# Chapter 9:

## Programmatic Advertising as a Data-Driven Information System: Personalization, Automation, and Managerial Challenges

Nermin Yıldırım
İstanbul Topkapı University

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## Abstract

Advances in digital technologies have significantly transformed the ways in which advertising activities are planned, purchased, targeted, and evaluated. Programmatic advertising, one of the prominent applications of this transformation, is a system based on the real-time buying and selling of advertising inventory through data, algorithms, and automation technologies. The development of programmatic advertising extends beyond the automation of advertising purchasing processes, giving rise to a multidimensional structure that involves the processing of user data, identification of target audiences, personalization of advertising content, and algorithmic decision-making. This chapter aims to provide a comprehensive examination of the conceptual and technological structure of programmatic advertising and to evaluate it from a Management Information Systems perspective. To this end, the chapter first examines the transformation of digital advertising toward programmatic advertising, followed by an analysis of its core components, personalization and targeting strategies, benefits, and associated risks. Finally, programmatic advertising is evaluated within the MIS context through the dimensions of data management, decision support systems, algorithmic decision-making, data quality, transparency, accountability, and information security. The discussion presented in this chapter suggests that programmatic advertising should be understood not merely as a digital marketing or advertising purchasing method, but as a sociotechnical information system shaped by the interaction between technological and managerial elements.

**Keywords:** programmatic advertising, digital advertising, personalization, algorithmic targeting, management information systems, data-driven decision-making

# 1. Introduction

Digitalization has evolved beyond merely changing the communication channels used in the advertising industry and has become a structural transformation that reshapes how advertisements are produced, purchased, targeted, and evaluated. While traditional advertising purchasing processes have largely relied on human intervention, predetermined media plans, and fixed advertising placements, digital environments have brought automation, real-time data processing, and algorithmic decision-making to the forefront of advertising activities. Within this transformation, programmatic advertising has created a new advertising ecosystem based on the real-time buying and selling of advertising inventory through technology and data (Busch, 2016; Uday Kiran & Arumugam, 2020). The rise of programmatic advertising can therefore be regarded not merely as a technical change in advertising purchasing methods, but as a broader transformation of advertising activities into a data-driven decision-making system.

One of the distinguishing characteristics of programmatic advertising is that the relationship among advertisers, publishers, and users is mediated through technological platforms and algorithms. Interconnected structures such as demand-side platforms, supply-side platforms, data management platforms, and ad exchanges enable decisions concerning advertising impressions to be made automatically within extremely short periods of time. Real-time bidding mechanisms allow each advertising impression to be evaluated according to user and contextual characteristics and priced through an auction-based process (Yuan et al., 2013; Wang et al., 2017). Advertising is thus evolving from a traditional structure based on the bulk purchasing of predetermined media space toward a data-intensive system in which decisions can be made at the level of individual users and individual impressions.

A major consequence of this transformation is that personalization has become a core function of programmatic advertising. Data derived from users' demographic characteristics, locations, browsing histories, click behaviors, and previous interactions enable advertisements to be

tailored to specific users or user groups (Boerman et al., 2017; Tran et al., 2020). With advances in artificial intelligence and machine learning technologies, this structure is increasingly moving toward more sophisticated predictive and contextual personalization practices. However, alongside the effectiveness and efficiency benefits offered by programmatic advertising, data-intensive personalization also raises significant concerns regarding user privacy, perceived intrusiveness, algorithmic opacity, and accountability (Palos-Sánchez et al., 2019; Samuel et al., 2021).

This dual nature of programmatic advertising makes it insufficient to examine the phenomenon solely from a marketing or advertising perspective. On the one hand, the system provides advertisers with a data-driven optimization mechanism that enables them to reach the right user at the right time. On the other hand, it requires the collection, classification, processing, and use of large volumes of user data in algorithmic decision-making processes. Moreover, the system requires the integration of different technological platforms, the maintenance of data reliability and security, and the effective management of algorithmic decisions. These characteristics make programmatic advertising an important area of inquiry from a Management Information Systems perspective.

