Jete – Journal of Philosophy, Religious and Cultural Studies
ISSN: 3080-1281. eISSN: 3080-6895.

ФИЛОСОФИЯ – PHILOSOPHY – ФИЛОСОФИЯ

Scientific article
IRSTI 02.41.21

https://doi.org/10.32523/3080-1281-2025-151-2-8-24

Epistemological and sociocultural aspects of the technoscience phenomenon

Inkar Jubatchanova

Postgraduate student at Kazan Federal University, Kazan, Russian Federation

jubatchanova@gmail.com

Abstract. The relevance of the research topic is due to the peculiarities and problems of development of modern science related to its impact on nature and society, which entails the need to search for methods, tools and solutions that allow harmonizing the mutual influence of science, technology, nature and man. Modern scientific activity is characterized by an externalistic approach that excludes vertical hierarchy. Here, the agents involved in the scientific process, such as: political and economic institutions, mass media, the public, the scientific community have equal rights. On the one hand, the heteronomy of modern science problematizes the issue of dependence of the creation of scientific knowledge on external factors. On the other hand, horizontal communication of technoscience agents creates a new type of knowledge production (MODE 2), which transforms the ontological and epistemological understanding of reality and the nature of knowledge. Conceptually, MODE 2 comprehends the meaning and empirical contribution of each agent, while acting as a guide to obtaining a new type of knowledge. The phenomenon of technoscience (a modern type of science) operates in a transdisciplinary space, which allows us to mark changes occurring in the socio-cultural context, for example, the emergence of a new class – the precariat, as well as the formation of a group of people voluntarily refusing education and employment (NEET) due to the complexity and uncertainty of understanding the world order.

Keywords: technoscience; transdisciplinarity; contextuality; precariat; actor-network theory; Mode 2; NEET

For citation:
Jubatchanova I. Epistemological and sociocultural aspects of the technoscience phenomenon // *Jete – Journal of Philosophy, Religious and Cultural Studies.* – 2025. – Vol. 151. – No. 2. – P. 8-24. https://doi.org/10.32523/3080-1281-2025-151-2-8-24

Техноғылым құбылысының эпистемологиялық және әлеуметтік мәдени аспектілері

Іңкәр Жубатжанова
Қазан федералды университеті аспиранты, Қазан, Ресей Федерациясы

Эпистемологические и социокультурные аспекты феномена технонаука

Инкар Джубатчанова
Казанский Федеральный университет, Казань, Российская Федерация

Аңдатпа. Зерттеу тақырыбының өзектілігі оның табиғат пен қоғамға әсерімен байланысты. Қазіргі ғылымның даму ерекшеліктері – бұл ғылымның, техниканың, табиғат пен адамның өзара әсерін үйлестіруге мүмкіндік беретін әдістерді, құралдарды және шешімдерді іздеу қажеттілігін туындатады. Қазіргі ғылыми қызмет тік иерархияны жоққа шығаратын экстернистік көзқараспен сипатталады. Ғылыми процеске қатысатын агенттер, мысалы, саяси және экономикалық институттар, бұқаралық ақпарат құралдары, қоғам, ғылыми қоғамдастық тең құқықтарға ие. Бір жағынан, қазіргі ғылымның гетерономиясы ғылыми білімді құрудың сыртқы факторларға тәуелділігі мәселесін проблема ретінде қояды. Екінші жағынан, техноғылым агенттерінің көлденең байланысы шындық пен білімнің табиғатын онтологиялық және гносеологиялық түсінуді түрлендіретін білім өндірісінің жаңа түрін (2-РЕЖИМ) қалыптастырады. 2-РЕЖИМ тұжырымдамалық тұрғыдан білімнің жаңа түрін алу үшін нұсқаулық ретінде әрекет ете отырып, әрбір агенттің мәні мен эмпирикалық үлесін түсінеді. Техноғылым феномені (ғылымның заманауи түрі) әлеуметтік-мәдени контексте болып жатқан өзгерістерді, мысалы, жаңа таптың – прекариаттың пайда болуын, сондай-ақ дүниенің күрделілігіне байланысты білім мен жұмысқа орналасудан өз еркімен бас тартатын адамдар тобының (NEET) қалыптасуын белгілеуге мүмкіндік беретін трансдисциплинарлық кеңістікте әрекет етеді.

