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Search pattern analytics as a source of marketing trend forecasting

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Abstract. The rapid pace of change in consumer interests in the digital economy outpaces the analytical capabilities of traditional systems, necessitating a transition from a reactive to a proactive model of marketing management. Using search patterns as a data source enables the detection of early signals of demand formation, creating new opportunities for building adaptive brand strategies, enhancing the efficiency of media planning, and predicting consumer behavior. The **purpose of the article** is to determine the essence, potential and practical directions of applying search pattern analytics to predict marketing trends in the digital economy, as well as to develop a conceptual model for integrating this data into the strategic marketing management system. The **research methodology** is based on a combination of systemic, synergistic, and cognitive-analytical approaches, which provide a comprehensive study of the relationship between user information behavior and market processes. **Results.** The properties of search data as behavioral predictors of changes in consumer interests are investigated. It was found that the inclusion of search indicators in forecasting models increases the accuracy of short-term demand estimates. It was found that the integration of analytical tools Google



Trends, Google Analytics 4, SEMrush and Power BI forms a closed loop of «observation – analysis – forecast – correction», which provides a significant reduction in management response time and increases the accuracy of marketing decisions. It is proven that the systematic use of search analytics increases the efficiency of budgeting and the accuracy of targeting in digital marketing.

Conclusions. It was found that search pattern analytics is an effective mechanism for increasing the accuracy of marketing forecasts and the adaptability of decisions. Key problems with its implementation were identified, including the incomplete representativeness of the data, the lack of standardized procedures for normalization, and ethical risks associated with the processing of behavioral data. Prospects for further research include the creation of hybrid intelligent models that combine search, social, and transactional analytics, as well as the development of a scientifically based Search Analytics Governance Framework aimed at ensuring the reliability, transparency, and responsible use of digital data in marketing activities.

Keywords: digital marketing, behavioral analytics, demand forecasting, search indices, consumer intent, adaptive modelling, big data, digital ecosystem.

Аналітика пошукових патернів як джерело прогнозування маркетингових трендів

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Анотація. Швидкі темпи зміни споживчих інтересів в умовах цифрової економіки випереджають аналітичні можливості традиційних систем, що зумовлює необхідність переходу від реактивної до проактивної моделі



маркетингового управління. Використання пошукових патернів як джерела даних дозволяє виявляти ранні сигнали формування попиту, що створює нові можливості для побудови адаптивних стратегій брендів, підвищення ефективності медіапланування та прогнозування поведінки споживачів. **Мета статті** полягає у визначенні сутності, потенціалу та практичних напрямів застосування аналітики пошукових патернів для прогнозування маркетингових трендів у цифровій економіці, а також у розробленні концептуальної моделі інтеграції цих даних у систему стратегічного маркетингового управління. **Методологія дослідження** ґрунтується на поєднанні системного, синергетичного й когнітивно-аналітичного підходів, що забезпечує комплексне вивчення взаємозв'язку між інформаційною поведінкою користувачів та ринковими процесами. **Результати.** Досліджено властивості пошукових даних як поведінкових предикторів змін споживчих інтересів. Встановлено, що включення пошукових індикаторів у прогнозні моделі підвищує точність короткострокових оцінок попиту. Виявлено, що інтеграція аналітичних інструментів Google Trends, Google Analytics 4, SEMrush та Power BI формує замкнутий цикл «спостереження – аналіз – прогноз – корекція», який забезпечує істотне скорочення часу управлінського реагування та підвищує точність прийняття маркетингових рішень. Доведено, що системне використання пошукової аналітики підвищує ефективність бюджетування та точність таргетування у цифровому маркетингу. **Висновки.** Встановлено, що аналітика пошукових патернів є дієвим механізмом підвищення точності маркетингових прогнозів і адаптивності рішень. Виявлено ключові проблеми її впровадження – неповну репрезентативність даних, відсутність стандартизованих процедур їх нормалізації та етичні ризики, пов'язані з обробленням поведінкових даних. Перспективи подальших досліджень полягають у створенні гібридних інтелектуальних моделей, що поєднують пошукову, соціальну та транзакційну аналітику, а також у розробленні науково обґрунтованої рамки Search



Analytics Governance Framework, спрямованої на забезпечення достовірності, прозорості та відповідального використання цифрових даних у маркетинговій діяльності.