MIS is regarded as an interdisciplinary field that integrates information technologies, data, and management processes in ways that support organizational activities and decision-making mechanisms (Damar & Coşkun, 2017). From this perspective, programmatic advertising can be viewed as a contemporary application of several core MIS domains, including data management, systems integration, and decision support mechanisms, within the context of digital advertising. Programmatic advertising algorithms process numerous data points in real time to automate decisions related to advertising allocation, targeting, and pricing. Consequently, the effectiveness of the system depends not only on the performance of the algorithms employed but also on the integrated management of technological and managerial factors such as data quality, system security, transparency, auditability, and governance.

Accordingly, this chapter examines programmatic advertising from a Management Information Systems perspective. It first traces the transformation of digital advertising and outlines the programmatic ecosystem, then discusses personalization and targeting strategies together with the benefits and risks of the system, and finally evaluates programmatic advertising in terms of data-driven decision-making, algorithmic control, data governance, transparency, and information security.

# 2. Literature Review

## 2.1. Evolution and Transformation of Digital Advertising

With technological advancements, the use of automation and artificial intelligence-supported applications in digital advertising has become increasingly widespread, while programmatic advertising has emerged as an alternative approach to traditional advertising purchasing processes (Deng et al., 2019). Whereas traditional advertising relies on manual negotiations and fixed placements, PA differs by employing automation, real-time data analytics, and dynamic optimization (Neves & Pereira, 2025). PA is fundamentally transforming both the decision-making processes and implementation practices of advertising activities (Dwivedi et al., 2021). As interest in digital channels has increased, businesses have become increasingly reliant on digital advertising (Ciuchita et al., 2023).

One of the key indicators demonstrating the economic dimension of this transformation is the growth recorded in programmatic advertising. It should be noted at the outset that the figures reported in this field are not directly comparable across sources, because the two sources cited below measure different quantities: Statista reports *programmatic advertising expenditure*, that is, the volume of advertising spending channelled through programmatic channels, whereas Grand View Research reports *programmatic advertising market size*, a broader measure based on a different

definition, reference period, and forecasting methodology. According to Statista's 2026 update, global programmatic advertising expenditure reached an estimated USD 595 billion in 2024 and is expected to approach USD 800 billion by 2028 (Guttmann, 2026). According to Grand View Research (2024), the global programmatic advertising market reached USD 678.4 billion in 2023 and is projected to grow at a compound annual growth rate of approximately 22.2% between 2024 and 2030, reaching USD 2,753.0 billion by 2030. Because these two series rest on different scopes, reference periods, and forecasting horizons, they should not be read as successive observations of a single trend; the difference between them reflects definitional and methodological differences between the two sources rather than a change in the market itself. The growing importance of programmatic advertising alongside the increasing adoption of automation, data utilization, and algorithmic targeting practices in digital advertising further illustrates this trend (Deng et al., 2019; Ciuchita et al., 2023). By integrating automation with data-driven decision-making mechanisms in digital advertising purchasing processes, PA enables advertisers to manage their targeting and purchasing activities more effectively (Busch, 2016; Uday Kiran & Arumugam, 2020).

An examination of the historical development of programmatic advertising indicates that internet advertising dates back to the 1990s, while the foundations of PA were established in the early 2000s (Gonzalvez-Cabañas & Mochón, 2016). During its early stages, manual negotiations between advertisers and publishers dominated digital advertising purchasing. With the development of Google AdWords, personalized advertisements based on users' search terms began to be delivered, contributing to the widespread adoption of targeted advertising practices (O'Shea, 2019). Following the expansion of advertising networks, ad exchanges emerged in which advertising inventory could be bought and sold through real-time bidding mechanisms (Gonzalvez-Cabañas & Mochón, 2016). This transformation is described by Busch (2016) as the beginning of a new era in which advertising purchasing transactions that had previously been performed manually were replaced by systems capable of automating millions of decisions using real-time

data. From the 2010s onward, PA continued to evolve through centralized media buying platforms, progressing from retargeting practices toward consumer-centric, data-driven advertising strategies (Turow, 2023).

Table 1 summarizes the major milestones in the transition from digital advertising to programmatic advertising.

