

Big data and artificial intelligence in digital marketing

Big data i veštačka inteligencija u digitalnom marketingu

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Abstract

Big Data and artificial intelligence are changing digital marketing through consumer behavior analysis, personalized communication, and automation. This paper examines their role in marketing processes, performance measurement, and the conditions for application in Serbia. A narrative review of selected literature is combined with a descriptive analysis of published statistics on ICT use, e-commerce, and enterprise AI adoption. The analysis identifies widespread consumer participation in digital channels alongside more limited enterprise adoption of AI. Serbia remains below the EU average in enterprise AI use, although above some member states. The paper's contribution lies in linking data resources, analytical capabilities, and managerial competencies to explain why technology adoption alone is insufficient for effective digital marketing. Practical implications emphasize employee development, responsible data management, and the evaluation of marketing outcomes. The findings should be interpreted within the limits of aggregate indicators, which do not directly measure marketing-specific AI use or its effectiveness. Future research should examine these applications and their outcomes at the enterprise level.

Keywords: Big Data, artificial intelligence, digital marketing, marketing metrics, Serbia

Sažetak

Big Data i veštačka inteligencija menjaju digitalni marketing kroz analizu ponašanja potrošača, personalizovanu komunikaciju i automatizaciju. Cilj rada je sagledavanje njihove uloge u marketinškim procesima, merenju rezultata i uslova primene u Srbiji. Narativni pregled odabrane literature kombinovan je sa deskriptivnom analizom objavljenih statističkih podataka o upotrebi IKT, elektronskoj trgovini i primeni veštačke inteligencije u preduzećima. Analiza ukazuje na široko učešće potrošača u digitalnim kanalima, uz ograničeniju primenu veštačke inteligencije u preduzećima. Srbija je ispod proseka EU prema zastupljenosti ove tehnologije, ali iznad pojedinih država članica. Doprinos rada ogleda se u povezivanju resursa podataka, analitičkih sposobnosti i menadžerskih kompetencija radi objašnjenja zašto samo usvajanje tehnologije nije dovoljno za delotvoran digitalni marketing. Praktične implikacije naglašavaju razvoj zaposlenih, odgovorno upravljanje podacima i ocenjivanje marketinških rezultata. Nalaze treba tumačiti u granicama zbirnih pokazatelja, koji neposredno ne mere primenu veštačke inteligencije u marketingu niti njene efekte. Buduća istraživanja treba da ispituju ove primene i njihove rezultate na nivou preduzeća.

Ključne reči: Big Data, veštačka inteligencija, digitalni marketing, marketinške metrike, Srbija

1. Introduction

Global changes in all fields of economy and society are largely the product of the accelerated development of “disruptive” technologies. Companies that are unable to follow new trends face increasing challenges in maintaining their position in the market. One of the first

challenges is dealing with the huge amount of data that is generated exponentially, requiring technology and knowledge to process it and turn it into information and knowledge (Vukmirović, 2023).

Information technology fundamentally changes traditional ways of doing business in all areas of human

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activity, including marketing, where digital platforms, Big Data analytics, and artificial intelligence enable interactive communication with the market, more precise targeting of consumers, and personalization of campaigns. However, the availability of data does not automatically ensure better marketing decisions. Its practical value depends on the ability of companies to analyze it and apply the resulting insights in planning and implementing marketing activities. In this context, artificial intelligence provides support for marketing research, segmentation, targeting, and the development of personalized relationships with consumers (Huang & Rust, 2021).

Digital marketing encompasses strategies and technologies aimed at promotion, communication, and sales in a digital environment. It is closely connected with the development of electronic commerce, one of the key forms of digital exchange of goods and services. In e-commerce, digital marketing utilizes tools such as personalized ads, search engine optimization, social media marketing, automated recommendation systems, and user behavior analytics, all aimed at enhancing customer experience and increasing sales. E-commerce experienced accelerated expansion during the Covid-19 pandemic, becoming an increasingly important segment of the global economy. Its main advantages include continuous access to online stores and the possibility of reaching consumers beyond local markets, although delivery and other operational conditions still affect the availability of products and services.

