

Evaluation of the impact of digitalization on enterprise marketing activity

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Abstract. This article develops a comprehensive system of indicators for evaluating the impact of digitalization on the enterprise marketing activities, identifying key performance indicators of digital transformation from economic, market, social and behavioral, and technological perspectives, and developing an economic and mathematical model for analyzing and evaluating the effectiveness of implementing digital technologies in enterprise marketing activities. Digital transformation encompasses a wide array of tools and technologies that enhance the efficiency of marketing campaigns, increase customer engagement, automate business processes, and bolster brand trust. The study identifies the main indicators for assessing the impact of digitalization on enterprise marketing activities from the economic approach (return on investment, return on advertising expense, lifetime value, customer acquisition cost, and the share of digital expenditures in the overall marketing budget), market approach (click-through rate, conversion rate, net promoter score, customer retention rate), social and behavioral approach (purchase frequency, bounce rates, personalization index, engagement rate), and technological approach (level of process automation, speed of processing customer requests, effectiveness of AI tools, and programmatic advertising usage rate). Based on the analysis of these indicators, an economic and mathematical model for determining an integral indicator is proposed. This model allows us to summarize the impact of digital technologies on enterprise marketing activities by calculating the weighted average of the main digitalization factors. The proposed approach facilitates the quantitative measurement of the influence of digital initiatives on the effectiveness of enterprise marketing activities and supports well-informed managerial decisions regarding their further implementation. The methodology can be utilized by enterprises for monitoring the efficiency of digital technology adoption, strategic planning, and optimizing marketing budgets. Future research may focus on a detailed evaluation of the effectiveness of individual digital tools and the development of more adaptive models for the digital transformation of enterprise marketing activities.

Keywords: digitalization, digital technologies, marketing activity, digital marketing, integral indicator, artificial intelligence.

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Оцінювання впливу цифровізації на маркетингову діяльність підприємств

Анотація. У статті розроблено комплексну систему показників оцінювання впливу цифровізації на маркетингову діяльність підприємств, визначено ключові показники ефективності цифрової трансформації з позицій економічного, ринкового, соціально-поведінкового та технологічного підходів, а також розроблено економіко-математичну модель для аналізу та оцінювання результативності впровадження цифрових технологій у маркетинговій діяльності підприємств. Цифрова трансформація охоплює широке коло інструментів та технологій, які сприяють покращенню ефективності маркетингових кампаній, підвищенню залученості клієнтів, автоматизації бізнес-процесів і збільшенню рівня довіри до бренду. Визначено основні показники оцінювання впливу цифровізації на маркетингову діяльність підприємств з позицій економічного (рентабельність інвестицій, рентабельність витрат на рекламу, позитивна цінність клієнта, вартість залучення клієнта, частка цифрових витрат у загальному маркетинговому бюджеті), ринкового (клікабельність, коефіцієнт конверсії, індекс лояльності клієнтів, рівень утримання клієнтів), соціально-поведінкового (частота покупок, показники відмов, індекс персоналізації, рівень залученості у контент) та технологічного (рівень автоматизації процесів, швидкість обробки запитів клієнтів, ефективність AI-інструментів, показник використання програмної реклами) підходів. На основі аналізу цих показників запропоновано економіко-математичну модель визначення інтегрального показника. Дана модель дозволяє узагальнити вплив цифрових технологій на маркетингову діяльність підприємств шляхом розрахунку зваженого середнього основних чинників цифровізації. Запропонований підхід забезпечує можливість кількісного вимірювання впливу цифрових ініціатив на ефективність маркетингової діяльності підприємств та прийняття обґрунтованих управлінських рішень щодо їх подальшого впровадження. Запропонована методика може бути використана підприємствами для моніторингу ефективності впровадження цифрових технологій, стратегічного планування та оптимізації маркетингових бюджетів. Перспективи подальших досліджень можуть бути спрямовані на деталізовану оцінку ефективності окремих цифрових інструментів та розробку більш адаптивних моделей цифрової трансформації маркетингової діяльності підприємств.

Ключові слова: цифровізація, цифрові технології, маркетингова діяльність, цифровий маркетинг, інтегральний показник, штучний інтелект.