**Table 1.** Transformation from digital advertising to programmatic advertising

| Period | Characteristics | Core Technologies |
|---|---|---|
| 1990s | Emergence of the first digital advertisements and predominantly manual advertising purchasing processes (Turow, 2023). | Banner advertisements and web-based advertising spaces |
| 2000s | Rise of advertising networks, development of targeted advertising, and increasing use of user data in advertising processes (Turow, 2023). | Google AdWords (rebranded as Google Ads), cookies, and advertising networks |
| 2010s | Emergence of real-time bidding, automated advertising purchasing, and widespread adoption of PA (Gonzalvez-Cabañas & Mochón, 2016; Busch, 2016). | Demand-side platforms, supply-side platforms, data management platforms, ad exchanges, and RTB |
| 2020s and beyond | Development of data-driven automation, algorithmic optimization, and AI- and ML-supported targeting and personalization (Turow, 2023). | AI, ML, big data, and algorithmic targeting |

## 2.2. Definition and Components of Programmatic Advertising

Programmatic advertising is defined as the automated process of buying and selling advertising inventory in real time through the use of technology and data (Uday Kiran & Arumugam, 2020). This definition clearly reflects the automation and data-driven decision-making mechanisms that constitute the fundamental operating logic of the system. PA enables advertising auctions to be conducted in real time through automation mechanisms supported by artificial intelligence and machine learning (Busch, 2016). Similarly, PA is regarded as a dynamic process that optimizes information flows through systems that manage user data,

thereby enhancing the profitability of digital marketing strategies (Palos-Sánchez et al., 2019).

One of the most critical components of PA is real-time bidding, which is based on the instantaneous evaluation of each advertising impression and its pricing through an auction mechanism (Yuan et al., 2013). Through real-time data exchange, PA provides a more cost-efficient and scalable advertising system connecting buyers, sellers, and intermediaries (Alaimo & Kallinikos, 2018). Within this mechanism, when a user requests a web page, available advertising spaces are filled with content from the advertiser submitting the highest bid (Häglund & Björklund, 2024). The PA ecosystem consists of various interconnected platforms that operate in an integrated manner to manage data-driven advertising processes. Table 2 presents a comparative overview of the primary functions of these platforms.

**Table 2.** Platforms in the programmatic advertising ecosystem

| Platform Type | Primary Function | Users | Example Task |
|---|---|---|---|
| Demand-Side Platform | Enables advertisers to automatically access and purchase digital advertising inventory across different publishers (Busch, 2014; Wang et al., 2017). | Advertisers and media agencies | Conducting real-time bidding based on user and contextual data and optimizing advertising impressions |
| Supply-Side Platform | Enables publishers to offer their advertising inventory for sale through programmatic channels and optimize advertising revenues (Busch, 2014; Cooper et al., 2023). | Publishers | Offering advertising inventory for auction and evaluating bids submitted by eligible buyers |
| Data Management Platform | Collects and organizes user data obtained from different sources for segmentation and audience creation (Alaimo & Kallinikos, 2018; Miralles-Pechuán et al., 2023). | Advertisers, agencies, and DSPs | Categorizing user data to create audience segments and support targeting processes |

Demand-side platforms are systems that enable advertisers to purchase advertising inventory in order to reach their target audiences

(Wang et al., 2017). Supply-side platforms, in contrast, are systems that enable publishers to automatically offer their digital advertising inventory for sale (Busch, 2016). Data management platforms play an important role in the advertising ecosystem by collecting user data from different sources, integrating and segmenting these data, and supporting advertising targeting processes (Chen et al., 2019; Núñez-Barriopedro et al., 2023). Together, these three types of platforms form an integrated structure, transforming the delivery of an advertising impression into an automated process that takes place within milliseconds (Uday Kiran & Arumugam, 2020).

## 2.3. Personalization in Programmatic Advertising

Personalized advertising involves delivering customized promotional messages to consumers based on their internet browsing histories and online behaviors (Tran et al., 2020). Aguirre et al. (2016) note that marketers frequently employ personalization strategies in online communications. Graf et al. (2025) emphasize that, as an alternative to personalized advertising based on behavioral tracking data, contextual advertising can enable effective ad placement without requiring user tracking. Table 3 provides a comparative overview of these strategies.