Ключові слова: цифровий маркетинг, поведінкова аналітика, прогнозування попиту, індекси пошуку, споживчі наміри, адаптивні моделі, big data, цифрова екосистема.

Problem statement. In today's rapidly digitalizing economy and changing consumer behavior, the problem of search pattern analytics is significant for forecasting marketing trends. Traditional methods of market analysis, based on surveys, statistical reports, and retrospective data, are insufficiently operational and fail to provide timely detection of emerging trends. Instead, digital traces of users, in the form of search queries, call frequency, and semantic associations, form a unique source of dynamic information about changes in consumer priorities, intentions, and socio-economic expectations. However, the potential of using such data for marketing forecasting in Ukrainian conditions remains insufficiently revealed due to methodological, technical, and interpretative limitations. The lack of unified standards for processing big data and insufficient integration between platforms complicate the transition from the descriptive to the predictive level of analytics. In view of this, the study of search pattern analytics is a crucial scientific and practical task that combines the development of new demand forecasting models, the enhancement of marketing analytics tools, and the support of managerial decision-making in the fields of strategic planning, branding, and digital communication. Its results have the potential to ensure increased forecast accuracy, reduce time lags between the emergence of a trend and its commercial implementation, and create adaptive market monitoring systems capable of responding to changes in consumer behavior in real-time.

Analysis of recent research and publications. Analysis of modern research allows us to identify four interrelated scientific directions. The first direction



concerns the conceptualization of approaches to using web search activity as an indicator of changes in consumer interests. In the work of S. P. Jun and co-authors, a method of forecasting by analogy based on web traffic was developed, which proves the effectiveness of search data as an early signal of market changes [1]. The authors showed that search activity reflects latent shifts in consumer behavior that precede actual demand fluctuations. A similar approach is taken by P. A. Okeleke et al., who demonstrated that search pattern analytics combined with artificial intelligence enables the early detection of trends based on user behavioral changes [2]. The study by P. S. Venkateswaran et al. substantiates the use of machine learning and big data in strategic brand management, where search activity acts as an indicator of the product life cycle [3]. R. Y. Du and T.-Y. Hsieh demonstrated that online queries serve as a source of marketing insights, reflecting latent consumer intentions long before market conditions change [4]. Further research in this area should focus on improving methods for behavioral-temporal analysis of search data and modelling demand formation cycles, taking into account the unique characteristics of digital platforms.

The second direction covers empirical studies that confirm the applied value of search data for forecasting demand and market dynamics. D. Wu et al. showed that Google Trends data can be a reliable predictor of sales, revealing a correlation between query frequency and actual sales volumes [5]. B. Nyagadza, in his study, established the relationship between search marketing and social media, emphasizing that integrated analysis of digital sources allows for the identification of the initial stages of trend formation [6]. M. Y. Huang et al. demonstrated that search patterns can serve as signals of collective investor expectations and indicators of changes in the stock market [7]. M. Seyedan and F. Mafakheri have summarized approaches to predictive analytics of big data in demand forecasting, pointing out the potential of using search trends to optimize supply chain management [8]. Further research in this area should focus on improving methods for cleaning, normalizing, and unifying search data, thereby enhancing the reliability of forecasts



and facilitating their practical application in marketing planning and decision-making.

The third area focuses on the development of intelligent analytical models and cognitive forecasting systems. W. Khan and co-authors have demonstrated that combining machine learning with the analysis of public sentiment and political factors allows predicting the behavior of markets based on search patterns [9]. A. Adewuyi and co-authors developed a conceptual model of predictive modeling in the financial sector, where the use of artificial intelligence in combination with search data allows assessing business success and market risks [10]. M. Naeem and co-authors systematized the main trends in the development of big data, emphasizing that the integration of search analytics into the analytical ecosystems of the future is a key condition for the formation of sustainable forecasting models [11]. Further research in this area should focus on creating cognitive systems that can integrate search, social, and transactional signals in real-time to enhance the accuracy of strategic forecasts.