The concept of Big Data, combined with the application of artificial intelligence, extends the capabilities of traditional market research methods in market segmentation, consumer targeting, and content personalization. While traditional campaigns often address broader groups of consumers with a common message, digital technologies enable communication to be adapted to individual interests and behavior. One of the greatest advancements in digital marketing is the ability to personalize content based on predictions of consumer preferences and purchasing behavior. The role of AI therefore goes beyond the automation of individual tasks and includes support for marketing strategies and a better understanding of consumers (Davenport et al., 2020). Recent research additionally emphasizes that digital marketing should be considered a component of strategic management, since digital channels, personalization, and interaction with consumers can support competitive positioning and business performance (Dobričanin & Aleksić, 2025).

Along with the advantages that these technologies bring to marketing and communication, their accelerated development and widespread application also raise numerous questions and controversies. Davenport et al. (2020) emphasize that the development of AI in marketing should be considered together with issues of privacy, bias, and ethics. Regulations are therefore of particular importance in establishing conditions for the responsible use of AI solutions, including the protection of users from discrimination, respect for their privacy, and transparency in the collection and use of data. These issues are

especially relevant in personalized recommendations, targeted advertising, and consumer profiling (Vukmirović et al., 2025).

The application of these technologies also depends on the digital capacities of companies and the characteristics of the market in which they operate. In Serbia, data on the use of ICT, e-commerce, and artificial intelligence provide a basis for considering the conditions for further development of digital marketing. However, general indicators of technology adoption need to be distinguished from indicators of its specific application in marketing. This distinction is important for assessing the opportunities and limitations of using Big Data and AI in communication with consumers.

The aim of this paper is to examine the role of Big Data and artificial intelligence in digital marketing, with particular attention to personalization, marketing metrics, and the conditions for their application in Serbia. The paper combines a narrative review of selected literature with a descriptive analysis of published statistical data on the use of ICT, e-commerce, and AI in Serbia. The discussion focuses on the relationship between the possibilities offered by these technologies and the capacities of companies to apply them. Its practical contribution lies in connecting the theoretical discussion with the Serbian market context and identifying areas in which further development of digital capabilities could support marketing activities.

2. Literature review

2.1. From big data to artificial intelligence

The concept of Big Data is commonly explained through three dimensions, or 3V: volume, velocity, and variety (Zikopoulos et al., 2012). Volume refers to the huge amount of data generated daily through transaction activities, electronic communications, movement, and the use of electronic devices such as cameras, sensors, scanners, and smart devices. Velocity refers to the speed at which data is generated and the need for its timely processing, while variety points to numerical, textual, audio, visual, biometric, and other heterogeneous data forms.

In digital marketing, these dimensions are reflected in the continuous generation of data on website visits, product searches, purchases, responses to advertisements, and interactions on social networks. Such data can provide information about consumer interests and behavior, but its volume alone does not guarantee useful insights. The marketing value of Big Data depends on the quality and relevance of the available data and the ability to connect its analysis with specific business objectives.

In this process of comprehensive digitization, decision-makers may have access to large amounts of data while still lacking reliable and timely information. This creates a need for business analytics and tools that support the identification of relevant patterns. Big Data and artificial intelligence therefore represent related but different

concepts. Big Data refers to the characteristics of data and the challenges of its management and analysis, while artificial intelligence encompasses systems capable of performing tasks that require abilities such as learning, reasoning, and decision-making. Machine learning, as an area of AI, enables systems to learn patterns from data, while deep learning uses multilayer neural networks. These approaches can support the analysis of large and complex datasets, although not every AI application requires Big Data (Russell & Norvig, 2020).