**Table 3.** Comparison of personalization and targeting strategies

| Strategy | Definition | Type of Data Used |
|---|---|---|
| Demographic Targeting | Identification of target audiences based on demographic characteristics such as age, gender, income, and education level (Shaddy et al., 2026). | Demographic data |
| Location-Based Targeting | Tailoring advertisements according to the consumer's physical or geographic location (Thapa et al., 2024). | Location and GPS data |
| Behavioral Targeting | Tracking users' online behaviors and delivering individualized advertisements based on the behavioral data obtained (Boerman et al., 2017). | Browsing history, clicks, and online interaction data |

| | | |
|---|---|---|
| Contextual Targeting | Matching advertisements with the semantic and contextual characteristics of the content being viewed rather than tracking user behavior (Häglund & Björklund, 2024; Graf et al., 2025). | Contextual and semantic data related to the content being viewed |
| Retargeting | Retargeting users who have previously interacted with a brand, product, or website (Bleier & Eisenbeiss, 2015). | Previous visit, interaction, and conversion data |

In recent years, personalization practices in PA have evolved toward a new stage conceptualized as algorithmic hyper-personalization. Mohiuddin (2024) defines hyper-personalization as the extreme end of the personalization continuum and explains this approach through dimensions such as predictive accuracy, data breadth, temporal depth, contextual sensitivity, and cross-channel integration.

## 2.4. Advantages and Risks of Programmatic Advertising

The benefits that PA offers advertisers include cost advantages, efficiency, precise targeting, real-time optimization, and scalability (Busch, 2016; Dörnyei, 2021). However, PA also presents significant challenges. Samuel et al. (2021) conceptualize this complexity around three major areas of tension: personalization, mechanization, and effectiveness. As illustrated in Figure 1, the authors argue that these three areas of tension interact with one another, creating a level of complexity within the PA system that both complicates academic research and makes it more difficult for practitioners to critically evaluate the system.

The PA system is characterized by a tripartite stakeholder structure consisting of providers, adopters, and consumers, operating across technical, economic, and social dimensions. Moreover, each of these tensions encompasses antagonistic factors that are inherently embedded within the PA system (Samuel et al., 2021). PA relies on large-scale data collection mechanisms; however, such practices may be perceived as intrusive by users and may intensify privacy concerns (Palos-Sánchez et al., 2019).

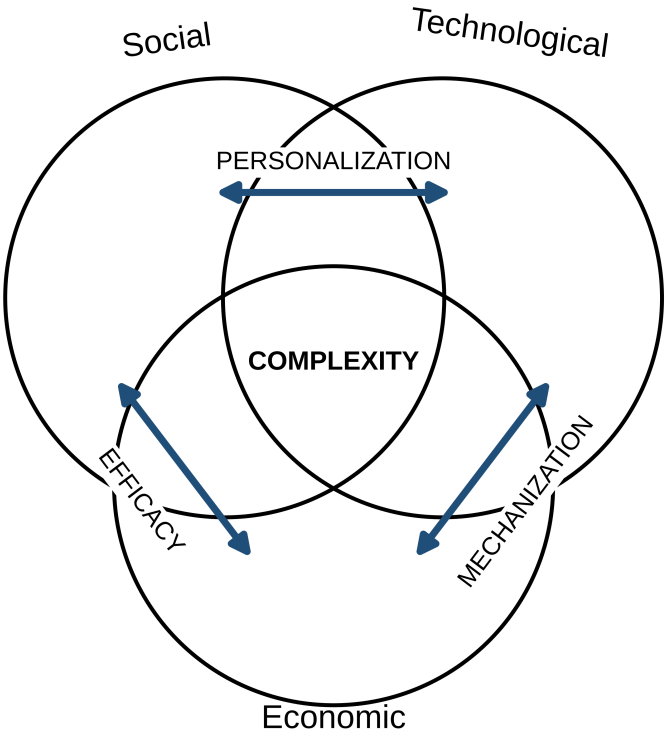



**Figure 1.** Systemic Complexity of Programmatic Advertising (adapted from Samuel et al., 2021)

Research indicates that approximately 57.4% of all purchased advertising inventory is not viewable, 14.5% is sold fraudulently, and 17.5% poses brand-safety risks (Gusic & Stallone, 2020; Dörnyei, 2021). Due to its high level of sociotechnical complexity, PA is frequently criticized for a lack of transparency and accountability, leading many advertisers to perceive the system as a "black box" (Dörnyei, 2021; Pärssinen et al., 2018). Jeon (2021) further draws attention to problems concerning the transparency of costs and fees across the intermediary chain in programmatic advertising.

