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RODIONOV Sergii
Simon Kuznets Kharkov National University of Economics
https://orcid.org/0000-0001-8893-0306
e-mail: sergii.rodionov@hneu.net

# EVOLUTION OF SEARCH ENGINE OPTIMIZATION AS A FACTOR IN INCREASING INTERNET MARKETING EFFECTIVENESS IN AN AI ENVIRONMENT

*The article explores the evolution of Search Engine Optimization (SEO) and its role in transforming internet marketing strategies under the influence of intelligent technologies. The study analyzes a shift in the information search paradigm: from a classic list of links to the generation of AI-driven answers. Special attention is paid to identifying systemic risks of AI implementation, including the "zero-click" search problem, lack of algorithm transparency, and content unification. The study proves that integrating traditional methods with AI-oriented strategies is critical for ensuring brand visibility. Finally, the article provides practical recommendations for adapting business marketing communications to work within generative search ecosystems.*

*Keywords Search Engine Optimization, SEO, internet marketing, artificial intelligence, generative search, GEO, AIO, digital marketing, ranking algorithms, Zero-Click Search.*

РОДІОНОВ Сергій
Харківського національного економічного університету імені Семена Кузнеця

# ЕВОЛЮЦІЯ ПОШУКОВОЇ ОПТИМІЗАЦІЇ ЯК ЧИННИК ПІДВИЩЕННЯ ЕФЕКТИВНОСТІ ІНТЕРНЕТ-МАРКЕТИНГУ В СЕРЕДОВИЩІ ШТУЧНОГО ІНТЕЛЕКТУ

*У статті досліджено еволюцію пошукової оптимізації (SEO) та її роль у трансформації стратегій інтернет-маркетингу під впливом штучного інтелекту. Проаналізовано зміну парадигми інформаційного пошуку: від класичної видачі посилань до формування генеративних відповідей. Особливу увагу приділено ідентифікації системних ризиків впровадження штучного інтелекту, зокрема проблемі «нульового кліка», непрозорості алгоритмів та уніфікації контенту. Обґрунтовано, що інтеграція традиційних методів із орієнтованими під роботу зі штучним інтелектом стратегіями є критичною умовою забезпечення видимості бренду. Сформульовано практичні рекомендації щодо адаптації маркетингових комунікацій підприємств до роботи в екосистемах генеративного пошуку.*

*Ключові слова: пошукова оптимізація, SEO, інтернет-маркетинг, штучний інтелект, генеративний пошук, GEO, AIO, цифровий маркетинг, алгоритми ранжування, Zero-Click Search.*

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## PROBLEM STATEMENT IN A GENERALIZED FORM AND ITS RELATION TO IMPORTANT SCIENTIFIC OR PRACTICAL TASKS

The current stage of digital economy development is characterized by the rapid integration of artificial intelligence technologies into all areas of business communication. One of the most profound transformations is taking place in the field of internet marketing, where traditional search engine optimization (SEO) mechanisms are gradually losing their monopolistic role in ensuring brand visibility. The core problem lies in the emergence of a fundamental gap between classical promotion methods focused on web page indexing and new generative search algorithms capable of independently formulating user responses without directing traffic to corporate websites.

The general formulation of the problem is driven by the phenomenon of Zero-Click Search, which is becoming increasingly dominant in contemporary consumer behavior. Users are progressively satisfying their informational needs directly within search engine interfaces, resulting in a systemic decline in organic traffic. For enterprises, this necessitates a radical reconsideration of digital presence strategies: from competing for positions in lists of hyperlinks to competing for citation and inclusion in AI-generated responses.

The connection of this problem with important scientific tasks lies in the need for a theoretical reconsideration of the conceptual apparatus of marketing. There is a growing demand for the scientific substantiation of new categories such as GEO (Generative Engine Optimization) and AIO (Artificial Intelligence Optimization), as well as for clarifying their place within the system of digital promotion tools. This requires the development of new methodological approaches to evaluating the effectiveness of marketing communications, where traditional metrics such as CTR and page views should be complemented by indicators reflecting reputational influence on machine learning algorithms.