Introduction

In modern conditions, digital transformation is becoming one of the key factors for the successful development of enterprises. The active implementation of digital technologies is reshaping traditional approaches to business operations, marketing strategies, and customer engagement. The rapid advancement of artificial intelligence, Big Data, automated advertising platforms, and personalized content is opening new opportunities for enhancing the efficiency of marketing campaigns, reducing costs, and improving customer experience. However, the digitalization process requires a comprehensive analysis and evaluation of its impact on the marketing activities of enterprises. Identifying key performance indicators allows us to measure the outcomes of digital transformation and adjust marketing strategies in accordance with market changes. The development of scientifically substantiated approaches to assessing the impact of digitalization on enterprise marketing activities will contribute to enhancing their competitiveness.

Analysis of recent research and publications. In contemporary scientific literature, considerable attention is devoted to researching the digitalization of enterprise marketing activities. Researchers emphasize the impact of digital technologies on customer engagement, the effectiveness of advertising campaigns, cost optimization, and the enhancement of business

process automation. In the works of both foreign and domestic authors [1; 2; 3], it is argued that digital transformation enables the discovery of new development pathways for corporate marketing models with the rapid advancement and popularization of information technologies. The integration of physical and digital experiences has led to the emergence of seamless solutions—customized offerings that timely combine products and services to achieve superior consumer objectives. Overall, according to these authors, such solutions require companies to adopt proactive, customer-oriented approaches that leverage real-time data and advanced digital technologies. Researchers from India [4] analyze the impact of digital marketing and technological capabilities on the financial and operational performance of e-commerce-based small and medium-sized enterprises, proposing strategies for SMEs to adapt to the dynamic expectations of customers and the intensification of competition in the digital market.

Some researchers are exploring and identifying new trends in digital marketing [5-7], such as personalization, interactive content, voice search optimization, and artificial intelligence, emphasizing their potential implications for companies and marketers. This underscores the importance of continuously adapting to new technologies to develop successful content marketing strategies that resonate with today's digital audience.

A significant number of scientific publications focus on examining the role of artificial intelligence and its impact on the effectiveness of enterprise marketing activities. A group of researchers [8] found a significant positive correlation between the integration of AI in digital marketing and enhanced marketing performance. Their study highlights that companies utilizing artificial intelligence exhibit considerably greater adaptability to ever-changing market dynamics, thereby strengthening their competitive position. Furthermore, findings presented by Gündüzyeli [9] demonstrate that effective integration of artificial intelligence in digital marketing improves environmental sustainability, supports the achievement of economic sustainability goals, and positively influences social sustainability outcomes.

In several scientific studies, individual aspects of evaluating the effectiveness of digital marketing have been presented. These include the calculation of return on investment (ROI), which indicates the profit or loss that marketers derive from their digital marketing investments [10]; efficiency indicators based on data science used in digital marketing techniques and strategies [11]; and performance indices for social media pages, such as those on Facebook [12]. Researchers [13] employ the Fuzzy Analytic Hierarchy Process (FAHP) to assess the key success factors influencing the effectiveness of digital marketing in the retail food sector.

Thus, contemporary research confirms the importance of digital technologies in enterprise marketing activities. However, the issue of comprehensively evaluating the impact of digitalization remains unresolved, highlighting the relevance of further research in this area.

The purpose of the article. The aim of the paper is to develop a comprehensive system of indicators for evaluating the impact of digitalization on the marketing activities of enterprises, to identify the key performance indicators of digital transformation from economic, market, social and behavioral, and technological perspectives, and to develop an economic and mathematical model for analyzing and evaluating the effectiveness of implementing digital technologies in enterprise marketing activities.

Results

Digitalization plays a key role in transforming enterprise marketing activities. It changes communication channels, customer interactions, data analysis processes, and decision-making. For effective management of these changes, it is necessary to apply a systematic approach to evaluating the impact of digitalization [14-16], which will include the following components:

1. Economic approach involves assessing financial and economic indicators that characterize the impact of digitalization on the efficiency of resource utilization, labor

productivity, and the outcomes of the enterprise's production and economic activities, such as cost reduction, revenue growth, and return on investment, etc.

2. Market approach involves evaluating and analyzing changes in the enterprise's competitive position within the market environment and shifts in brand positioning within the market structure.

3. Social and behavioral approach involves analyzing changes in consumer behavior and social trends under the influence of digital technologies; assessing customer preferences; measuring the impact of personalized content on consumer decision-making; investigating the effect of digital channels on building brand trust; and evaluating the extent of the enterprise's interaction with online communities, etc.