Recent research further distinguishes analytical AI from generative AI. Analytical AI primarily supports the identification of patterns and the prediction of outcomes, while generative AI produces content such as text, images, and video. In digital marketing, these capabilities can complement each other: analytical insights can inform the selection of audiences and offers, while generative tools can assist in preparing communication adapted to those audiences. Grewal et al. (2025) emphasize that implementation requires decisions about data inputs and the extent of human involvement in reviewing outputs. Chan and Choi (2025) similarly identify applications across consumer adoption, services, advertising, and innovation, showing that the role of generative AI extends beyond content creation.

The development and application of AI draw on a number of principles and disciplines, including mathematics and statistics, logic, cognitive science, psychology, neurobiology, linguistics, philosophy, ethics, computer science, robotics, economics, and sociology. Artificial intelligence is therefore an interdisciplinary field that combines different approaches to developing systems that imitate or complement aspects of human intelligence. An intelligent agent acts to maximize the expected achievement of its objectives based on available observations and knowledge (Russell & Norvig, 2020).

Marketing is also studied from multiple perspectives. On one hand, it is viewed as a scientific discipline that develops theoretical models of market behavior and value exchange. On the other, marketing has an engineering dimension because it involves the application of research methods, metrics, analytical tools, and technologies in shaping market strategies. At the same time, marketing is an essential business function within companies, responsible for creating, communicating, and delivering value to consumers (Kotler & Keller, 2016; Solomon, 2018).

The connection between Big Data and AI becomes particularly visible when consumer data is used to support marketing decisions. Data on previous purchases, browsing behavior, and responses to promotional messages can be analyzed to identify consumer preferences and estimate future responses. These insights can support segmentation, the selection of target groups, and the adaptation of offers and communication. Huang and Rust (2021) connect the application of AI with marketing research, marketing strategy, and marketing actions, showing that its role extends across different stages of the marketing process.

The role of artificial intelligence in the behavioral aspect of marketing is also becoming increasingly significant, as it supports the understanding and prediction of consumer behavior. However, predictions based on observed patterns do not necessarily explain the motives behind individual decisions. Consumer behavior theories therefore remain important for interpreting analytical results and understanding the context in which purchasing decisions are made (Solomon, 2018). In this sense, AI can complement the knowledge and experience of marketing managers rather than remove the need for their judgment (Davenport et al., 2020).

Understanding consumer behavior also requires attention to emotions and interpersonal communication. Goleman (1995) emphasizes the importance of emotional awareness and empathy in human relationships. These concepts provide a broader basis for considering the quality of communication with consumers, while the application of AI to customer interactions requires separate consideration of technological capabilities and limitations. Personalized communication should therefore combine analytical insights with an understanding of the human context in which purchasing decisions are made.

At the operational level, AI can support automated communication, recommendation systems, and the processing of consumer requests. Davenport and Ronanki (2018) distinguish applications related to process automation, the development of insights from data, and engagement with customers and employees. These applications provide a useful basis for understanding how AI can support different marketing activities. In hospitality, contemporary applications similarly emphasize automation, personalized services, and data-driven management, which are relevant for digital marketing in service industries (Zrnić, 2026).

The importance of adapting digital communication to the characteristics of a particular market is also visible in luxury branding. Krsmanović (2026) discusses how luxury brands use digital marketing, personalized AI experiences, and social media while seeking to preserve exclusivity. This illustrates that the application of digital technologies needs to reflect brand positioning and consumer expectations, rather than follow the same approach in all industries.

Accordingly, the relationship between Big Data and AI in digital marketing can be understood as a connection between data resources, analytical capabilities, and marketing decisions. Big Data provides a potential source of market information, while AI offers tools for identifying patterns and supporting responses to consumer needs. Their practical value depends on how companies interpret the resulting insights and apply them in communication, service delivery, and the evaluation of marketing results.

2.2. Key aspects and metrics in digital marketing

Digital marketing is based on communication with the market via the Internet and other digital channels. The main advantages of the Internet as a platform for marketing communications are the ability to direct multimedia content to selected audiences and the interactivity between companies and consumers. Unlike communication limited to a particular advertising space or broadcasting schedule, digital channels allow users to access content at different times and interact with companies throughout the purchasing process.

