, interactions in social networks, digital transactions and other behavioral data (Al-Jubory, Zakaria & Al-Mulla Hasan, 2026). Recent literature highlights that these digital footprints give organizations the opportunity to better understand consumer preferences, anticipate consumer needs, and develop personalized experiences (Al-Jubory, Zakaria & Al-Mulla Hasan, 2026). Hence, the consumer begins to be represented not only as an individual, but also as a continuous source of data usable in the processes of analysis and prediction.

As consumer-generated data volumes grew exponentially, the development of Big Data and artificial intelligence allowed this information to be transformed into complex behavioral models. Consequently, what can be called the Datafied Consumer, a consumer represented by profiles built from demographic, behavioral, transactional and contextual data. Organizations use this information to segment, personalize, and predict future behavior, turning the consumer into an analyzable entity through data (Theodorakopoulos et al., 2026).

A distinct step in this evolution is the emergence of the concept of Algorithmic Consumer. According to Gal & Elkin-Koren (2017), the algorithmic consumer represents an individual whose preferences, decision-making processes and purchasing behaviors are influenced and assisted by intelligent algorithms. In this case, the consumer remains the main actor of the consumer process, but the algorithms intervene in identifying the relevant information,

recommending products, comparing alternatives and even automating some purchasing decisions. Virtual assistants, referral systems and artificial intelligence platforms reduce the cognitive effort required for decision making and transform the way consumers interact with the market. Therefore, Algorithmic Consumer is not a digital copy of the consumer, but a real consumer whose decisions are mediated and modeled by algorithmic systems.

Recent research highlights that algorithms increasingly influence selection, evaluation and purchasing processes, making the consumer an active participant in a decision-making ecosystem assisted by artificial intelligence (Sifat, 2025).

The evolution of digital technologies has subsequently led to the development of advanced forms of digital consumer representation. A first step in this direction is to use data from digital footprints to build digital models capable of reflecting individual consumer behaviour and characteristics. These developments have created the premises for the emergence of the concept of Digital Consumer Twin, which is a dynamic virtual replica of a real consumer, built through the continuous integration and updating of data from multiple sources. Unlike the algorithmic consumer, who is a real person assisted by algorithms, Consumer Digital Twin is a digital copy of an existing individual, used for monitoring, analysis, simulation and prediction of their behavior (Hornik & Rachamim, 2025).

The most recent stage of this development is the emergence of the concept of Synthetic Consumer. If Consumer Digital Twin reproduces the behavior of a real consumer, Synthetic Consumer is an artificial entity generated by artificial intelligence, designed to simulate human preferences, behaviors and decision processes. These entities do not require a real correspondent and can be used for market simulations, testing marketing strategies, evaluating product concepts and anticipating consumer reactions in different decision scenarios (Toubia et al., 2025). Thus, consumer representation evolves from observing human behavior to building digital models capable not only of reproducing, but also of simulating consumer behaviors in virtual environments.

3. FROM DIGITAL FOOTPRINTS AND CUSTOMER EXPERIENCE TO CONSUMER DIGITAL TWINS AND SYNTHETIC CONSUMERS

Digital transformation and the development of artificial intelligence have significantly expanded the possibilities of consumer analysis. While traditional models aimed at explaining

consumer behaviour, new technologies allow for the collection, integration and use of considerable volumes of behavioural data in order to predict and simulate consumer decisions. Therefore, digital footprints, Consumer Digital Twins and Synthetic Consumers are key concepts illustrating the new development directions of consumer research and modern marketing practices.

3.1 Digital Footprints as the Foundation of Consumer Representation

In today's digital economy, consumers are continuously generating significant amounts of data through their interactions with online platforms, mobile applications, social networks and connected devices. This information forms what the literature defines as digital footprints, namely the totality of digital footprints created by users in the online environment, either voluntarily or as a result of activities carried out in the digital space (Al-Jubory, Zakaria & Al-Mulla Hasan, 2026).

The importance of digital footprints has increased considerably in recent years due to their ability to provide detailed information about consumer behaviors, preferences and habits. According to Al-Jubory, Zakaria & Al-Mulla Hasan (2026), digital trace analysis allows organizations to identify latent needs, anticipate future preferences, and develop personalized offers tailored to each consumer. In this respect, digital footprints are the raw material that feeds modern systems of behavioral analysis and personalization.

Recent literature emphasizes that digital footprints are one of the main resources used to develop modern personalized marketing strategies and to anticipate consumer preferences (Raut et al., 2025).

In addition, effective fingerprint management has become an essential element of organizational competitiveness, contributing to the optimization of communication and consumer relations in the online environment (Pramiarsih et al., 2024).