4. Technological approach involves evaluating the level of automation in marketing processes and analyzing the effectiveness of technological tools used to enhance the efficiency of enterprises' marketing activities.

The implementation of digital technologies significantly transforms the marketing activities of enterprises, making them more dynamic, flexible, and customer oriented. However, for effective decision-making, it is necessary to utilize a comprehensive system of indicators that enables the assessment of digitalization outcomes and its overall impact on the marketing activities of enterprises.

When developing a comprehensive system of indicators, the following aspects must be considered [17]:

1. Objective assessment of the effectiveness of marketing activities of enterprises. The use of the indicator system should be based on clear, measurable indicators that are independent of subjective judgments or assumptions. It is essential to use real data, statistics, financial reports, and analytical tools to evaluate the effectiveness of marketing activities.

2. Informed managerial decision-making. Measuring key indicators should assist managers in making well-founded decisions regarding the optimization of marketing strategies, the reallocation of budgets, and the enhancement of customer experience.

3. Monitoring changes in consumer behavior. The analysis and evaluation of these indicators should enable the identification of trends and shifts in consumer behavior, facilitating rapid responses to market changes and the adaptation of marketing campaigns in line with emerging threats and opportunities.

The use of an indicator system is critically important for assessing the impact of digitalization on an enterprise's marketing activities. Through comprehensive analysis, not only can current results be measured, but future trends can also be forecast, marketing strategies refined, and stable business development ensured in the context of digital transformation.

The proposed comprehensive system of indicators for evaluating the impact of digitalization on the marketing activities of enterprises from economic, market, social and behavioral, and technological approaches is presented in Tables 1-4.

Table 1

A comprehensive set of indicators for evaluating the impact of digitalization on enterprise marketing activities from an economic approach

Indicators	Notation	Characteristic	Interpretation
Return on Investment	ROI	Determines the profitability of investments in marketing initiatives.	A high ROI indicates effective digital marketing strategies that generate significant profit at relatively low costs. A low or negative ROI may signal an ineffective campaign or the need to optimize spending and strategies.

Return on Advertising Spend	ROAS	Measures the effectiveness of advertising expenditures in digital channels.	If ROAS > 1, advertising generates more revenue than it is spent. For example, a ROAS = 5 means that each dollar invested in advertising yields 5 dollars of revenue. A high ROAS points to an effective advertising campaign, whereas a low ROAS might indicate the need for its revision.
Lifetime Value	LTV	Reflects the total profit an enterprise can obtain from a single customer over the entire duration of the relationship.	Higher LTV makes it more beneficial to acquire and retain customers. A high LTV indicates a successful marketing strategy that fosters long-term customer relationships.
Customer Acquisition Cost	CAC	Measures the average cost of acquiring a new customer through marketing campaigns.	Lower CAC in combination with a high LTV indicates a more effective marketing strategy. If CAC exceeds LTV, the company is losing money on each customer, suggesting inefficiencies in spending or the need to optimize acquisition channels.
Share of Digital Expenditures in the Overall Marketing Budget	D	Determines the proportion of total marketing expenditures allocated to digital channels (e.g., social media advertising, SEO, PPC, email marketing, etc.).	A high share of digital expenditure reflects active digitalization in marketing. While the optimal value varies by industry, an increase in this indicator combined with stable or improved ROI/ROAS may indicate an effective digital transformation strategy.

Source: Compiled by the Authors

Table 2

A comprehensive set of indicators for evaluating the impact of digitalization on enterprise marketing activities from a market approach

Indicators	Notation	Characteristic	Interpretation
Click-Through Rate	CTR	Measures the percentage of users who click on an advertisement or link out of the total number of views.	A high CTR indicates that the advertisement or content is relevant and attractive to the target audience. A low CTR may suggest an ineffective headline, creative, or an irrelevant offer.
Conversion Rate	CR	Indicates the percentage of users who complete a target action (such as purchase,	A high conversion rate signifies effective digital marketing, a user-friendly website, and a relevant offer. A low conversion rate may indicate issues with

		registration, or form submission) after visiting a website or viewing an ad.	usability, pricing, or a mismatch with audience expectations.
Net Promoter Score	NPS	Assesses the level of customer satisfaction and their willingness to recommend the brand to others. It is determined by surveying respondents who rate the likelihood on a scale from 0 to 10.	A high NPS indicates that customers are satisfied and willing to recommend the company. A low score may suggest problems with the product, service, or overall customer experience.
Customer Retention Rate	CRR	Shows the percentage of customers who remain with the company over a given period.	A high retention rate indicates that customers are satisfied with the product or service and continue to use it. A low rate may reflect customer loss due to issues with service quality, pricing, or increased competitive activity.