From a practical perspective, solving this problem is directly related to enhancing the competitiveness of domestic enterprises in the global digital market. Adaptation to operating conditions within AI-driven environments enables businesses to minimize target audience losses, optimize customer acquisition costs, and ensure brand sustainability under conditions of technological uncertainty. Therefore, the development of applied recommendations for the transition from traditional SEO to AI-oriented optimization strategies is critically important for preserving the long-term effectiveness of internet marketing.

## ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

The theoretical and applied aspects of internet marketing and search engine optimization have remained at the center of scholarly attention over the past decade.

The fundamental principles of digital marketing evolution in Ukraine and the specific features of promotion strategy formation under digitalization are highlighted in the works of O. V. Vynohradova and N. M. Nedopako [3], which trace the industry's development from basic tools to integrated digital ecosystems. The integration of advanced approaches, particularly LSI- and GEO-based content adaptation within socially responsible marketing communication strategies, has been comprehensively examined in the study by I. K. Liadskyi, O. V. Reshetnikova, and M. O. Kushnirenko [2]. Particularly significant in current conditions are the transformations driven by the development of large language models. In parallel, international scholarship emphasizes the radical shift in consumer behavior. In this regard, M. Sheridan [4] substantiates the emergence of the Zero-Click era, which fundamentally transforms trust-building mechanisms and sales stimulation in digital environments. Despite these contributions, the need for systematizing the stages of SEO evolution and conducting a comprehensive analysis of risks within generative AI environments remains an актуальний scientific task, to which this article is devoted.

## IDENTIFICATION OF PREVIOUSLY UNRESOLVED PARTS OF THE GENERAL PROBLEM TO WHICH THE ARTICLE IS DEVOTED

Despite the considerable number of publications devoted to the general aspects of AI application in marketing, many applied issues related to the transformation of search strategies remain insufficiently explored.

In particular, most existing studies focus on artificial intelligence as a tool for content generation, whereas the mechanisms for adapting web resources to the requirements of generative search algorithms remain underexamined.

An unresolved aspect of the broader problem is the absence of a clear periodization of SEO evolution in the context of intelligent systems development, which complicates forecasting future transformations in digital marketing. Moreover, the academic literature demonstrates a shortage of studies that reveal the essence of emerging concepts such as GEO (Generative Engine Optimization) and AIO (Artificial Intelligence Optimization), as well as their distinctions from classical optimization methods.

In addition, the issue of systemic risks arising during the transition to AI-oriented strategies requires further specification. The phenomenon of Zero-Click Search and its impact on the economic effectiveness of enterprise marketing communications still lacks a holistic theoretical justification.

## FORMULATION OF THE ARTICLE'S OBJECTIVES

The purpose of this article is to provide a theoretical substantiation of the evolution of search optimization and to determine its role as a key factor in improving the effectiveness of internet marketing under the conditions of generative artificial intelligence systems.

## PRESENTATION OF THE MAIN MATERIAL

The transformation of internet marketing under the influence of intelligent technologies necessitates a radical revision of traditional brand promotion approaches. Over recent decades, search engine optimization has remained the foundation of digital strategies, ensuring the connection between user intent and enterprise resources. However, the current stage is marked by a transition from classical ranking algorithms to complex neural network models capable not only of indexing but also of independently synthesizing content.

The relevance of studying SEO evolution is reinforced by the introduction of Search Generative Experience (SGE) systems, which fundamentally alter consumer behavior. Instead of following traditional hyperlinks, users increasingly receive comprehensive answers directly within the search interface. This shift creates the risk of declining organic traffic and compels marketers to seek new methods of influencing algorithms in order to preserve brand visibility.