The fourth area covers the integration of deep learning, information fusion and multimodal analytics in forecasting marketing trends. A. Thakkar and K. Chaudhari summarized a decade of experience in applying information fusion methods to forecasting stock markets, emphasizing the importance of combining behavioral, financial, and search data [12]. P. Mehta and co-authors demonstrated that combining search analytics with social media, based on deep learning, can significantly enhance the accuracy of forecasting consumer sentiment and market dynamics [13]. Further research in this area should focus on developing adaptive multimodal platforms that integrate deep learning, semantic analysis, and behavioral indicators into a unified forecasting system.

Highlighting previously unresolved parts of the general problem. Despite the active development of digital marketing, the issues of defining search pattern analytics as a systematic forecasting tool remain unresolved. In its role as a behavioral predictor of consumer intentions, the relationship between search activity



and market changes has not been sufficiently studied, and there are no unified methods for the normalization, verification, and ethical use of search data. It limits the reliability and applied value of forecasts. The proposed study aims to address these gaps by developing a concept for an adaptive marketing trend forecasting system that integrates search analytics with digital marketing platforms. This approach combines behavioral and statistical data within a single analytical cycle, enhancing the accuracy of forecasts and laying the groundwork for the ethical and methodologically consistent use of search indicators in marketing practice.

Formulation of the objectives of the article (task statement). The article aims to determine the essence, potential and practical directions of applying search pattern analytics to forecast marketing trends in the digital economy.

To achieve the set goal, the following tasks have been defined:

1. To determine the essence and analytical value of search patterns in identifying changes in consumer interests and forming marketing trends.
2. To assess the effectiveness of digital analytical tools for forecasting demand based on search data, taking into account their reliability and ethical limitations.
3. To develop an adaptive model for forecasting marketing trends, integrated with digital analytics platforms.

Presentation of the main research material. Search pattern analytics is considered an effective tool for identifying changes in consumer interests and market dynamics, based on a systematic analysis of a wide range of user queries in search engines. Search queries reflect not only information needs but also behavioral intentions, expectations, and reactions to external events, making them a key indicator of demand transformation. In today's highly turbulent market environment, where traditional survey and monitoring methods often fail to provide efficiency, query analytics enables you to identify new trends at their inception. The peculiarity of the approach is to transform user search activity into quantifiable signals that can be integrated into a marketing forecasting system (table 1).



Table 1

Relationship between search patterns and market dynamics

Element of the search pattern	Signal characteristic	Marketing value	Potential management response
Increasing frequency of keyword queries	An intensive increase in interest in a particular product or topic	Sign of short-term trend formation	Intensification of advertising campaigns, inventory adjustment
Emergence of new combinations of search phrases	Change in consumer discourse, emergence of new associations	Sign of changing perception of the brand or product functions	Development of new positioning strategies
Territorial concentration of queries	Geographic localization of interest	Identification of regions of potential demand growth	Targeting regional advertising, logistical adaptation
Seasonal cyclicity of queries	Repetition of interest in specific periods	Indicator of forecasted demand	Planning marketing campaigns in peak seasons
Correlation between thematic groups of queries	Interrelationship between products or needs	Identification of complementary products	Development of package offers, cross-marketing

Source: formed by the author based on [1, p. 45–47; 4, p. 260–262; 5, p. 633–635; 6, p. 414–416; 7, p. 2825–2827]

Search pattern analytics is gradually becoming a key area in the marketing forecasting system, as it enables the detection of hidden changes in consumer intentions before corresponding signals appear in statistical or financial data. Its mechanism of action is based on analyzing time series of search query frequencies, which reflect users' collective attention to specific topics, brands, or product categories. While traditional methods rely on retrospective indicators, query analytics allows for recording shifts in interest almost in real time, providing the so-called «leading signal effect».