Түйін сөздер: техноғылым; трансдисциплинарлық; контекстік; прекариат; акторлық-желі теориясы; Режим 2, NEET

Аннотация. Актуальность темы исследования обусловлена особенностями и проблемами развития современной науки. Развитие конвергентных технологий влечет за собой необходимость поиска способов, инструментов и решений, позволяющих гармонизировать взаимовлияние науки, технологии, природы и человека. Современная научная деятельность характеризуется экстерналистским подходом, исключающим вертикальную иерархию. Здесь агенты, задействованные в научном процессе, такие, как политические и экономические институты, средства массовой информации, общественность, научное сообщество, обладают равными правами. С одной стороны, экстерна-лизм современной науки проблематизирует вопрос зависимости научного знания от внешних факторов. С другой стороны, горизонтальная коммуникация агентов технонауки создает новый тип производства знания (РЕЖИМ 2), который трансформирует онтологическое и эпистемологическое понимание реальности и природу знания. Концептуально РЕЖИМ 2 осмысляет значение и эмпирический вклад каждого агента, выступая при этом руководством по получению нового типа знания. Феномен технонауки (современного типа науки) работает в трансдисциплинарном пространстве, что позволяет маркировать изменения, происходящие в социокультурном контексте, например, зарождение нового класса – прекариат, а также появление группы людей, добровольно отказывающихся от образования и трудоустройства (NEET) в виду сложности и неопределенности понимания мироустройства.

Ключевые слова: технонаука; трансдисциплинарность; контекстуальность; прекариат; акторно-сетевая теория; Режим 2, NEET

Introduction

Today there are serious changes in the epistemology of modern science. There is a disproportionate development between theoretical and empirical science within the framework of research activities, where the leading position remains with the latter. This imbalance, which highlights the practical aspects of science, serves as one of the reasons for the emergence of a new type of knowledge. Cooperation between modern science and business leads to the commercialization of scientific and technological activities, which is becoming standard practice in society. The processes occurring in the scientific space indicate that modern science takes the form of technoscience, characterized by the integration of convergent technologies and scientific research. The development of technoscience transforms societal perceptions of science, emphasizing the effectiveness of scientific achievements.

Several conceptual frameworks describe the phenomenon of technoscience. Currently, there is no consensus among scientists regarding the status of technoscience. Some researchers insist that technoscience does not represent anything fundamentally distinct from classical science, arguing that it remains embedded within the scientific domain and employs traditional methodological tools (Gorokhov, 2008). Other scholars assert that technoscience reconstructs scientific methodology, emphasizing its transdisciplinary nature, wherein the outcomes of scientific activities directly impact society and influence social processes. This perspective positions the human being, including the individual's inner world and existential experience, as the central object of technoscientific inquiry. In previous research, the author of this article has stated that " the product of the interaction between modern science and society is the information society, which is not viable without innovative technologies. Information containing knowledge becomes another form of commodity, thus transforming relationships within politics, economics, culture, and society. Therefore, scientific knowledge is not just an artifact, but a "hidden social mass" that encompasses societal morality significantly influencing social relationships" (Dzhubatchanova, 2024:108).

The post-academic form of science, currently represented by technoscience, demonstrates high rates of development, forming a complex system composed of various actors, and this system is presented as a new reality. In this regard, technoscience serves as a central theme for socio-philosophical disciplines.

Thus, the purpose of this article is to provide sufficient evidence to prove the impact of techno-science on sociocultural space and ways of acquiring knowledge. The interrelation of technoscience and modern digital society is a trend, thus arousing the interest of the scientific community.

Methods

The theoretical foundation of this research comprises the principles of comprehensiveness and complementarity.

The primary methods employed in this study include socio-philosophical analysis, dialectical methodology, systemic approach, comparative analysis, synthesis, and hermeneutic interpretation. Additionally, works in the philosophy of technology, ontology, and epistemology

were utilized. The methodological basis is the transdisciplinary approach, which is one of the key characteristics of technoscience.

Modern science has emerged through a decisive break from the ancient worldview based on the revolutionary notion, remarkable for its time, of an absolute separation between the knowing subject and a reality that was presumed to exist independently from the observer.

On the one hand, this rupture allowed science to evolve independently from theology, philosophy, and culture: the only knowledge considered worthy of its name had to be scientific and objective, and the sole reality acknowledged was, naturally, objective reality governed by objective laws. All knowledge distinct from scientific knowledge thus became categorized as subjective. However, objectivity, upheld as the highest criterion of truth, has an inevitable consequence – the transformation of the subject into an object. The "death of the subject" is the price paid for objective knowledge. Consequently, the human being became an object – subject to exploitation by others, and an object of scientific experiments and research, undergoing dissection, formalization, and manipulation.

At the same time, science has always served as a fundamental axis of human evolution, not only biologically but also socially. Owing to science, which continually provides new elements compelling the individual to experience daily life in a different, more comprehensible manner, personal development and adaptive capacity are enhanced.

In the second half of the 20th century, the concept of transdisciplinarity emerged, evolving into something beyond mere criticism of disciplinary structures. Transdisciplinarity became recognized as a research method applicable to real-world problems that require ethical reflection and unconventional solutions. Specifically, transdisciplinarity addresses issues that simultaneously exist between different disciplines and extend beyond the boundaries of all disciplines, aiming at comprehending the modern world, wherein the unity of knowledge constitutes one of its central imperatives.