## 2.5. Programmatic Advertising from a Management Information Systems Perspective

As outlined in the Introduction, MIS is not merely a management tool but also constitutes a technological infrastructure; it lies at the intersection of business and computing (Damar & Coşkun, 2017), and programmatic advertising represents one of the most contemporary

examples of this intersection. The relationship between PA and MIS has become an increasingly important area of interest in information systems research (Stange, 2017). Stange (2017) examines, within a Bayesian modeling framework, how decision support systems can optimize multichannel advertising effectiveness through user behavior modeling in real-time advertising. This study provides an important theoretical foundation for understanding how PA algorithms function as decision support systems. From an MIS perspective, PA is therefore not merely a marketing activity but also a complex information system and a data-driven decision-making mechanism. PA is built upon a big data-driven infrastructure and automates real-time digital advertising transactions through algorithms (Palos-Sánchez et al., 2019).

Shapiro and Varian (1999) emphasize that information has become a strategic resource for businesses in the information economy. In this context, programmatic advertising can be regarded as a contemporary application of the data-driven decision support functions of MIS within digital advertising. For organizations, MIS constitutes one of the most important components of decision-making by reducing the time and effort required and enabling decisions to be made more reliably, accurately, and efficiently. PA algorithms function as decision support systems by processing consumer data in real time and automating decisions concerning advertising allocation and pricing. Ananny and Crawford (2018) argue that the accountability of algorithmic systems is not merely a technical issue but also a matter of institutional governance. According to the authors, the auditability of algorithmic decision-making processes is essential for establishing trust in these systems. This highlights the need to incorporate transparency and accountability mechanisms into the design of PA systems. Within MIS, different types of information systems are required at different managerial levels to support sound and appropriate decision-making in addressing different types of problems. This structure is illustrated by the MIS Information Pyramid presented in Figure 2 (Tecim, n.d.).

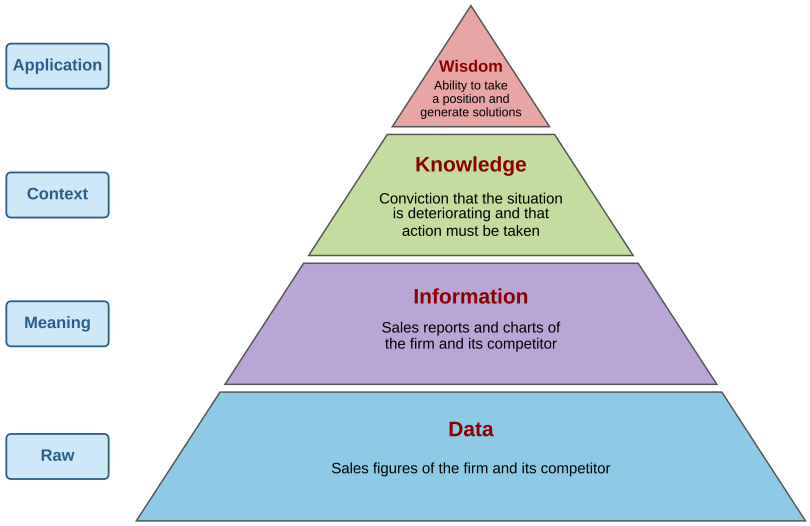



**Figure 2.** Management Information Systems Information Pyramid (adapted from Tecim, n.d.)

At the base of the MIS information pyramid lies data, followed upward by information and knowledge, while wisdom occupies the highest level of the pyramid (Özen, 2016; Tecim, n.d.). This pyramid conceptualizes data processing and the generation of meaningful information that also underpins PA systems. Contemporary MIS research emphasizes the need to reinterpret the information pyramid within the context of digital marketing. Key characteristics of MIS include the use of relational databases, timely and convenient managerial access to information, flexibility, system security, support for structured decision-making, and a focus on intra-organizational operations (Özen, 2016).

