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CLASSIFICATION OF SCIENTIFIC METHODS: A MODERN VIEW

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The article reveals modern approaches to the classification of scientific methods in the context of global transformations in science and technology. It is noted that the existing classifications need to be revised to take into account interdisciplinarity, digital research tools and the subjective factor in the cognitive process. The author emphasizes the need to integrate quantitative, qualitative and digital methods to create adaptive hybrid methodologies. Examples of the use of Big Data, machine learning and interdisciplinary approach in the activities of leading companies (Amazon, Netflix, Google) are analyzed. The expediency of updating the methodological foundations through the development of new classification models that meet the challenges of the XXI century is substantiated. Ways to solve the problem of inconsistency between traditional approaches to methodological practice and the modern scientific environment are proposed. It is emphasized that only through a meaningful rethinking of the methods of cognition can science meet the dynamics of modern society, maintain openness to new knowledge and remain an effective tool for understanding complex reality. The article also emphasizes the role of the researcher's methodological culture as an important resource for adapting to the changing conditions of scientific activity and the effective use of interdisciplinary and digital potential.

КЛАСИФІКАЦІЯ НАУКОВИХ МЕТОДІВ: СУЧАСНИЙ ПОГЛЯД

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Ключові слова:
дослідження, методи, моделі, тенденції, цифрові технології, техніки, наука, розвиток, підприємство.

Розкрито сучасні підходи до класифікації наукових методів у контексті глобальних трансформацій у сфері науки та технологій. Зазначено, що наявні класифікації потребують перегляду з урахуванням інтердисциплінарності, цифрових інструментів досліджень і суб'єктивного чинника у пізнавальному процесі. Акцентовано увагу на необхідності інтеграції кількісних, якісних і цифрових методів задля створення адаптивних гібридних методологій. Проаналізовано приклади застосування Big Data, машинного навчання та інтердисциплінарного підходу у діяльності провідних компаній (Amazon, Netflix, Google). Обґрунтовано доцільність оновлення методологічних засад через розробку нових класифікаційних моделей, що відповідають викликам XXI століття. Запропоновано шляхи вирішення проблеми невідповідності традиційних підходів до методологічної практики сучасного наукового середовища. Підкреслено, що лише шляхом осмисленого переосмислення методів пізнання наука може відповідати динаміці сучасного суспільства, підтримувати відкритість до нових знань і залишатися ефективним інструментом пізнання складної реальності. У статті також акцентовано на ролі методологічної культури дослідника як важливого ресурсу адаптації до змінних умов наукової діяльності та ефективного використання міждисциплінарного й цифрового потенціалу.

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Statement of the problem

Despite the many attempts to create a single and universal system of classification of scientific methods, there is a problem of ambiguity in their interpretation and use in the context of modern scientific realities. This requires new approaches to the classification and synthesis of traditional and innovative methods.

Analysis of recent research and publications

A significant contribution to the classification of scientific methods was made by R. Merton, who developed the concept of "middle-range theories" [1], and T. Kuhn, who identified the concept of scientific paradigms [2]. The foundations of the modern systematization of scientific methods were developed in the works of F. Bacon [3], who described the empirical approach in science. Among Ukrainian researchers, it is worth noting S. Prysyazhnyuk, who dealt with the structure of scientific research [4], and T. Bichek, who studied the methods of systematic analysis [5].

Formulation of the objectives of the article

The purpose of the article is to highlight the current approaches to the classification of scientific methods, to identify their varieties and problems of interpretation in the context of modern scientific activity.

Summary of the main research material

Establishing a clear classification of scientific methods is an important factor in ensuring scientific credibility and innovation in research in the 21st century. Established classifications need to be adapted to changing realities, such as interdisciplinary research, digital technologies, and globalization processes.

Science as a form of human activity is characterized by strict requirements for research methods. The modern methodology considers the classification of scientific methods as a means of generalizing their meaning and role in scientific knowledge.

Modern scientific methods are conditionally classified according to various criteria:

1. By levels of scientific knowledge:

1) empirical methods (observation, experiment, measurement):

– observation is used in modern cognitive science research (e.g., observation of neural activity) [6]. For example, a system of observations at Nestlé of consumer behavior when testing new product flavors.

– experiment – widely used in creating virtual environments for testing hypotheses [7];

– measurement – is actively used in bioinformatics for accurate estimates of genomic changes [8]. For example, a system for measuring energy consumption at Tesla when testing new batteries.