More than mere recordings of online activity, digital traces help to build an ever more detailed representation of the consumer. The information collected from multiple sources allows organizations to go beyond the boundaries of traditional research and develop dynamic models capable of capturing consumer behavior in real time. Thus, digital footprints are the technological foundation on which concepts such as Consumer Digital Twins and Synthetic Consumers are developed.

3.2 Customer Experience and the Shift toward Data-Driven Personalization

Digital technologies have profoundly changed the way organizations manage consumer relationships. As a result, Customer Experience (CX) has become one of the main factors of competitive differentiation, being defined as the totality of interactions between the consumer and the organization throughout the entire consumer journey (Lemon & Verhoef, 2016).

The literature suggests that the use of consumer-generated data allows for the development of increasingly personalized experiences. Oumaima & Lamari (2024) emphasizes that digital transformation has driven the shift from mass marketing strategies to approaches based on personalization and customer relationship management. By using behavioral data and predictive analytics algorithms, organizations can tailor products, services, and marketing messages to the characteristics of each consumer.

In parallel, the development of artificial intelligence and advanced analytics systems has expanded the ability of organizations to understand and predict consumer behavior. Customised recommendations, automated segmentation systems and predictive tools turn the consumer experience into a dynamic and continuous process optimized based on the available data. Hence, the goal is no longer just to understand the consumer, but also to simulate his behavior in order to improve the experience offered.

3.3 Consumer Digital Twins: From Observation to Simulation

As the volumes of available data increased, organizations began to develop models capable not only of describing consumer behavior, but also of simulating it. In this context, the concept of Consumer Digital Twin, derived from Digital Twin technology originally used in industry and engineering, appears.

The concept of Digital Twin was originally defined as a virtual representation of a physical entity, continuously updated through data flows and used for monitoring, analysis and simulation (Barricelli, Casiraghi & Fogli, 2019).

According to Hornik & Rachamim (2025), a Digital Twin Consumer represents a dynamic virtual representation of a real consumer, built through the continuous integration and synchronization of information from multiple sources. This data may include demographic

information, transaction history, online activity, stated preferences, digital interactions, and other information relevant to understanding individual behavior.

Unlike traditional consumer analysis models, the Consumer Digital Twins allow the simulation of hypothetical scenarios and the anticipation of consumer reactions before they manifest in reality. Hence, organizations can evaluate the impact of marketing campaigns, test product changes or analyze different customization strategies without directly interfering with the real consumer (Hornik & Rachamim, 2025).

In addition, recent literature suggests that integrating data from neuromarketing, social media, and other behavioral sources may lead to the development of Consumer Digital Twins capable of capturing not only observable behaviors, but also cognitive and emotional dimensions of decision making (Sefa, Rezaei & Valilai, 2026).

3.4 Synthetic Consumers and the Future of Consumer Simulation

The latest development in consumer representation is the emergence of the concept of the Synthetic Consumer. Unlike Consumer Digital Twin, which reproduces the characteristics of a real individual, Synthetic Consumer is an artificial entity generated by artificial intelligence, designed to reproduce human behavior, preferences and decision-making processes.

The development of generative models and Large Language Models (LLMs) created the premises for the emergence of artificial agents capable of participating in complex simulations of consumer behavior. According to Toubia et al. (2025), these systems can replicate individual and collective behaviors using demographic, psychological, and behavioral information, giving researchers and organizations the opportunity to conduct virtual experiments at low cost and in a significantly shorter time.

The use of Synthetic Consumers opens up new perspectives for marketing research, as it enables organizations to test commercial strategies, evaluate product concepts and simulate market reactions before their actual launch. However, as these technologies become more sophisticated, questions arise about the validity of the results, the transparency of the models and the ethical implications associated with the use of artificial consumer representations.

4. MANAGERIAL, SOCIETAL AND ETHICAL IMPLICATIONS

Digital transformation has profoundly changed the way organizations understand, analyze and interact with consumers. The development of technologies based on artificial intelligence, the use of digital footprints, as well as the emergence of Consumer Digital Twin and Synthetic Consumer concepts provide companies with unprecedented opportunities to anticipate behaviors, personalize experiences and optimize decision-making processes. By integrating data from multiple sources, organizations can gain a more detailed understanding of consumer preferences and needs, which contributes to the development of more relevant and effective products, services and marketing strategies (Hornik & Rachamim, 2025).