However, the possibility of reaching a selected audience does not automatically ensure that a message will attract attention or produce the desired response. The effectiveness of digital communication depends on the relevance of the content, the characteristics of the audience, the choice of channel, and the objectives of the campaign. Measurement is therefore an important component of digital marketing because it connects communication activities with observable user behavior and business results (Chaffey & Ellis-Chadwick, 2019).

Marketing as an engineering discipline relies on metrics and on the principle that effective management requires reliable, relevant, and timely information. Digital platforms provide opportunities for collecting such information, but the selection of indicators needs to follow the purpose of the activity being evaluated. Kaushik (2009) emphasizes the importance of connecting web analytics with business objectives, experimentation, and an understanding of customer experience. A campaign aimed at increasing brand awareness therefore requires a different emphasis from a campaign intended to generate inquiries or direct sales.

Website and campaign indicators can be considered through several related groups. Traffic indicators include visits, users, pageviews, and traffic sources. Audience and technical characteristics include geographical location, devices, and browsers. Engagement indicators describe interactions with content, while conversion indicators record the completion of desired actions. Financial indicators, such as customer acquisition cost, customer lifetime value, and return on marketing investment, connect marketing activities with their economic effects (Chaffey & Ellis-Chadwick, 2019; Kotler & Keller, 2016).

The conversion rate represents the proportion of users or interactions that result in a defined action, such as a purchase, registration, inquiry, or subscription. Its calculation requires a clearly specified action and denominator, which may refer to users, sessions, or advertising interactions. Comparisons are meaningful only when the same definitions and measurement conditions are used. A higher conversion rate can indicate more effective communication, but it does not independently demonstrate profitability because costs, transaction values, and subsequent customer behavior also affect business results.

The practical relevance of conversion measurement is also reflected in industry benchmark publications. Bendasyuk

(2025) and First Page Sage (2023) present conversion benchmarks across industries, while Red Stag Fulfillment (n.d.) discusses differences associated with product categories, devices, and measurement approaches. These publications illustrate why a single average conversion rate cannot serve as a universal performance target. The interpretation of a benchmark requires attention to the type of conversion, the characteristics of the observed businesses, and the period covered by the data. Such sources can provide practical orientation, but their figures should not be treated as directly comparable findings from a common research design.

Artificial intelligence can support the use of marketing metrics by identifying behavioral patterns, estimating the probability of a response, and assisting the adaptation of messages and offers. Huang and Rust (2021) connect analytical applications with marketing decisions, while Davenport et al. (2020) emphasize the broader implications of AI for marketing strategies and customer behavior.

Commercial and practitioner publications also describe the use of AI for personalized recommendations, customer engagement, and conversion optimization (Agentive AIQ, 2025; Girvan, 2025; Tilawat, 2025). However, reported performance improvements depend on the application, baseline conditions, and method of evaluation. These publications provide examples of expected or reported business benefits, rather than sufficient evidence that AI produces the same increase in conversion rates across companies and industries. The contribution of an AI tool therefore needs to be assessed against a defined objective and an appropriate comparison.

The development of generative AI also broadens the assessment of marketing performance. Alongside conversion and financial indicators, companies need to consider whether generated content is accurate, appropriate to the brand, and suitable for its intended audience. Kshetri et al. (2024) discuss both opportunities and barriers associated with generative AI in marketing, while Kumar et al. (2025) connect its business and societal effects with organizational resources and capabilities. These perspectives suggest that efficiency gains should be considered together with content quality, human oversight, and responsible implementation.

Performance measurement also needs to consider the conditions under which consumer data is collected and processed. Personalization and algorithmic targeting raise questions of privacy, transparency, and consumer trust (Vukmirović et al., 2025). Accordingly, the evaluation of digital marketing should connect traffic, engagement, conversion, and financial indicators with responsible data practices. This provides a more complete basis for assessing whether Big Data and AI contribute to marketing objectives.