2. Theoretical methods (analysis, synthesis, modeling, abstraction):

– analysis – used to decipher complex systems, for example, in big data analysis [9]. For example, big data analysis at Amazon to optimize supply chains;

– synthesis – used to collect and combine data in scientific visualizations [10]. For example, combining consumer data at Samsung to create new product models;

– modeling – is actively used to create artificial neural networks [11]. For example, creating models of consumer behavior at Netflix using artificial neural networks.

2) Abstraction – used to create a theoretical framework in meta-analysis [12]. For example, creating theoretical models of risks in the financial activities of Goldman Sachs.

2. By the nature of the research:

1) qualitative (descriptive, symbolic) methods: qualitative methods are focused on a deep understanding of the essence of phenomena and focus on texts, symbols and interpretations. For example, content analysis of customer reviews at Starbucks or analysis of evaluative comments by users of the Airbnb service [13];

2) quantitative (statistical, data processing methods) methods: quantitative methods are based on numerical data and statistical analyzes. For example, Facebook's use of A/B testing to evaluate the effectiveness of new features or Netflix's use of big data analysis to predict the success of movie productions [14].

3. By means of general logical cognition: analytical and synthetic methods:

– Analytical methods are used to break down complex phenomena into parts. For example: analysis of Amazon's sales by market segments [15];

– Synthetic methods ensure that parts are combined into complete systems. For example: synthesizing different data at Microsoft to create new services [16].

2) Induction and deduction:

– Induction is based on the accumulation of individual facts and their generalization. For example, a general conclusion about seasonal sales trends at Zara [17];

– deduction is used to apply general principles to specific cases. For example, the use of general supply models by Apple to organize its supply chains.

Modern trends in the development of science emphasize interdisciplinary methods, digital research techniques (big data, machine learning), and the awareness of the role of subjectivity in scientific knowledge:

– Interdisciplinary methods combine knowledge from different sciences to study complex problems in a comprehensive manner. For example, Google applies interdisciplinary approaches, combining computer science, psychology, and design in the development of user interfaces [18].

– digital research techniques:

1) Big Data: Amazon uses big data analysis to personalize recommendations and optimize logistics, which allows it to effectively predict consumer demand [18; 22];

2) machine learning: Netflix uses machine learning algorithms to create recommendation systems that predict viewer preferences based on their previous views [20; 21].

Modern science recognizes that complete objectivity is unattainable: data interpretation always has elements of subjectivity. At Airbnb, data analysts take into account subjective factors in customer reviews when assessing the quality of services and formulating proposals for service improvement [20].

Despite the existence of numerous classifications of scientific methods, there is a problem of their insufficient compliance with modern scientific challenges. Most

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traditional classifications do not take into account the development of digital technologies, an interdisciplinary approach and the subjective factor in the process of scientific knowledge, which creates difficulties in choosing adequate methodological tools for researchers, reduces the efficiency of research work and complicates interdisciplinary knowledge integration.

Based on the above, we can suggest ways to solve the problem:

1. Update the classifications of scientific methods to reflect the latest advances in digital technologies and interdisciplinary research.
2. Introduction of flexible and adaptive methodological models that allow combining quantitative, qualitative and digital methods.
3. Institutionalization of courses on the methodology of modern scientific knowledge in higher education programs.
4. Development of integrated research platforms that facilitate the use of Big Data, machine learning and interpretive methods simultaneously.

Thus, the classification of scientific methods is a necessary tool for orienting a researcher in a complex system of scientific knowledge. The modern approach requires taking into account the latest technological tools and interdisciplinary connections.

Conclusions

As a result of the study of current trends in the classification of scientific methods, it is established that traditional approaches no longer meet the dynamic conditions of modern scientific practice. The need to revise the methodological foundations is due to the active introduction of digital technologies, the strengthening of the interdisciplinary approach and the recognition of the role of the subjective factor in the cognitive process. The urgency of integrating qualitative, quantitative and digital methods emphasizes the importance of creating new hybrid methodologies.

In particular, the successful application of Big Data and machine learning methods at enterprises (e.g., Amazon, Netflix, Google) demonstrates the effectiveness of combining analytical tools with a deep understanding of human behavior. Companies that implement an interdisciplinary approach are better able to adapt to the complex environment of the modern market.

Therefore, further development of science requires not only the adaptation of existing methods but also the development of new classification models that can take into account the complexity of research objects, the digital transformation of knowledge, and the interconnection of objective and subjective factors.

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