The transdisciplinary approach in scientific research brings together experts from various fields for a period defined by the effectiveness of their collaboration. Such research fosters the transfer of methodologies from one discipline to another, thereby producing fundamentally new knowledge. Examples include convergent NBICS technologies, in which cognition and creation are inseparably connected. Notably, transdisciplinarity relies equally upon fundamental and empirical data, and research outcomes are realized during the process itself, not merely upon its completion. Penicillin, artificial sweeteners, pacemakers, and X-rays exemplify this characteristic.

Social development is structured based on a transdisciplinary approach: temporary groups are formed with the specific aim of identifying and addressing social issues, and upon completion of their tasks, these groups disband (Nicolescu, 2010).

Consequently, the current stage of scientific development can be defined as "technoscience," owing to the unprecedented convergence of science and technology. This study aims to examine how technoscience influences society within epistemological and socio-cultural contexts.

MODE 2

Technoscience emerges and takes shape within inherently unstable and fluid conditions, in which the principle of causality becomes a crucial and indispensable factor for the achievement

of scientifically and socially relevant outcomes. This instability manifests in a variety of ways, including, but not limited to, uncertainty in research results, lack of reproducibility, and an inconsistent level of interest and support from key external stakeholders - such as business enterprises, government agencies, and other institutional actors. In light of such conditions, it can be suggested that technoscience is characterized less by universal knowledge and more by, context-sensitive insights.

In its canonical and traditional configuration, science has typically grounded itself in the pursuit of universal principles and truths. In contrast, technoscientific knowledge is marked by its interpretative flexibility and dependence on the specific contexts in which it is generated and applied. This distinction is elaborated upon in the conceptual framework of a new model of knowledge production known as MODE 2. To fully comprehend the conceptual significance of MODE 2, it is necessary to first delineate the foundations of MODE 1. The authors of the MODE 2 framework emphasize that there are no clearly defined or rigid boundaries that neatly distinguish one mode from the other.

This lack of clear demarcation mirrors the position held by some scholars who view technoscience as a subcomponent of science, rather than as a distinct paradigm with its own theoretical foundations. Nonetheless, the accumulation of empirical data and emerging patterns of knowledge generation point toward the development of novel modes of cognition and forms of social communication that cannot be fully captured by the epistemological logic of MODE 1.

The production of knowledge under MODE 1 aligns closely with the traditional conception of scientific inquiry. It is characterized by elements such as the pursuit of verifiable truth, hierarchical organization of expertise, adherence to disciplinary boundaries, institutional validation, and the ideal of detached objectivity. By contrast, MODE 2 rejects these attributes in favor of a set of principles that include transdisciplinarity, contextual relevance, heterogeneity, and practical applicability.

The diversity of actors involved in knowledge production - combined with the transdisciplinary structure of MODE 2 - encourages a multiplicity of approaches that are explicitly aimed at achieving real-world impact. In this framework, knowledge producers are no longer confined to academic institutions. Instead, they include a wide range of societal participants - engineers, startup innovators, design firms, bloggers, independent researchers, and artisans - who contribute contextually grounded information, both in digital environments and in tangible real-world contexts.

This shift has facilitated the rapid expansion of practice-based knowledge and the proliferation of highly specialized fields that are oriented toward solving concrete problems. The growing influence of knowledge that is dependent on causal and practical considerations resonates with the economic principle that “demand creates supply.” As a result, this form of knowledge contributes to the transformation and reorganization of various social institutions. The authors of MODE 2 conceptualize such knowledge as being “socially distributed,” emphasizing its emergence from diverse sources and actors.

Higher education institutions, by contrast, remain deeply rooted in disciplinary traditions and hierarchical structures, positioning themselves as guardians of authentic and validated

knowledge. This alignment with MODE 1 remains strong. However, to preserve their relevance and maintain academic credibility, universities are increasingly compelled to compete with new knowledge-producing actors operating within the MODE 2 paradigm. This competitive dynamic has driven significant changes in university systems, including the growth of applied disciplines and hybrid fields that exist at the interface of MODE 1 and MODE 2 (Nowotny et al., 2001).

Mastery of causal, context-driven knowledge and its practical implementation is increasingly viewed as a sign of advanced professional competence. The scope and depth of context-specific knowledge in a given domain now correlates directly with the level and sophistication of the competencies acquired. This evolution has led to a reconceptualization of professionalism itself, which is now seen as a constellation of specialized skills, practical experience, and adaptive knowledge.