The scientific problem lies in the need for a conceptual justification of the latest optimization approaches, particularly GEO and AIO. These concepts extend beyond the technical configuration of websites and encompass the management of reputational background across the data arrays on which language models are trained. Understanding these processes allows enterprises to leverage generative technologies as a powerful factor in strengthening marketing communications.

One of the newest directions is AIO (Artificial Intelligence Optimization), a concept that involves optimizing content with regard to how it is perceived and processed by generative AI systems. On this basis, Table 1 presents a comparison between traditional SEO and AI optimization across key parameters [1].

GEO (Generative Engine Optimization) is based on deep semantic processing, text adaptation to the specific characteristics of AI algorithms, and the integration of relevant data in structured formats [2].

The effectiveness of internet marketing in the new realities depends on the ability of businesses to integrate proven SEO mechanics with innovative methods of interaction with neural networks. This implies prioritizing qualitative parameters—expertise, authority, and trustworthiness—over quantitative indicators such as keyword density or backlink volume. Only such an integrated approach can ensure sustainable conversion performance within the renewed digital ecosystem.

For this reason, examining the stages of SEO evolution makes it possible to trace the logic of algorithmic development and forecast further transformations in the digital marketing toolkit (table 1)

Table 1

**Evolutionary dynamics of SEO development in the context of intelligent technologies**

| Period | Concept | Key Success Factor | Role of Artificial Intelligence |
|---|---|---|---|
| 2000-2010 | Technical SEO and link building | Keyword density, backlink volume | Absent (simple mathematical algorithms) |
| 2010–2018 | Content marketing and quality | Text uniqueness, behavioral factors | Early-stage application (spam filtering, Panda and Penguin algorithms) |
| 2018–2023 | Semantic search and user intent | Query-context relevance, authority | Machine learning |
| Since 2024 | Generative search (GEO/AIO) | Citation in AI-generated responses, structured knowledge | Foundational |

The first stage of evolution, which covered the first decade of the 2000s, was characterized by a mechanistic approach to promotion. During this period, internet marketing largely depended on technical ingenuity, particularly the direct insertion of search queries and the large-scale accumulation of backlinks without regard to their quality. Search engines functioned as simple directories, which made search engine optimization relatively predictable but rather ineffective in terms of delivering real value to users, since the focus was placed on “manipulating” crawlers rather than satisfying customer needs [3].

A qualitative turning point occurred in the 2010s, when major search engines introduced algorithms based on the early elements of machine learning. This shift forced marketers to move their focus from technical parameters toward the creation of high-quality and unique content. It was during this period that the concept of authority first emerged, later evolving into contemporary website evaluation standards. The effectiveness of internet marketing began to be determined not by positions in the top 10 search results, but by the level of audience trust and the brand’s ability to solve specific consumer problems through informative content.

The introduction of natural language processing technologies in 2018 marked the beginning of the semantic search stage. Search engines started to interpret not individual words, but user intentions, which significantly improved the precision of search results. For marketing, this meant the need for a deeper analysis of the target audience and the development of sophisticated content strategies that take into account the context of information consumption. Search engine optimization was transformed into an intelligent tool requiring the synergy of analytics, psychology, and copywriting [1].

The current stage, which began with the widespread deployment of generative models in 2023–2024, represents the greatest challenge for the professional community. The emergence of GEO (Generative Engine Optimization) means that the object of optimization is no longer a web page, but rather the informational “footprint” of a brand that is interpreted by neural networks. In this environment, artificial intelligence acts as a mediator that aggregates data from multiple sources and produces the final output. Consequently, marketing strategy must now account for how well company-related data are structured and how accessible they are for interpretation by large language models.

It should be emphasized that each new stage in the evolution of search engine optimization has raised the requirements for the quality of marketing activities. The current integration of artificial intelligence into search processes does not eliminate previous achievements; rather, it incorporates them into a complex, multi-layered promotion system. The future of internet marketing belongs to those enterprises that can secure their presence within artificial intelligence “answers” by combining technical website excellence with a high level of expertise and proven authority within their niche.