One of the most important applications of these technologies is customization and hyper-personalization. The analysis of digital behavior facilitates the adaptation of offers and communication to the individual characteristics of each consumer, helping to improve the consumer experience and strengthen the relationship between the organization and the client (Al-Jubory, Zakaria & Al-Mulla Hasan, 2026). At the same time, the use of Consumer Digital Twins and Synthetic Consumers enables virtual testing of commercial strategies and simulating consumer reactions before their implementation in real conditions, reducing the costs and risks associated with the decision-making process (Toubia et al., 2025). Although personalization generates important benefits for both organizations and consumers, it can simultaneously create feelings of vulnerability when users perceive that their data is collected and used without sufficient control. This phenomenon is known in the literature as „personalization paradox" (Aguirre et al., 2015).

From a societal perspective, these developments can generate important benefits for both organisations and consumers. Customised recommendations, tailored services and automated processes help to increase efficiency and simplify the buying process. However, the development of increasingly sophisticated digital models also raises many concerns about the protection of personal data and consumer autonomy. The significant amounts of information collected through digital footprints allow the construction of highly detailed behavioural profiles, which can amplify surveillance perception and reduce user control over their own data (Al-Jubory, Zakaria & Al-Mulla Hasan, 2026).

In addition, as algorithms become increasingly involved in the processes of recommendation, selection and customization, there is a risk of influencing consumer behavior in a manner that

is difficult to observe and understand at the subconscious level. The recent literature highlights that artificial intelligence can enhance the effectiveness of influence strategies by adapting messages to the preferences and seniorities of individuals and using advanced personalization mechanisms (by de Marcellis-Warin et al., 2022). In such situations, the boundary between personalization, persuasion and manipulation is becoming increasingly difficult.

In addition, research shows that consumer reactions differ depending on the source of recommendations and decisions. In some contexts, consumers show a higher level of confidence in decisions made by people than in those generated exclusively by algorithms, even when their performance is similar (Yalcin et al., 2022).

Another important challenge is the possibility of algorithmic biases and modeling errors. Both Consumer Digital Twins and Synthetic Consumers depend on the quality of the data and the validity of the models used. Incomplete data, erroneous information or poorly validated algorithms can lead to inaccurate results and questionable managerial decisions. For this reason, the development and use of these technologies must be accompanied by clear principles of transparency, accountability and ethical use of artificial intelligence. Initiatives such as the GDPR and the EU AI Act are important steps in building a regulatory framework capable of protecting consumer rights and ensuring a balance between technological innovation and respect for fundamental ethical values (Helbing, 2024).

Thus, Consumer Digital Twins and Synthetic Consumers offer significant opportunities for marketing research and the development of organizational strategies, but the success of their implementation depends on the ability of organizations to responsibly manage consumer data, limit the risks associated with the use of artificial intelligence, and maintain a high level of trust in the relationship between technology and society.

5. WHAT LIES AHEAD? FUTURE DIRECTIONS IN CONSUMER RESEARCH

The evolution of digital technologies and the accelerated development of artificial intelligence suggest that the process of consumer conceptualization and analysis will continue to transform in the coming years. While organizations are currently using Consumer Digital Twins and Synthetic Consumers primarily for personalization, segmentation, and behavioral simulations, recent advances point to the possibility of developing increasingly complex models capable of

integrating cognitive, emotional, and contextual information in a way that is much closer to real human behavior.

A first direction of development is the integration of neuromarketing-specific technologies into digital consumer models. Data from tools such as eye-tracking, electroencephalography (EEG), facial expression analysis or galvanic skin response (GSR) could contribute to the development of Digital Twins capable of capturing not only observable behaviors but also emotional reactions and cognitive processes associated with decision making. Such an approach could provide organizations with a deeper understanding of the motivations that influence consumer behavior.

In parallel, the development of generative models and systems based on Large Language Models (LLMs) will likely contribute to the expansion of Synthetic Consumers' use in marketing research. These artificial entities could be used to simulate entire market segments, to test product concepts or to evaluate consumer reactions before the effective implementation of commercial strategies. In this context, marketing research could become faster, more flexible and less dependent on traditional data collection methods.

Another important direction is the development of systems capable of updating and adapting consumer digital models in real time. Increasing the volume of data generated through smart devices, social networks and connected digital ecosystems can turn Consumer Digital Twins into dynamic tools capable of continuously reflecting user behavioural changes. In this scenario, organisations could increasingly anticipate consumer needs and preferences.

However, the development of increasingly sophisticated digital models will be accompanied by significant challenges regarding data privacy, algorithmic transparency and consumer autonomy. For this reason, technological progress must be accompanied by the development of effective governance mechanisms and the definition of clear ethical standards for the use of artificial intelligence in research and analysis of consumer behaviour.