Bodó et al. (2017) characterize the problems encountered in PA as an "algorithmic control crisis," arguing that the lack of algorithmic transparency prevents individuals from exercising control over their digital actions. Similarly, Pasquale (2015), through the concept of the "black box society," provides a detailed analysis of the risks that the opacity of algorithmic decision-making systems creates for individuals and institutions. From an MIS perspective, designing PA systems within a more transparent, reliable, and ethical framework is therefore not merely

a technical requirement but also a strategic management imperative. When evaluated within the framework of MIS data management principles, these platforms play a key role in organizational management because they concern the confidentiality, integrity, and availability of data and information, which constitute some of the most valuable resources of organizations (Antunes et al., 2021).

Another important dimension in evaluating PA from an MIS perspective concerns data quality and governance standards (Redman, 2008). PA is regarded not only as a technological system but also as a sociotechnical structure and simultaneously functions as an interactive information technology system that shapes consumer behavior (Samuel et al., 2021). This transformation extends beyond the traditional boundaries of MIS by redefining both the operational structure of advertising and the nature of its interaction with users. In this context, the design and management of PA systems are closely related to core areas of the MIS discipline, including data security, systems integration, and decision theory.

## 3. Discussion

The development of programmatic advertising demonstrates that the transformation taking place in digital advertising cannot be explained solely by changes in technological tools. The transition from manual advertising purchasing processes to real-time and algorithmic decision-making mechanisms has also transformed the roles of actors within the advertising ecosystem and the ways in which decisions are made. Technological intermediaries such as DSPs, SSPs, DMPs, and ad exchanges have enabled many functions that were previously performed through interactions between individuals and organizations to be carried out through software systems (Busch, 2016; Wang et al., 2017). This indicates that, at its core, programmatic advertising represents a structure in which automation and data-driven decision-making converge.

One of the most prominent outcomes of this structure is personalization. By processing user and contextual data, programmatic systems enable advertisers to engage in more precise targeting. Applications ranging from demographic and location-based targeting to behavioral targeting, retargeting, and contextual targeting seek to achieve a closer match between advertising messages and users. However, increasing the level of personalization does not necessarily generate more favorable user responses in all circumstances. While personalized advertisements may enhance advertising effectiveness when users perceive them as relevant and useful, the scope of the data employed or the intensity of tracking practices may be perceived as intrusive (Bleier & Eisenbeiss, 2015; Boerman et al., 2017). Therefore, a tension exists between the technological capabilities offered by programmatic advertising and consumers' expectations of privacy, and this tension needs to be carefully managed.

This tension also demonstrates that the benefits and risks of programmatic advertising should not be evaluated independently of one another. Real-time optimization, precise targeting, scalability, and cost efficiency constitute major advantages for advertisers, whereas advertising fraud, brand safety, privacy, transparency, and accountability concerns represent risks arising from the same technological structure. The analysis by Samuel et al. (2021) makes this dual nature particularly visible by explaining programmatic advertising through systemic tensions centered on personalization, mechanization, and effectiveness. Consequently, evaluating the success of programmatic advertising solely on the basis of advertising performance indicators or technological efficiency is insufficient.

Algorithmic opacity, in particular, brings the managerial dimension of the system to the forefront. The involvement of numerous actors and algorithmic intermediaries in the delivery of advertising impressions within the programmatic advertising ecosystem may make it difficult to trace how decisions are made and how advertising expenditures are distributed. This has led to discussions of programmatic systems in terms of their "black box" characteristics (Pasquale, 2015; Pärssinen et al., 2018).

In light of Ananny and Crawford's (2018) discussion of algorithmic accountability, making the algorithm itself visible is not sufficient; the organizational, technological, and institutional structures surrounding the algorithm must also be taken into consideration.

At this point, an MIS perspective contributes to a more comprehensive understanding of programmatic advertising. From an MIS perspective, programmatic advertising can be conceptualized as an information and decision system in which user, contextual, and advertising data constitute the inputs; these data are processed through algorithms and integrated platforms; and the outputs take the form of decisions concerning ad delivery, pricing, and targeting. The transformation of raw data into information that can be used for decision-making also corresponds to the data–information–knowledge relationship within MIS. Accordingly, the performance of programmatic advertising is closely associated not only with the accuracy of algorithmic models but also with the quality and reliability of the data entering the system (Redman, 2008).