Particular attention should also be paid to the transformation of the classical online consumer behavior model. While traditional SEO was oriented toward the linear user journey of “query → click → website → conversion,” the integration of generative artificial intelligence into search systems has created the phenomenon of Zero-Click Search [6]. In this environment, the effectiveness of internet marketing is determined not by the number of visits to a web resource, but by the brand’s ability to become part of the synthesized AI-generated response.

The comparative mechanism of the impact of traditional and innovative optimization methods on marketing performance is presented in Figure 1.

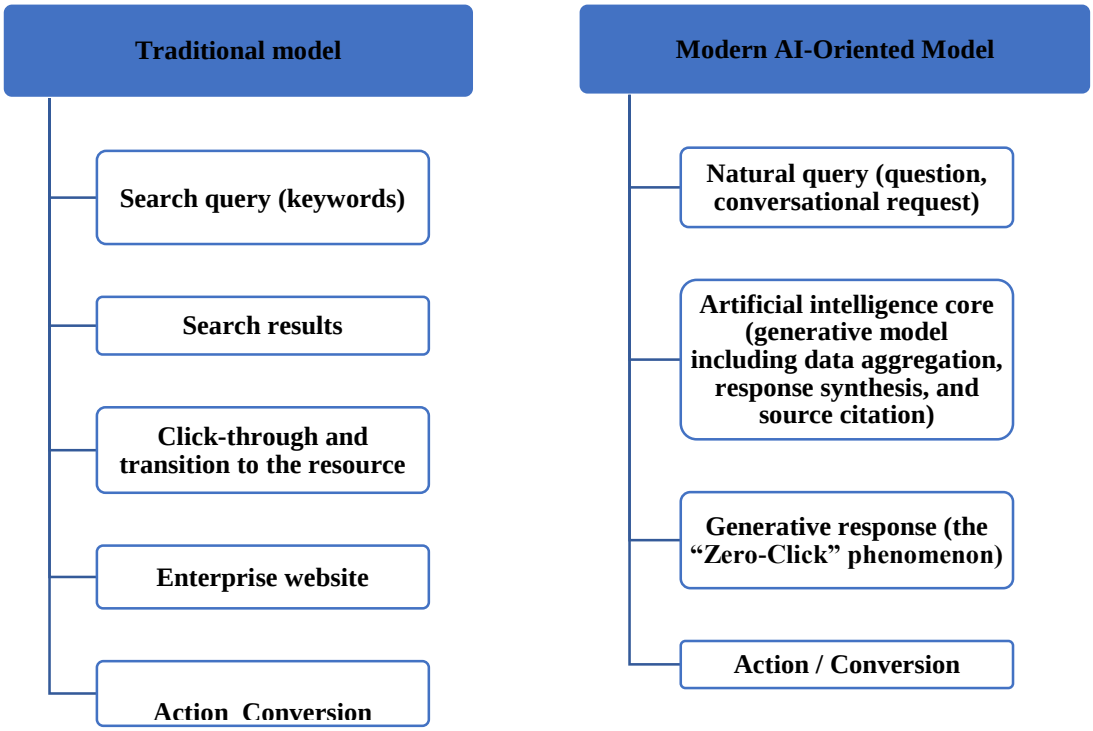


**Fig. 1. Comparison of user interaction models with search content. Source: developed by the author**

Instead of the traditional funnel based on a list of hyperlinks, where the primary focus is traffic acquisition, we now observe a complex ecosystem in which the user receives a ready-made generative response directly within the interface, reflecting the "Zero-Click" phenomenon [4]. In this environment, the focus of marketing shifts toward ensuring brand presence within the context of the artificial intelligence response and its subsequent citation.

At the same time, alongside the new opportunities created by the use of artificial intelligence in search optimization, a number of systemic risks and limitations emerge that significantly affect the effectiveness of internet marketing and require more detailed scholarly investigation.