In the future, the relationship between consumers and artificial intelligence will likely become ever closer, and the boundary between observed behavior, modeled behavior, and simulated behavior will continue to fade. From this perspective, Consumer Digital Twins and Synthetic Consumers should not only be seen as technological tools, but as elements that can redefine how organizations understand, analyze and interact with consumers in the digital economy of the future.

6. LIMITATIONS OF THE STUDY

This study has a number of limitations that need to be considered in interpreting the results. First, the article is conceptual in nature and is based exclusively on the analysis and integration of the literature, without including an empirical validation of the proposed framework. For this reason, the relationships between the analyzed concepts and the stages of the evolution of consumer conceptualization require testing and validation through future research.

Secondly, some of the concepts analyzed, such as Consumer Digital Twins and Synthetic Consumers, represent relatively recent research areas that are in a continuous development process. Existing literature is still limited compared to that devoted to consumer behavior or behavioral economics, and the definitions and applications of these concepts continue to evolve.

Last but not least, the accelerated pace of development of artificial intelligence and digital technologies may lead to the emergence of new theoretical perspectives and practical applications that have not been included in this analysis. Consequently, the proposed conceptual framework should be seen as a starting point for future research into the transformation of the consumer into the era of artificial intelligence.

CONCLUSIONS

Consumer conceptualization has evolved significantly in recent decades, reflecting both societal changes and technological progress. From the classic model of Homo Economicus, based on the assumption of perfect rationality, the literature has gone through successive stages that have highlighted the cognitive limitations of individuals, the influence of emotions and social context on decision-making, as well as the impact of digital technologies on consumer behavior. Thus, the contemporary consumer can no longer be understood exclusively through traditional economic theories, but must be analyzed in a context characterized by permanent connectivity, large volumes of data and the use of artificial intelligence.

The article proposed a conceptual framework explaining the evolution of consumer conceptualization from Homo Economicus and the behavioral consumer to Digital Consumer, Datafied Consumer, Algorithmic Consumer, Consumer Digital Twin and Synthetic Consumer. The analysis indicates that each stage was driven by the development of new theoretical

perspectives and technologies that have expanded the ability of organizations to understand, analyze and predict consumer behavior.

The results suggest that digital footprints are the foundation on which new forms of consumer modeling are developing, while Consumer Digital Twins and Synthetic Consumers mark an important shift from simply observing behavior to simulating and anticipating it. These technologies provide significant opportunities for marketing research and organizational decision making, helping to develop more effective strategies and more personalized consumer experiences.

At the same time, the use of increasingly sophisticated digital models raises important questions about data protection, consumer autonomy, algorithmic transparency, and ethical limits to the influence of human behavior. For this reason, the future development of these technologies must be accompanied by appropriate regulatory mechanisms and clear principles on the responsible use of artificial intelligence.

In conclusion, the transformations analysed suggest that the future of consumer research will be characterised by a growing integration between human behaviour, digital data and artificial intelligence. Therefore, Consumer Digital Twins and Synthetic Consumers are not only emerging technological tools, but also new perspectives through which the consumer can be understood, analyzed and studied in the digital economy of the future.

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REFERENCES

1. Aguirre E., Mahr D., Grewal D., de Ruyter K. & Wetzels M. (2015). *Unraveling the Personalization Paradox: The Effect of Information Collection and Trust-Building Strategies on Online Advertisement Effectiveness*. Journal of Retailing, 91(1), 34-49. DOI: 10.1016/j.jretai.2014.09.005
2. Al-Jubory A.S.S., Zakaria S.K. & Al-Mulla Hasan M.M. (2026). *Digital Footprint and Its Impact on Improving Customer Experience: An Exploratory Study of a Sample of Internet Companies in Nineveh Governorate*. F1000Research, 15, 116. DOI: 10.12688/f1000research.174437.2