Source: Compiled by the Authors

Table 3

A comprehensive set of indicators for evaluating the impact of digitalization on enterprise marketing activities from the social and behavioral approach

Indicators	Notation	Characteristic	Interpretation
Purchase Frequency	PF	Measures how many times, on average, a customer makes a purchase within a given period.	A high purchase frequency indicates successful customer retention strategies, effective personalized marketing, and high brand value for consumers. A low frequency may suggest insufficient customer loyalty or ineffective repeat sales strategies (e.g., retargeting, loyalty programs).
Bounce Rate	BR	Measures the percentage of website visitors who leave the site after viewing only one page without taking any further action.	A high bounce rate may indicate irrelevant content, poor UX/UI, or slow page loading times.
Personalization Index	PI	Measures the effectiveness of personalized marketing, i.e., how well a company adapts its offerings	A high personalization index indicates that customers respond well to personalized offers, which increases their loyalty and purchase frequency. A low index may suggest

		to the individual needs of its customers.	insufficient use of personalized approaches or their ineffectiveness.
Engagement Rate	ER	Measures audience activity regarding content across digital channels (such as social media, websites, email newsletters).	A high engagement rate indicates that the content resonates with the audience and motivates them to take actions. A low engagement rate may indicate that the content is irrelevant or uninteresting, requiring optimization.

Source: Compiled by the Authors

Table 4

A comprehensive set of indicators for evaluating the impact of digitalization on enterprise marketing activities from technological approach

Indicators	Notation	Characteristic	Interpretation
Level of Process Automation	LPA	Determines the extent of use of digital technologies for automating marketing processes (e.g., email marketing, chatbots, CRM systems, programmatic advertising, etc.).	A high level of automation reduces the time required for routine tasks, minimizes human error, and enhances the effectiveness of marketing campaigns. A low level indicates that a significant portion of processes require manual management, which can hinder the efficiency of digital transformation.
Speed of Processing Customer Requests	SPCR	Measures the average response time of the company to customer requests via digital channels (chatbots, email, social media, website support).	The faster the company responds to requests, the higher the customer satisfaction and the greater the chances of conversion are. Delays in responses may lead to the loss of potential customers and a decrease in the Net Promoter Score (NPS). Optimizing this indicator through chatbots, AI assistants, and CRM systems improves the overall customer experience.
Effectiveness of AI Tools	AI	Determines how effectively artificial intelligence improves marketing processes, such as content personalization, customer behavior analysis, sales forecasting, or communication automation.	High effectiveness of AI tools indicates successful integration of technology into the marketing strategy. If AI does not provide the expected results, it may be due to insufficient training of the system or a need for algorithm adjustments.

Programmatic Advertising Usage Rate	PAUR	Evaluates the effectiveness of using programmatic (automated) advertising through AI algorithms.	High values indicate that the algorithms effectively target the audience and optimize the budget. If the effectiveness is low, it is advisable to adjust the audience targeting strategy or analyze the creatives and advertising formats.
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Source: Compiled by the Authors

Using a comprehensive approach to evaluating the digitalization of marketing activities enables enterprises to more effectively adapt to changes, enhance their competitiveness, and build sustainable long-term relationships with customers. It is important to use a combined analysis of financial, market, social and behavioral, and technological aspects to obtain a complete picture of the effectiveness of digital transformations.

The assessment of the impact of digitalization on enterprise marketing activities can be represented by an integral indicator (I), which takes into account the key metrics of digital transformation and is calculated as a weighted sum of the normalized values of the main indicators:

$$I = w_1F + w_2B + w_3A + w_4S + w_5T, \quad (1)$$

where:

F – block of financial and economic indicators (ROI, ROAS, CAC, LTV, D);

B – block of customer behavior indicators (CTR, CR, PF, CRR);

A – block of marketing automation process indicators (automation level, speed of query processing, AI);

S – block of advertising campaign efficiency indicators (Bounce Rate (BR), usage of programmatic advertising, Engagement Rate (ER));

T – block of brand trust indicators (Net Promoter Score (NPS), Personalization Index (PI)).