Empirical results prove that the inclusion of search indexes in forecasting models increases the accuracy of short-term forecasts at the monthly level. In particular, a comparative analysis has shown that using web search indexes in time



models significantly reduces the average error in forecasting tourist arrivals at the level of individual cities, where fluctuations in interest occur more rapidly than at the national level [14, p. 2]. Search dynamics can serve as an effective indicator of seasonal demand, helping optimize marketing budgets, plan logistics, and manage load on service infrastructure. In the retail sector, search data analysis demonstrates no less predictive value. The correlation between search frequency and consumer goods sales exceeds 0.8, confirming the potential of transforming search activity into a tool for predicting revenue dynamics [15]. In practical terms, this means that changes in user queries over a period of one to two months can signal future demand fluctuations, allowing companies to adjust their pricing, inventory management, and marketing campaigns in advance. Thus, modern search pattern analytics serves as a «sensor layer» of the market, converting aggregated user digital traces into analytical indicators that improve forecasting accuracy, accelerate management responses, and enhance the adaptability of marketing strategies in a changing environment. Its integration with CRM platforms and demand-monitoring systems provides the foundation for building intelligent models that learn from real user behavior and predict market trends with high reliability.

The relationship between user search activity and the formation of marketing trends reflects the transition from individual interest to mass demand, where digital signals catalyze new consumer models. Search engines record primary changes in the structure of social preferences before they are reflected in sales statistics or social media content. The frequency of queries, the emergence of new key combinations and the territorial spread of interest create a sequence of phases that correspond to the stages of marketing trend formation. Empirical data show that an increase in searches for specific topics usually precedes changes in media discourse by 4–6 weeks and the emergence of new product offers over the next two quarters [16]. As a result, search activity is transformed from a passive indicator of information into a dynamic mechanism for trend formation that directly affects brand strategies, recommendation algorithms, and consumer behavior (table 2).



Table 2

Phases of search activity and corresponding stages of marketing trend formation

Stage of search activity	Signs in the data	Stage of trend	Practical significance
Spark growth	A sharp increase in the frequency of several key phrases	Latent interest	Identification of early signals of demand
Semantic expansion	Adding clarifications, the appearance of related words	Consolidation of the topic	Expansion of communication contexts
Geographic diffusion	Spread of interest in different countries or regions	Mass attention	Planning of advertising and logistics campaigns
Platform of visibility	Stable high search volumes	Commercialization	Mass launch of products and services
Recombination or decline	Change in semantics or a decrease in the frequency of requests	Fading of the trend	Restructuring of the offer, search for a new niche

Source: formed by the author based on [2, p. 40–42; 3, p. 476–478; 4, p. 270–272; 8; 9, p. 11030–11033]

In practice, this process is clearly evident in industries with high rates of product updates. For example, an analysis of Google Trends data on artificial intelligence reveals that the surge in queries for «AI tools» and «best AI for coding» outpaced the peak number of launches of the corresponding services by about two quarters [17]. In the fashion industry, an increase in interest in queries such as «sustainable fabrics» and «capsule wardrobe» was observed across more than 50 countries, which served as the basis for global advertising campaigns targeting local markets [18]. It demonstrates that analyzing the semantic clusters of search queries not only allows for observation but also for prediction of changes in consumer culture, providing brands with a time advantage in shaping demand. Thus, search activity analytics serves as an integration link between user behavioral data and strategic marketing decisions, enabling early trend recognition, reducing reaction lag, and improving the effectiveness of market forecasts.



The assessment of the potential for using digital analytical tools to predict demand trends in marketing is based on the fact that search data reflects consumers' actual intentions at various stages of the purchase decision-making process. Changes in the frequency, content, and structure of queries enable us to identify not only current interests but also expected changes in demand that have not yet been reflected in sales statistics. In this context, digital analytical tools do not simply process big data; they transform behavioral signals into predictive indicators of marketing dynamics. They enable us to measure demand elasticity, predict the effects of advertising campaigns, and make timely adjustments to positioning strategies. This approach serves as the basis for the transition from reactive to proactive marketing, in which decisions are made not based on market changes, but at the stage of their emergence (table 3).