3. Digital marketing and AI adoption in Serbia

Artificial intelligence provides opportunities to develop digital marketing through personalized communication,

automated customer support, and the analysis of consumer behavior. Companies in Serbia can consider these applications through available platforms and services, without necessarily developing their own AI systems. However, the availability of technology does not automatically ensure its effective use. Its application requires appropriate data, employee competencies, and clearly defined marketing objectives.

The Statistical Office of the Republic of Serbia publishes annual data on ICT use based on Eurostat methodology. The 2024 enterprise survey covered enterprises with ten or more employees in selected economic activities, while the individual survey covered persons aged 16–74. According to the enterprise results, 85.0% had a website, 7.0% used AI technologies, and 25.2% employed ICT specialists. The same publication reports that 28.4% of enterprises sold products or services online during 2023 (Statistical Office of the Republic of Serbia, 2024). Among individuals, 87.7% had used the Internet in the preceding three months. Among recent Internet users, 81.5% participated in social networks and 79.1% searched for information about goods and services. The publication also reports that 51.8% of Internet users bought or ordered goods or services online in the preceding three months (Statistical Office of the Republic of Serbia, 2024).

A comparison with the European Union provides additional context for assessing AI adoption in Serbia. In 2024, 13.5% of EU enterprises with ten or more persons employed used AI technologies, compared with 7.0% in Serbia, a difference of 6.5 percentage points. However, considerable differences also existed among EU member states. The highest adoption rates were recorded in Denmark (27.6%), Sweden (25.1%), and Belgium (24.7%), while Romania (3.1%), Poland (5.9%), and Bulgaria (6.5%) recorded lower rates than Serbia (Eurostat, 2025; Statistical Office of the Republic of Serbia, 2024). Serbia therefore remained below the EU average, although its position was more favorable in comparison with some member states. These figures concern AI use across business functions and should not be interpreted as direct measures of its application in digital marketing. Nevertheless, they provide a useful benchmark for considering the wider technological conditions in which AI-supported marketing can develop.

The Serbian indicators suggest favorable conditions for reaching consumers through digital channels, alongside more limited adoption of advanced technologies in enterprises. Nevertheless, website ownership, online sales, and AI use represent different dimensions of business activity. A website can support information provision and customer communication even when transactions are completed offline. Similarly, the reported use of AI refers to business applications generally and does not establish the proportion of enterprises using it specifically in marketing.

The relationship between these indicators can therefore be interpreted as a potential gap between basic digital presence and more advanced use of digital tools. However, the data do not demonstrate that consumers are

uniformly digitally mature or that all enterprises without online sales are technologically unprepared. The relevance of e-commerce and AI depends on the sector, customer characteristics, and business model. The employment of ICT specialists also provides only a partial view of enterprise capabilities because companies may rely on external service providers.

For digital marketing, the practical question is how available technologies can support specific business needs. A company receiving frequent customer inquiries could consider an automated assistant, while an online retailer could examine recommendation tools or audience segmentation. These examples represent possible applications rather than evidence of their current prevalence in Serbia. Their value should be assessed through indicators such as response time, conversion rate, customer acquisition cost, and customer satisfaction.

The opportunities and limitations identified in this discussion can be summarized through an indicative SWOT framework. The framework represents an author interpretation of the selected indicators and literature rather than a separately validated empirical assessment.

Strengths include widespread Internet use and consumer participation in digital communication and product searches. The established online presence of many enterprises provides a potential starting point for developing more advanced marketing activities. Weaknesses include the limited reported adoption of AI and possible constraints in internal technical capacities. However, the available indicators do not directly measure the quality of marketing analytics, data integration, or employee readiness to use AI tools.