One of the key problems is the inaccuracy and incompleteness of the data on which generative system responses are based. Large language models rely on aggregated information from multiple sources, which is not always up-to-date or reliable. As a result, this may lead to the generation of plausible yet factually incorrect information. For brands, this creates the risk of spreading a distorted perception of their activities, which directly affects consumer trust [5].

A second important issue is the limited transparency of artificial intelligence algorithms. Unlike traditional search engines, where ranking principles are relatively understandable, developers of generative models do not currently disclose these mechanisms. This complicates the ability to forecast optimization outcomes and to control which specific sources are used in generating responses. Consequently, enterprises lose part of their control over the informational space surrounding their own brand.

Equally significant is the problem of content standardization and unification. Generative systems tend to generalize information, which leads to reduced differentiation among brands. Under such conditions, unique selling propositions may be neutralized, while competition shifts into the domain of intangible assets—trust, expertise, reputation, and depth of content.

In addition, the traffic reduction effect caused by Zero-Click Search, or the zero-click effect, should also be taken into account, as it transforms the traditional economics of digital marketing. Since users receive answers without visiting a website, companies lose the opportunity for direct interaction with their audience, which complicates conversion processes and the measurement of marketing campaign effectiveness.

Taken together, these factors form a new risk paradigm in the field of internet marketing, requiring the development of adaptive strategies for managing a brand's digital presence. The risks associated with the use of generative artificial intelligence and their impact on internet marketing effectiveness are summarized in Table 2.

The integration of intelligent technologies into search engine optimization is transforming approaches to marketing management. Success in the contemporary digital environment depends on the ability of enterprises to balance innovative tools with mechanisms for ensuring information quality and maintaining brand reputation.

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Table 2

**Risks of Using Generative Artificial Intelligence in SEO and Their Impact on Internet Marketing Effectiveness**

| Risks | Essence | Impact on Marketing | Possible Mitigation Measures |
|---|---|---|---|
| Data inaccuracy | Generation of incorrect or outdated information | Distortion of brand image | Regular content updates, use of authoritative sources |
| Algorithm opacity | Lack of understanding of response-generation principles | Reduced controllability of marketing processes | Channel diversification |
| Zero-click effect | Absence of website visits | Decline in traffic and conversion rates | Focus on branding and brand awareness |
| Content unification | Generalized AI-generated information | Loss of brand uniqueness | Development of expert-driven content |
| Platform dependency | Dependence on external services | Loss of control over the audience | Omnichannel strategy |
| Reputational risks | Uncontrolled generation of brand-related information | Decline in consumer trust | Digital reputation management |

## CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH

Based on the conducted study, it has been substantiated that the evolution of search engine optimization has followed a complex trajectory—from the technical manipulation of algorithms to intelligent interaction with generative models. The results of the analysis indicate a fundamental paradigm shift in internet marketing, where the key performance indicator is no longer merely a website's position in search rankings, but rather the presence of the brand within AI-generated responses.

This transformation necessitates a transition toward GEO (Generative Engine Optimization) and AIO (Artificial Intelligence Optimization) strategies, which are grounded in the management of digital authority and deep semantic data processing. It has been demonstrated that the modern digital environment is characterized by the emergence of systemic risks, among which the most significant include the Zero-Click phenomenon, the opacity of neural network algorithms, and the threat of losing brand uniqueness due to AI-driven content standardization.

The successful adaptation of marketing strategies to these conditions requires enterprises to focus on the credibility and expertise of information sources, as well as on the use of structured data that enables algorithms to accurately identify and represent the brand.

Prospects for further research in this field are associated with the need to develop new methodological approaches to evaluating the effectiveness of marketing communications. In particular, the formulation of metrics for measuring the share of brand mentions in generative responses and the analysis of changes in customer acquisition costs under conditions of declining organic traffic become critically important.

Further studies should also focus on the adaptability of omnichannel strategies to the continuous evolution of large language models, which will ensure the sustainable development of internet marketing in the long term.

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