Table 3

Digital marketing analytics tools for forecasting demand trends

Tool	Marketing purpose	Analytics/forecast type	Use case
Google Trends	Interest indexes by brand/category and region	Leading demand signals, nowcasting, seasonality	Adding query index as a predictor to short-term demand models and «current» market activity estimates
Google Analytics 4 (GA4)	Transforming search impulses into predictive audiences	Probability of purchase/bounce, conversion forecast	Early media retargeting to high-probability audiences
Semrush Keyword Overview	Semantic and competitive query intelligence	Selecting trend «nuclei», intent, volume	Prioritizing clusters for creative/SEO/paid search and building regional demand signals
Power BI (Analytics pane)	Forecasting and scenario planning on dashboards	ETS/AR forecast lines with intervals	Quick «what-if» scenarios for planning promotional calendar and inventory for search peaks
Prophet (Meta)	Robust trend and seasonal forecasts with event effects	Models with search index lags	Integrating holidays/promotion windows and search lags



Tool	Marketing purpose	Analytics/forecast type	Use case
			into strategic demand forecasts

Source: created by the author based on [19-23]

The described tools, when applied in practice, form a coherent cycle. First, a «core» of the trend is formed by selecting clusters of queries based on growth and stability; these series are normalised and added to the demand model, with lags reflecting the typical delay between interest and purchase [19]. Next, predictive metrics are activated in GA4 to build audiences with a high probability of conversion, which enables the translation of search interest into a managed forecast of marketing returns, and the budget is redistributed to segments with the highest expected value [20]. Semantic intelligence in Semrush enables you to clarify the structure of intentions and the competitive landscape, and to identify local «windows of opportunity» for rapid campaigns and regional SKUs [21]. For management teams, dashboards in Power BI with forecast lines and confidence intervals are connected, making scenario decisions transparent and aligning media, trade, and inventory plans with behavioral signals [22]. For medium- and long-term planning, Prophet models are supplemented with event effects (such as holidays and promotions) and lags of search indicators, ensuring forecast explainability and resistance to trend breaks [23]. As a result, marketing receives a tool for proactive demand management: decisions are made at the stage of emerging changes in search, rather than after they are reflected in sales. The implementation of search pattern analytics in marketing practice faces several critical issues related to data quality, reliability, and ethical use [4, p. 260–262]. In the Ukrainian market, these challenges are further intensified by structural and situational factors that differentiate the national digital environment from more stable economies. The dominance of Google as the primary search platform, combined with uneven levels of digitalization across regions, creates significant fluctuations in data representativeness. Rural–urban disparities in internet access, differences in device usage, and the fragmented



development of local e-commerce ecosystems reduce the completeness and stability of search signals at the national scale. Russia's war against Ukraine adds another layer of volatility: search behavior is highly sensitive to security threats, forced migration, blackouts, infrastructure disruptions, and abrupt shifts in consumer priorities. These war-driven oscillations amplify noise in search data, shorten trend life cycles, and complicate the attribution of causality between search patterns and real economic activity. As a result, forecasting models require more frequent recalibration and stronger normalization procedures to remain valid under Ukrainian conditions. First of all, search data is not always representative of the entire audience, as it covers only users who are active in certain digital environments and exhibit specific language or behavioral patterns. It creates systematic distortions, mainly when search analytics is used to predict mass demand or national trends. The second problem lies in the heterogeneity of search engine ranking algorithms: changes in output, personalization filters, or localization can distort query statistics, thereby reducing the stability of models [7, p. 2825–2827]. The third is the dynamic nature of content: query semantics change faster than trends are formed, so any built model quickly loses accuracy without regular updates to dictionaries and contextual weights. A significant problem remains the lack of unified methodological standards for normalizing search data: indicators across platforms (Google, Bing, YouTube Search, Amazon) are not comparable, making it impossible to integrate the results into a single marketing analytics system [11, p. 319–321]. A separate difficulty is attributing cause-and-effect relationships between search patterns and actual consumer actions: a high level of correlation does not always imply causality, so that misinterpretation can lead to erroneous decisions about advertising strategy or positioning. The ethical dimension of the problem lies in the risk of intrusion into users' privacy: aggregating even anonymized queries can reveal sensitive categories or behavioral profiles [10, p. 431–433]. In addition, the issue of algorithm transparency arises, as marketers do not have full access to the principles governing the formation of trend indices, making it difficult to verify the reliability of the



results [12, p. 102–103]. Finally, the shortage of ethics experts and the lack of internal company policies regarding the use of behavioral data create a risk of manipulation and discriminatory practices in personalized advertising. The combination of these factors necessitates the establishment of a system for ethical and methodological control of search pattern analytics in marketing organizations, incorporating verification standards, source audits, and a clear distinction between statistical analysis and behavioral targeting.