The sociotechnical nature of programmatic advertising is also particularly important. The system is shaped not only by technological infrastructure, algorithms, and data but also by the relationships among advertisers, publishers, technology providers, and consumers (Samuel et al., 2021). Therefore, the fact that a particular targeting or personalization practice is technically feasible does not automatically mean that it is managerially or ethically acceptable. Incorporating mechanisms for data security, user privacy, transparency, and accountability into system design is important for the long-term reliability of programmatic advertising.

Taken together, these considerations indicate that the central managerial question in programmatic advertising is not simply "How accurately can advertisements be targeted?" Equally important is the question: "With what data, through which decision-making mechanisms, and with what degree of transparency and accountability should targeting be conducted?" Such an approach makes it possible to conceptualize programmatic advertising as an MIS problem in which technological performance and governance requirements must be evaluated together.

## 4. Conclusion

Programmatic advertising represents one of the most significant outcomes of the transformation of digital advertising driven by automation, big data, and algorithmic decision-making. Unlike traditional advertising purchasing processes, programmatic advertising manages interactions among advertisers, publishers, and users through real-time data flows and interconnected technological platforms. The ecosystem formed by DSPs, SSPs, DMPs, ad exchanges, and RTB mechanisms enables advertising impressions to be evaluated, priced, and matched with specific users or user groups within extremely short periods of time.

The development of programmatic advertising has also expanded the scope of personalization practices. The ability to utilize different types of data, ranging from users' demographic characteristics and online behaviors to contextual information, enables advertisements to be delivered in a more relevant and targeted manner. However, the increasing capacity for personalization also raises concerns regarding privacy, perceived intrusiveness, and user control due to the extensive collection and processing of user data. Therefore, rather than pursuing the highest technologically achievable level of personalization, it is important to establish a balanced approach that considers both advertising effectiveness and users' rights and expectations.

Similarly, the speed, scalability, cost advantages, and real-time optimization capabilities offered by programmatic advertising cannot be considered independently of risks such as advertising fraud, brand safety, algorithmic opacity, and accountability. The multi-actor and technologically complex structure of the programmatic ecosystem can make it difficult to trace transactions within the system and understand the rationale underlying algorithmic decisions. This makes it necessary to consider transparency and governance mechanisms, alongside system performance, as fundamental elements in the sustainable development of programmatic advertising.

In this context, the Management Information Systems perspective provides an appropriate framework for evaluating the technological and managerial dimensions of programmatic advertising together. Programmatic advertising is directly related to the core domains of MIS because it involves the collection and processing of large volumes of data for decision-making purposes, the integration of different information systems, and the automation of decisions through algorithms. From this perspective, programmatic advertising should be regarded not merely as an advertising technology but as a sociotechnical decision system constituted by the interaction of data, algorithms, technological platforms, organizational actors, and users.

In conclusion, the future of programmatic advertising is unlikely to be determined solely by more sophisticated targeting algorithms or higher levels of automation. Data quality, information security, privacy, transparency, accountability, and governance mechanisms must evolve alongside technological developments. Holistic approaches developed from an MIS perspective can help organizations leverage the data-driven decision-making capabilities of programmatic advertising while managing the technical, managerial, and ethical risks associated with the system. In this way, programmatic advertising can move beyond being viewed merely as an automation technology for more efficient ad delivery and instead be understood within a reliable, manageable, and accountable digital information ecosystem.

## Declarations

**Ethics Committee Approval:** This chapter is derived from the author's doctoral dissertation, conducted in the Management Information Systems PhD Program, Graduate Education Institute, İstanbul Topkapı University. Ethics committee approval for the dissertation research was obtained from the İstanbul Topkapı University Scientific Research and Publication Ethics Committee (decision no. 2025/16, dated 5 May 2025; document no. E-49896378-050.04-2500010797).

**Use of Artificial Intelligence:** In this chapter, artificial intelligence tools were used for language editing, proofreading, and assistance with citation formatting. AI tools were not used to generate scientific content, analyze data, or formulate the arguments presented in the chapter. All AI-assisted output was reviewed and verified by the author, who takes full responsibility for the content of the chapter.

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**Third-Party Materials and Permissions:** Figure 1 is adapted from Samuel et al. (2021), and Figure 2 is adapted from Tecim (n.d.) and translated into English. Both figures were redrawn by the author, and the original sources are cited in the figure captions. All tables were prepared by the author on the basis of the cited literature and contain no reproduced third-party material.

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