Opportunities include the gradual introduction of personalized communication, automated support, and more systematic analysis of campaign results. Cooperation with technology providers and educational institutions could support the development of the competencies required for these activities. Threats include dependence on external platforms, competitive pressure, data security risks, and inappropriate use of personal information. Ethical concerns associated with profiling and targeted advertising also require attention, particularly where consumers have limited understanding of how their data is processed (Vukmirović et al., 2025).

Overall, the Serbian context provides opportunities for further development of digital marketing, but the effects of Big Data and AI cannot be inferred from adoption indicators alone. A practical approach would connect technology selection with employee development, responsible data management, and the measurement of marketing results.

5. Conclusion

The development of digital technologies is changing the ways companies communicate with consumers, collect market information, and evaluate marketing activities. Big Data and artificial intelligence have an important role in

this process because they support the analysis of consumer behavior, the personalization of communication, and the automation of selected tasks. Their practical value, however, depends on the ability of companies to connect technological possibilities with clearly defined marketing objectives.

The discussion in this paper connects data resources, analytical capabilities, and marketing decisions. Big Data provides a potential source of information about consumer interests and interactions, while AI offers tools for identifying patterns and supporting decisions. Marketing metrics help companies assess whether these applications contribute to desired results. The use of advanced technology should therefore be accompanied by the evaluation of customer responses, acquisition costs, and the longer-term value of customer relationships.

From a theoretical perspective, the discussion supports an integrated understanding of Big Data, artificial intelligence, and digital marketing. Big Data provides information resources, AI supports their analysis, and marketing metrics connect analytical insights with the evaluation of marketing activities. This interpretation is consistent with Huang and Rust's (2021) framework, which links AI with marketing research, strategy, and actions. It also follows Davenport et al. (2020) in emphasizing that AI can complement managerial judgment. More recent research reinforces this interpretation by identifying infrastructure, skilled personnel, data access, and adaptive leadership as conditions shaping the contribution of generative AI to marketing capabilities and business transformation (Kumar et al., 2025). The theoretical implication is that the role of AI in digital marketing should be considered through its integration with marketing processes and human competencies, rather than through technology adoption alone. In the Serbian context, this distinction also explains why general indicators of AI use provide only a partial basis for understanding its marketing applications.

The selected indicators for Serbia show widespread use of digital channels among consumers and an established online presence among enterprises covered by the survey. At the same time, the adoption of AI remains more limited. The comparison with the European Union places Serbia below the EU average in enterprise AI use, although above some member states. These findings suggest room for further development, but they do not directly establish the extent or effectiveness of AI application in digital marketing.

For companies in Serbia, a practical approach would involve the gradual introduction of tools that address specific business needs. Automated customer support, personalized recommendations, and campaign analysis represent possible starting points. Their implementation should be supported by employee training, appropriate data management, and cooperation with external specialists where necessary. The choice of technology should reflect the characteristics of the company and its customers, while expected benefits should be evaluated against implementation and operating costs.

The application of Big Data and AI also requires attention to privacy, transparency, and consumer trust. More detailed knowledge of consumer behavior creates opportunities for relevant communication, but also increases responsibility for the collection and use of personal information. Responsible implementation is therefore an integral part of the development of digital marketing.

The paper has several limitations. It is based on a narrative review of selected literature and a descriptive analysis of aggregate statistical data. The enterprise indicators cover selected activities and enterprises with ten or more employees, and therefore do not represent all businesses in Serbia. Furthermore, general AI adoption indicators do not isolate marketing applications or establish their effects on business performance. The SWOT framework should accordingly be understood as an interpretative summary rather than an independently validated assessment.

Future research could examine the specific AI tools used in marketing by Serbian enterprises, the barriers to their adoption, and differences across sectors and company sizes. Studies connecting these applications with campaign results and consumer responses would provide a stronger basis for assessing their contribution. The further development of digital marketing therefore requires a connection between technology, employee competencies, responsible data practices, and measurable business objectives.

Declaration of generative AI in the writing process

During the preparation of this manuscript, the author(s) did not use generative AI or AI-assisted technologies in the writing process.

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