Creating an adaptive system for forecasting marketing trends by integrating search analytics with digital marketing platforms involves establishing a continuous management loop that combines the stages of «observation – analysis – forecast – correction». Such a system should operate at three interconnected levels: analytical, technological, and organizational. At the analytical level, the primary task is to develop algorithms that can quickly respond to changes in user search behavior. Search data must be integrated with Customer Relationship Management (CRM) systems, e-commerce platforms, and advertising platforms to obtain a comprehensive view of the user's journey from initial intention to purchase. For this, the application programming interfaces (APIs) of Google Ads, Meta Business Suite, and HubSpot are used, enabling the synchronization of search query dynamics with actual conversion rates and Return on Investment (ROI) indicators.

At the technical level, system efficiency is ensured by creating a single data repository (Data Hub) that aggregates search signals, social listening results, content analytics, and data from advertising campaigns. Machine learning models are developed using this framework, leveraging sliding windows, seasonal patterns, and contextual factors to forecast demand. In modern practice, the method demonstrates a strong effect, with search indexes serving as leading predictors in conversion and sales forecasting models, allowing marketers to optimize the distribution of advertising budgets in real time.

The organizational level includes creating a cross-functional analytical group within the company structure, responsible for supporting forecast models, updating



parameters in response to market changes, and auditing data quality. Within this group, it is worth introducing a system for verifying information reliability, regularly assessing forecast accuracy, and a feedback procedure that ensures training models based on the actual results of marketing campaigns.

In practical implementation, such an adaptive system involves three stages: automatic detection of trend signals (for example, the growth of the popularity of queries «sustainable travel» or «AI marketing tools»), assessment of the stability and relevance of trends, and the formation of response scenarios – from content correction to the launch of A/B testing. Using this approach ensures faster response to market changes and improves the reliability of demand forecasts.

Thus, an integrated forecasting system based on search analytics transforms marketing from a reactive tool into a proactive mechanism for managing consumer attention. It ensures continuity among analytics, communication, and sales, forming a closed decision-making loop and laying the foundation for the Data-Driven Marketing model, in which each action is confirmed by behavioral signals and evaluated for its actual impact on demand.

Conclusions. The study found that search pattern analytics is an effective tool for forecasting marketing trends, as it reflects early signals of changes in consumer intentions and information behavior. Search indexes can act as leading indicators of demand formation, increasing the accuracy of short-term forecasts and reducing the time lag between the emergence of a trend and management response. It is substantiated that integrating search analytics with digital platforms (Google Trends, Google Analytics 4, SEMrush, Power BI, Prophet) creates a holistic monitoring ecosystem that enables adaptive, data-driven marketing decisions. Key problems in implementing search pattern analytics were identified, including incomplete data representativeness due to uneven audience coverage, the lack of standardized methods for indicator normalization, the difficulty of attributing causal links between search signals and consumer behavior, and insufficient ethical regulation of behavioral data use. These limitations necessitate the development of unified



methodological principles for verifying data reliability, standardizing analytical algorithms, and ensuring transparency in their application.

An adaptive marketing trend forecasting system is proposed that operates by integrating search analytics with CRM and media platforms, forming a closed cycle of «observation – analysis – forecast – correction». Its practical implementation can reduce the reaction lag to as little as 1–2 weeks and substantially improve the accuracy of short-term forecasts, thereby enabling a more rational, evidence-based distribution of marketing budgets. Prospects for further research include the development of intelligent hybrid models that combine search, social, and transactional data, as well as the creation of a national ethical framework, the «Search Analytics Governance Framework», to ensure transparency and the responsible use of behavioral data in marketing analytics.

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