In earlier studies, the author of this article observed that "a focus on competencies requires the development of domain-specific terminologies, which serve not only functional purposes within a given field but also facilitate the commercialization of educational services in that area. MODE 2 introduces a distinctive lexicon that highlights the interconnectedness of science and society, effectively bridging domains traditionally regarded as separate - such as internal academic discourse and external societal engagement. For instance, the concept of 'strategic research' is foundational to the scientific enterprise, yet in the context of MODE 2, it becomes destabilized due to external pressures such as political interests, economic incentives, sustainability objectives, utilitarian demands, and concerns about competitiveness. Another pertinent example is that of 'targeted research,' which embodies the core MODE 2 principles of reflexivity and social responsibility, as such research must be accountable to the broader public" (Dzhubatchanova, 2023:25).

Scientific activity in the realm of technoscience is increasingly driven by the imperative to deliver effective and usable solutions, regardless of the level of epistemological or methodological depth involved. The primary aim is to demonstrate immediate utility to end-users and stakeholders - effectively generating knowledge that can be monetized. This emphasis on applied outcomes contributes to the spread of a consumerist societal model and accelerates the development of areas such as information technology, biomedical innovation, and services aimed at improving the quality of life (Adamowsky et al., 2011).

The directed nature of applied research and its concrete deliverables - be they products, services, or technological systems - also engenders feedback loops from society. Russian philosopher O.N. Yanitsky has argued that scientific inquiry is increasingly merging with business practices, resulting in the proliferation of a knowledge-capital model that transforms society. One can observe this shift in the rising number of professionals practicing independently in various sectors - for example, the increase in private medical centers in healthcare and the growing number of freelance tutors and consultants in education (Yanitsky, 2020:147).

Additionally, the commercialization of knowledge has led to the fragmentation and diversification of tasks within a single field, producing numerous specialized spin-offs. As knowledge becomes more contextualized, new professions and areas of expertise emerge, reinforcing the demand for subject-matter experts. This, in turn, elevates the role of expert knowledge and specialized authority.

However, this transition is accompanied by significant challenges. Many emerging domains are transdisciplinary in nature and fall outside the normative scope of traditional ethical frameworks. As a result, there is a growing need to develop new ethical paradigms across various disciplines - such as bioethics, cyberethics, technoethics, and roboethics - to address the novel dilemmas posed by innovation.

Unfortunately, these new ethical systems often lag far behind technological advancements. This delay contributes to a situation where technology dominates over human-centered values. In the case of bioethics, for instance, formal indicators of life's value emerge that influence not so much human spirituality as financial and regulatory practices. Adherence to bioethical standards in scientific publishing, for example, may not reflect the moral integrity of the individual researcher but rather compliance with formal requirements. Consequently, many of the newly developed ethical frameworks remain largely procedural and formalistic in nature. Moreover, following such standards often incurs financial costs, which in turn point to a deeper commercial foundation (Frolov & Yudin, 2009).

In conclusion, MODE 2 should be regarded as an essential framework for understanding the development of technoscience. It not only opens science to wider participation but also establishes a structured environment for interaction among state bodies, laboratories, funding institutions, and other stakeholders. Through this framework, the conditions necessary for the ongoing advancement of contemporary science and the integration of technoscience into society have been comprehensively articulated and operationalized.

Media as an actor of technoscience

The phenomenon of technoscience, which emerged in the last century, is now perceived as the face of science – its driving force – pushing fundamental science into the background. Every action produces effects, which may be either visible or invisible, immediate or requiring time to manifest. The fusion of science and technology into a unified mechanism that constitutes technoscience, as an action, generates a variety of effects – social, economic, ethical, and others – each differing in nature and scope.

Technoscience represents the culmination of the transition toward an activist model of science, resulting in a fundamental revision of the relationship with nature as an object of study - thereby reshaping the stages of scientific activity. This shift has altered the principal actors in the development of scientific knowledge: the traditional chain of "science – technique – technology" has been replaced by a new configuration of "technology – society." As a result, the influence of science, technology, and engineering on social life has undergone significant transformation.

The outcomes of scientific and innovative activities have become increasingly accessible to society, primarily through the mediatization of science and the materialization of research results in the form of technological devices. The modernization of tools and technologies has become the primary indicator of progressive societal development. Contemporary civilization is more dependent on innovative techno-technological solutions than any prior epoch. These innovations not only restructure material processes and generate new materials, but also

penetrate the spiritual domain, influence cognitive functions, and shape value systems and worldviews (Kordonsky, 2002:79). Unlike science, technology has become the principal driving force of modern civilization (Shcherbakov, 2021:169).

However, the adoption of new technologies is not possible without a sufficient level of knowledge; thus, modern society experiences not only technological dependency but also epistemic dependency. This epistemic dependency can be described by the following formula: an original speaker S1 sees that p and informs S2; S2, in turn, informs S3, and so on until Sn conveys the proposition p to an audience A. In the case of technoscience, this dependency is constructed and mediated by media resources (Filatov et al., 2018).