3. Ariely D. (2008). *Predictably Irrational: The Hidden Forces That Shape Our Decisions*. New York: HarperCollins.
4. Barricelli B.R., Casiraghi E. & Fogli D. (2019). *A Survey on Digital Twin: Definitions, Characteristics, Applications, and Design Implications*. IEEE Access, 7, 167653-167671. DOI: 10.1109/ACCESS.2019.2953499
5. Cialdini R.B. (2009). *Influence: Science and Practice*. 5th Edition. Boston: Pearson Education.
6. de Marcellis-Warin N., Marty F., Thelisson E. & Warin T. (2022). *Artificial Intelligence and Consumer Manipulations: From Consumer's Counter Algorithms to Firm's Self-Regulation Tools*. AI and Ethics, 2(2), 259-268. DOI: 10.1007/s43681-022-00149-5
7. Gal M.S. & Elkin-Koren N. (2017). *Algorithmic Consumers*. Harvard Journal of Law & Technology, 30(2), 309-353.
8. Helbing D. (2024). *Emerging Cybernetic Societies in the Age of Nano-, Neuro- and Quantum Technologies: Opportunities, Challenges, and Ethical Issues*. AI & Society.
9. Hornik J. & Rachamim M. (2025). *AI-enabled Consumer Digital Twins as a Platform for Research Aimed at Enhancing Customer Experience*. Management Review Quarterly. DOI: 10.1007/s11301-025-00527-3
10. Kahneman D. (2011). *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux.
11. Kahneman D. & Tversky A. (1979). *Prospect Theory: An Analysis of Decision Under Risk*. Econometrica, 47(2), 263-291. DOI: 10.2307/1914185
12. Kotler P., Kartajaya H. & Setiawan I. (2021). *Marketing 5.0: Technology for Humanity*. Hoboken: Wiley.
13. Lim W.M., Kumar S., Pandey N., Verma D. & Kumar D. (2023). *Evolution and Trends in Consumer Behaviour: Insights from Journal of Consumer Behaviour*. Journal of Consumer Behaviour, 22(5), 1010-1031. DOI: 10.1002/cb.2118
14. Mill J.S. (1848). *Principles of Political Economy with Some of Their Applications to Social Philosophy*. London: John W. Parker.
15. Oumaima J. & Lamari S. (2024). *Customer Experience in the Digital Transformation Era: Insights on Personalization, Digital Marketing, and Customer Relationship Management*. International Journal of Economics, Management and Finance, 3(2), 52-69. DOI: 10.5281/zenodo.14109688

16. Persky J. (1995). *The Ethology of Homo Economicus*. Journal of Economic Perspectives, 9(2), 221-231. DOI: 10.1257/jep.9.2.221
17. Pramiarsih E.E., Mulyono S., Judijanto L., Azzahra H.S. & Damayanto A. (2024). *Nurturing a Robust Digital Footprint: Orchestrating Tactical Mastery in the Realm of Online Marketing Excellence*.
18. Raut N., Ahluwalia G.K., Patankar G. & Narkhede A.P. (2025). *The Role of Digital Footprints in Shaping Personalized Marketing Strategies*. Journal of Informatics Education and Research, 5(2), 429-444. DOI: 10.52783/jier.v5i2.2481
19. Sefa A.A.O., Rezaei M. & Valilai O.F. (2026). *An Analytics-Driven Method for Building Ethical Customer Digital Twins Using Neuromarketing and Social Media Data*. Decision Analytics Journal, 18, 100689.
20. Sepasgozar S.M.E. (2021). *Differentiating Digital Twin from Digital Shadow: Elucidating a Paradigm Shift to Expedite a Smart, Sustainable Built Environment*. Buildings, 11(4), 151. DOI: 10.3390/buildings11040151
21. Sifat A.I. (2025). *The Algorithmic Consumer: A Conceptual Investigation of AI's Influence on Consumer Preferences and Decisions*. Asian Management and Business Review, 5(2), 471-486. DOI: 10.20885/AMBR.vol5.iss2.art14
22. Simon H.A. (1955). *A Behavioral Model of Rational Choice*. Quarterly Journal of Economics, 69(1), 99-118. DOI: 10.2307/1884852
23. Solomon M.R. (2020). *Consumer Behavior: Buying, Having and Being*. 13th Edition. Harlow: Pearson.
24. Taheran F., Thomas V.L., Fowler K. & Mortazavi A. (2024). *Understanding the Application of Evolutionary Psychology in Consumer Behavior: A Review and Future Research Agenda*. Psychology & Marketing, 41(12), 2431-2447. DOI: 10.1002/mar.22066
25. Theodorakopoulos L., Theodoropoulou A. & Klavdianos C. (2026). *Big Data Analytics and AI for Consumer Behavior in Digital Marketing: Applications, Synthetic and Dark Data, and Future Directions*. Big Data and Cognitive Computing, 10(2), 46. DOI: 10.3390/bdcc10020046
26. Toubia O., Gui G.Z., Peng T., Merlau D.J., Li A. & Chen H. (2025). *Database Report: Twin-2K-500: A Data Set for Building Digital Twins of over 2,000 People Based on Their*

Answers to over 500 Questions. Marketing Science, 44(6), 1446-1455. DOI: 10.1287/mksc.2025.0262

27. Yalcin G., Lim S., Puntoni S. & van Osselaer S.M.J. (2022). *Thumbs Up or Down: Consumer Reactions to Decisions by Algorithms Versus Humans*. Journal of Marketing Research, 59(4), 696-717. DOI: 10.1177/00222437211070016.