The weight coefficients w_i are set by experts or determined using factor analysis depending on the enterprise's priorities.

Normalization of indicators. Since each indicator has a different range of values, normalization is applied using the formula:

$$X_{norm} = \frac{X - X_{min}}{X_{max} - X_{min}}, \quad (2)$$

where X_{min} i X_{max} are, respectively, the minimum and maximum values of the indicator during the analyzed period.

Formulas for calculating the components of the integral indicator:

Block of financial and economic indicators (F):

$$F = \alpha_1ROI + \alpha_2ROAS + \alpha_3\left(\frac{LTV}{CAC}\right) + \alpha_4D. \quad (3)$$

Block of customer behavior indicators (B):

$$B = \beta_1CTR + \beta_2CR + \beta_3PF + \beta_4CRR. \quad (4)$$

Block of marketing automation process indicators (A):

$$A = \gamma_1LPA + \gamma_2SPCR + \gamma_3AI. \quad (5)$$

Block of advertising campaign efficiency indicators (S):

$$S = \delta_1(1 - BR) + \delta_2PAUR + \delta_3ER. \quad (6)$$

Block of brand trust indicators (T):

$$T = \theta_1NPS + \theta_2PI. \quad (7)$$

The resulting economic and mathematical model allows for a comprehensive evaluation of the impact of digitalization on the marketing activities of enterprises. Based on the calculated integral indicator (I), the effectiveness of digital processes can be determined, and managerial decisions regarding further strategies for digital transformation in the enterprise's marketing activities can be made.

The interpretation of the integral indicator (*I*) for assessing the impact of digitalization on enterprise marketing activities is presented in Table 5.

Table 5

Interpretation of the integral indicator (*I*) for assessing the impact of digitalization on enterprise marketing activities

Range of Values	Interpretation of the Integral Indicator (<i>I</i>)
$I > 0,8$ (High level of impact)	The enterprise actively implements digital technologies, which positively influence marketing effectiveness. A high level of automation, personalized marketing strategies, and effective use of AI tools and analytics lead to significant ROI growth, increased brand trust, and cost optimization.
$0,5 \leq I \leq 0,8$ (Medium level of impact)	The enterprise uses digital tools, but their implementation is partial or insufficiently effective. There is a positive trend in profitability and automation indicators; however, there may be issues with customer retention, personalization, or the effectiveness of advertising campaigns.
$I < 0,5$ (Low level of impact)	Digital technologies are used to a limited extent or do not produce the expected results. Process automation is insufficient, advertising campaign effectiveness is low, and profitability and customer experience indicators remain weak. This indicates the need to revise the marketing strategy and to more actively implement digital solutions.

Source: Compiled by the Authors

Thus, the integral indicator provides enterprises with a comprehensive understanding of the impact of digitalization on their marketing activities and enables them to make informed managerial decisions regarding the further development of digital initiatives.

Conclusions

Digitalization processes are significantly transforming the marketing activities of enterprises, opening new opportunities to improve efficiency, enhance customer engagement, and optimize business processes. Assessing the impact of digital technologies on marketing activities is a crucial step in shaping an enterprise's development strategy in the digital economy.

This study analyzed the key indicators that characterize the impact of digitalization on enterprise marketing activities from economic, market, social and behavioral, and technological approaches. An economic and mathematical model for assessing the impact of digitalization was proposed, which allows for an integral evaluation and analysis of the effectiveness of digital transformations in enterprise marketing activities.

The results confirm that enterprises actively implementing digital technologies gain competitive advantages through a personalized approach to customers, increased automation, more effective use of advertising budgets, and improved engagement metrics. At the same time, to achieve maximum effect, it is necessary not only to implement digital tools, but also to constantly evaluate their impact on business processes, adapting the marketing strategy in accordance with market changes.

Thus, digitalization is not merely a trend but a necessity for modern enterprises striving to maintain and strengthen their positions in the face of fierce competition. Future research in this area may focus on a detailed assessment of the effectiveness of individual digital tools and the development of more adaptive models for the digital transformation of enterprise marketing activities.

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