As previously demonstrated, the formation and development of technoscience involves a multitude of actors, each with their own specific functional orientation, collectively constituting the essence of technoscience. Bruno Latour illustrates the significance of media within the system of technoscientific actors using the example of the development of an anthrax vaccine. In this case, the media's role was not educational but rather promotional, aimed at attracting investment. Moreover, the example shows how scientific language is translated into a simplified, more accessible form – an essential feature of the technoscientific phenomenon (Latour, 2002:214). The advertising of scientific achievements and the simplification of scientific discourse help foster public trust in the product and generate consumer interest.

Russian scholars interpret technoscience through its subject-based components. Philosopher B.G. Yudin identifies five key agents of technoscience: the scientific community, the state apparatus, business structures, mass media, and society at large – each of which occupies a central role in the formation and development of technoscience. In broader terms, mass media encompasses all forms of representation of scientific research activities, including advertising. The advertising industry, by directly influencing consumer demand, exerts subtle pressure and acts as a lever for social control (Yudin, 2010:60).

Since the 1950s – a period marked by major scientific breakthroughs – media resources have begun to serve as a bridge between the scientific community and the public, as societal interest in science grew dramatically. Notably, this initial interaction between science and mass media was primarily educational in nature (Latour, 2013:203). Newspapers, magazines, and radio served as intermediaries in the transmission of scientific knowledge, compensating for the scientific community's detachment from society. Scientists often employed terminology comprehensible only within their specialized circles, which alienated the public. In response, the media simplified and adapted scientific information for broader audiences, thereby sparking public interest in science. However, this process often resulted in errors, with the original semantic meanings of terms being lost during translation.

In the 1990s, the concept of mediatization (or mediation) entered scientific discourse, denoting the integrative role of media in relation to other social institutions. As L.A. Pronina observes, "information culture penetrates all spheres of social life, becoming a necessary condition for their functioning" (Pronina, 2008:77). In this context, it is also important to note that the mediatization of science – through the coverage of scientific and technological advancements in mass media – transforms science itself, making it increasingly media-oriented (Gureeva, 2016).

The development of technoscience has profoundly transformed media culture, relocating all media resources into the digital realm. As a result, traditional print media have been largely replaced by their digital counterparts. Technology has thus enabled a proliferation of opportunities both for accessing content and for producing it. In other words, within the digital environment, all actors can become not only consumers of informational content but also their creators. A clear example of this is the open-access online encyclopedia Wikipedia, based on wiki principles, which allows anyone to edit or add articles (Savchuk, 2013). This phenomenon reflects the nature of knowledge production in MODE 2, where the processes of creation and understanding are intertwined. Based on the above, several social consequences of the development of technoscience can be identified.

Firstly, there is a noticeable departure from the principle of truth as the foundation of scientific knowledge, replaced by the emphasis on the effectiveness of scientific and technological achievements. This shift leads to a reevaluation of the values of academic science, manifested in the growing contestation and skepticism toward the results of scientific activity – both within the scientific community and among external actors.

Secondly, the increasing popularity of scientific information in the media sphere influences its narrative presentation. Media discourse intrudes into scientific vocabulary, rendering it more accessible. However, the simplification of scientific language can have detrimental consequences. Using the "slippery slope" metaphor, one can observe how the simplification or misinterpretation of a scientific term can result in adverse societal effects. A striking example is the term evolution, which, at the turn of the 19th and 20th centuries, underwent interpretive shifts in the social sciences, eventually giving rise to the concept of "social Darwinism." This notion was later used to justify Nazi eugenics. Another example is the term race, rooted in biology and anthropology, which, when subject to distorted interpretations, led to pseudoscientific theories of biological racial inequality.

This issue was addressed by the author in a previous study, where it was noted that “in discursive practices, the process of simplifying scientific knowledge is defined in various ways: tabloidization and scientification. Ultimately, this process may take the form of infotainment, a hybrid of information and entertainment. Infotainment offers no guarantee of the reliability of scientific information. Pseudoscience may present itself either as infotainment or as manipulative content designed to retain user interest in a specific topic. Within the media environment, a competitive struggle unfolds between scientific and pseudoscientific content; however, users are often unaware of this divide and tend to choose between interesting, accessible science (often pseudoscience) and complex, less engaging science” (Dzhubatchanova, 2024:82).

Thirdly, the digitalization of media culture has significantly transformed the process of mediating science, altering the model of interaction between information carriers and society. At this stage, the interaction takes the form of a dialogue, while media agents continue to maintain authority. Considering the media as one of the key actors in technoscience, it becomes evident that mass media are gaining a form of latent power over society. This trend can be observed in the rise of various mass cultural movements such as consumerism, anti-consumerism, minimalism, eco-activism, feminism, and others (Yudin, 2018).

The development of technoscience has led to media permeating the film industry, literature, music, video game design, and comic book production. This process blurs the boundaries

between creative activity and the creation of media-driven images, ultimately offering society consumable products (Yanitsky, 2020). The expansion of information dissemination channels in the digital environment increases both the volume and the diversity of media audiences. Society has become a mass consumer of digital media content, enabling mass media to shape needs, instill habits, create dependencies, and exert psychological pressure on individuals at the level of their existential experience.

This influence occurs through the alienation of personal data or through the analytics of user-generated queries on the Internet. Whereas governmental institutions exercise societal control through legislation, the media exerts influence over desires and behavioral patterns at a subtle, often unperceived level.

Social implications of the development of technoscience

With each successive year, a steadily growing array of economic sectors drawn from virtually every corner of human industry - manufacturing, services, agriculture, creative trades, and even public administration - tilts ever more decisively toward models of vigorous business activity and overt commercialization. One compelling piece of evidence attesting to this all-encompassing trend is the dramatic proliferation of specialized recruitment and head-hunting agencies that focus almost exclusively on sourcing, vetting, and placing personnel for profit-oriented enterprises. Simultaneously, the ongoing capitalization of knowledge in every scholarly and professional domain is accelerating, prompting society to renegotiate what it values in human life and ushering in a suite of novel ethical frameworks. These frameworks increasingly treat material prosperity and spiritual fulfillment as co-equal - or at least mutually exchangeable - goods.

A sizeable segment of the global population now devotes substantial energy to maximizing the financial productivity of personal assets, ranging from real estate and securities portfolios to self-branding on digital platforms. This widespread preoccupation has, in turn, contributed to the gradual erosion - or at minimum the blurring - of the once-clear contours that defined the twentieth-century middle class. During the industrial era, that class consisted predominantly of proletarian factory workers and salaried wage laborers with relatively stable employment. In contrast, the contemporary social landscape is evolving in a nonlinear, recursive fashion: income brackets stretch and overlap, job descriptions mutate rapidly, and career trajectories rarely fit tidy statistical categories. Consequently, measuring or even defining "the middle class" with precision becomes ever more challenging. New business models, powered by algorithmic finance and platform economies, can rapidly magnify an individual's earning capacity - yet they also introduce heightened volatility. A paradox therefore emerges: while people still strive for financial freedom, long-term stability, and an enhanced quality of life, the very pathways they follow have become inherently precarious. Indeed, the closer one appears to achieving fiscal security, the greater the exposure to sudden market fluctuations or technological disruptions that could erase hard-won gains.

Turning briefly to global well-being metrics, the World Happiness Report - which blends qualitative sociological surveys with quantitative indicators such as life expectancy, perceived

safety, and social support - offers additional insight. According to the 2025 edition, Finland and Denmark once again top the list of the world's "happiest" nations (Helliwell J. F. et al., 2025). These Scandinavian countries excel not only in gross domestic product per capita and robust social-welfare systems but also rank near the pinnacle for innovation capacity, digital readiness, and ecological resilience. The data suggest a strong correlation: sustained economic health and a comfortably livable environment exert a measurable, positive influence on citizens' subjective sense of life satisfaction. From this one can reasonably infer that financial well-being serves as more than an external badge of success; over time, it reshapes psychological outlooks and even recalibrates personal moral and spiritual priorities.

At the same time, mainstream science, as well as broader cultural narratives, are displaying waning interest in humanity per se - inherent dignity, pure contemplation, or universal moral worth - and redirecting their curiosity toward the quantifiable range of human capabilities and latent potentials. This shift, largely subterranean and not always recognized by everyday observers, manifests concretely in the formation of new quasi-classes. A prime example is the precariat: men and women who, often by necessity but sometimes by choice, accept irregular, short-term, or platform-mediated employment, thereby relinquishing many conventional protections of long-term labor contracts. Yet their overarching aspiration mirrors that of more established strata: to secure sufficient financial autonomy to craft a stable and comfortable life. Crucially, the precariat traverses demographic boundaries - it may include gig-economy couriers, freelance coders, adjunct academics, or seasonal agricultural hands - making it difficult to demarcate neatly from either the shrinking middle class or the working poor.

Broader transformations in socio-labor relations stem from several intersecting drivers, with rapid technological advancement ranking foremost. Constant breakthroughs in robotics, artificial intelligence, additive manufacturing, and digital logistics demand continual reskilling and upskilling from the workforce. Concurrently, these same breakthroughs fuel steady job displacement as automated systems assume tasks once performed by humans. Hence, employment in the twenty-first century is defined less by permanent positions and more by serial projects, contractor agreements, or algorithm-assigned "gigs." Job security, viewed across both short and long planning horizons, has become the exception rather than the norm.

The expanding precariat also resonates conceptually with the VUCA framework - Volatility, Uncertainty, Complexity, Ambiguity - which many analysts use to characterize today's geopolitical and economic climate. In synergetic terms (Smirnov, 2022: 162), the labor market now behaves as a nonlinear, far-from-equilibrium system that is exquisitely sensitive to fluctuations in global supply chains, currency valuations, and data-driven consumer trends. A fragmented worldview, reinforced by social-media echo chambers, pushes individuals to prioritize causal, short-term knowledge over grand explanatory theories - precisely the knowledge-production dynamic described by the scholars of MODE 2 (Kozin S. V., Zhidiayeva, 2025).

Parallel to the precariat, the early twenty-first century witnessed the rise of another socio-economic designation: NEET - young people "Not in Employment, Education, or Training." Coined in the United Kingdom and later institutionalized across European-Union reportage, the term typically embraces individuals between fifteen and twenty-four who are neither studying nor working (Toshchenko, 2020). Like precarity, the NEET phenomenon is intertwined with technoscience: as specialized knowledge fragments, many adolescents and young adults struggle to perceive clear vocational pathways that feel attainable or meaningful. Simultaneously,

relentless exhortations to remain hyper-mobile, flexible, and permanently reachable via digital platforms can generate existential paralysis - a fear of choosing "the wrong" option in a swiftly changing world. All the while, ever-accelerating automation amplifies competitive pressure by making entry-level positions scarcer.

Despite these headwinds, targeted policy interventions can yield positive results. In Kazakhstan, for instance, government statistics indicate a meaningful decline in the NEET share of youth during 2024. This improvement followed the launch of industry-aligned certificate programs and practice-oriented curricula developed jointly by universities and the Ministry of Science and Higher Education. By tailoring course content to the precise talent gaps identified by commercial enterprises and municipal agencies, educators successfully re-engaged thousands of young people who had previously hovered outside both classrooms and job markets (Bureau of National Statistics RK, 2024).

Taken together, these interconnected developments - commercialization of virtually every sector, ethical recalibrations around wealth, erosion of middle-class boundaries, proliferation of precariat and NEET identities, and technological forces reshaping labor - compose a complex mosaic. Policymakers, corporate leaders, and civil-society actors alike must grapple with the dual imperative of harnessing technoscientific dynamism for collective prosperity while simultaneously devising safeguards that mitigate volatility, cultivate inclusive opportunity, and preserve a sense of human dignity amid perpetual flux.

Conclusion

Drawing on the discussion presented above, it becomes evident that one of the principal underlying forces propelling technoscientific progress within the broader spectrum of socio-cultural and institutional transformations is the financial dimension. While this factor may not always manifest explicitly on the surface, its influence is clearly reflected in the ultimate direction and outcomes of these transformations. Financial processes, operating as key agents within the structure of contemporary science, have gradually come to exert considerable influence over various domains of social life.

Simultaneously, fundamental science continues to play a crucial role in responding to societal needs and expectations. By aligning itself with these external demands, it assists in stabilizing and legitimizing financial control mechanisms, rendering them more nuanced and adaptable to public discourse. This dynamic results in the illusion that society itself guides and governs the development and deployment of new technologies. To a limited extent, this perception contains elements of truth; yet, in most practical cases, a flexible but nonetheless one-directional system of control is maintained, predominantly by commercial institutions.

This subtle form of asymmetrical influence persists largely unchallenged due to the existence of a continuous and seemingly collaborative dialogue between technoscientific institutions and the broader public sphere. Because this interaction does not take the form of overt coercion, but rather of alignment and co-evolution, individuals often do not perceive the authoritative power held by technoscientific actors as oppressive. Instead, what occurs is a form of voluntary alignment with, and submission to, the prevailing imperatives of technological innovation and development.

Given that technoscience remains an evolving and dynamic domain, the actors that constitute and drive it are likewise in a continuous state of transformation. On the one hand, this evolution may be understood as the autonomous and internal development of distinct institutional or disciplinary elements. On the other hand, it increasingly involves the blending and mutual penetration of various actors and sectors - one of the most illustrative examples being the media. Initially, media outlets operated largely as intermediaries, tasked with transmitting the outcomes of scientific and technological advancements to the general public. Their role involved simplifying complex terminology and converting scientific findings into language that was comprehensible and relevant to non-specialist audiences.

Over time, however, the role of media evolved significantly. No longer confined to their traditional mediating function, media organizations began to inhabit a more ambiguous space, where the boundary between science and pseudoscience became increasingly difficult to delineate. This blurring of lines gave rise to a new form of content production and consumption commonly referred to as infotainment. The continued evolution of scientific practices further compelled media institutions to adopt strategies of transmediality - disseminating information across a variety of platforms in both linear and nonlinear formats.

This progressive transmedial expansion has served to deepen society's epistemological dependency, as the public increasingly relies on media narratives to understand complex scientific phenomena. Subtle transformations in the structure and function of media platforms have resulted in the emergence of new mechanisms of social influence and control. In many ways, media now manage access to the key indicators and resources necessary for ensuring individuals' well-being and social integration. Since contemporary society has willingly provided detailed and extensive data about its needs, behaviors, and preferences, media infrastructures are able to tailor content - be it informational, educational, scientific, political, or entertainment-focused - with increasing precision and psychological impact.

In response to these complex and evolving social challenges, one viable approach involves the reorientation of both individual consciousness and cultural norms toward a modern paradigm of knowledge production - namely, MODE 2. This framework eschews the rigid institutionalization of knowledge as well as traditional hierarchies of authority. In its place, it offers a more decentralized and open-ended model of cognition and understanding. Within this structure, knowledge assumes a hypertextual character, and the process of acquiring knowledge is no longer bound by a fixed number of sources, but instead flows across networks and platforms of virtually unlimited diversity.

As a result, the way individuals cognitively perceive and interpret the world undergoes a fundamental transformation. The influence of this new mode of thinking extends deeply into every dimension of socio-cultural life, including education, labor, governance, identity, and communication. Consequently, the emergence of new social strata and differentiated population groups becomes increasingly apparent. These transformations mark not only a shift in social composition, but also a redefinition of what it means to participate in society, to acquire knowledge, and to engage with the future.

Conflict of interest

The author declares no conflict of interest.

Литература

Adamowsky N. et al. History and Philosophy of Technoscience.

Buchert, L. Linkages Revisited. Higher Education and Development Cooperation - An Assessment. High Educ Policy. –1997. – № 10 – С.93–94. https://doi.org/10.1016/S0952-8733(97)89701-2

Gibbons M., Nowotny H. The potential of transdisciplinarity //Transdisciplinarity: Joint problem solving among science, technology, and society: An effective way for managing complexity. – Basel: Birkhäuser Basel, 2001. – 332 с.

Helliwell J. F. et al. World happiness report 2025. – 2025.

Joslyn C. S. Sorokin on social mobility //The Quarterly Journal of Economics. – 1927. – Т. 42. – №. 1. – С. 130-139.

Manyika J. et al. Harnessing automation for a future that works //McKinsey Global Institute. – 2017. – С. 2-4.

Nicolescu B. Methodology of transdisciplinarity: Levels of reality, logic of the included middle and complexity. Transdiscipl. J. Eng. Sci. – 2010. –№1. – P. 17–32.

Nordmann A., Radder H., Schiemann G. (ed.). Science transformed?: Debating claims of an epochal break. – University of Pittsburgh Press, 2011.– 213 с.

Nowotny H. et al. Re-thinking science: Knowledge and the public in an age of uncertainty. – Cambridge: Polity, 2001. – 228 с.

Nowotny H., Scott P., Gibbons M. Wissenschaft neu denken //Wissen und Öffentlichkeit in einem Zeitalter der Ungewissheit. Weilerswist: Velbrück. – 2004.– 339 с.

Выровцева Е.В. Инфотеймент в научно-популярной обучающей коммуникации: стратегии вовлечения и вовлеченности //Цифровая журналистика: технологии, смыслы и особенности творческой деятельности. – Екатеринбург, 2024. – 2024. – С. 315-317.

Горохов В.Г. Проблема технонауки - связь науки и современных технологий //Философские науки. – 2008. – №. 1. – С. 33-57.

Гуреева А.Н. Теоретическое понимание медиатизации в условиях цифровой среды //Вестник Московского университета. Серия 10. Журналистика. – 2016. – №. 6. – С. 192-208.

Джубатчанова И. Феномен технонауки с точки зрения процессуальной рациональности // Казанский социально-гуманитарный вестник. – 2024. – №. 1 (64). – С. 107-112.

Джубатчанова, И. Процесс медиатизации технологизированной науки / И. Джубатчанова // Философия в XXI веке: новые стратегии философского поиска: Сборник статей X научной конференции студентов, аспирантов и молодых ученых, Москва, 05–09 декабря 2022 года. – Москва: ООО "МАКС Пресс", 2024. – С. 81-84. – EDN ISPNRJ.

Джубатчанова, И. Трансдисциплинарность как важнейшая характеристика технонауки / И. Джубатчанова // Основы экономики, управления и права. – 2023. – № 4(39). – С. 24-26. – DOI 10.51608/23058641_2023_4_24. – EDN EJQCNA.

Козин С.В., Жидяева Т.П. Новые знания в изучении российского прекариата (рецензия на книгу: Жизненный мир работников: устойчивость versus прекарность /под ред. Ж.Т ТОЩЕНКО. М.: Весь мир, 2024. 462 с.) //Наука. Культура. Общество. – 2025. – Т. 31. – №. 1. – С. 85-93.

Кордонский С. Кризисы науки и научная мифология //Отечественные записки. – 2002. – №. 7. – С. 71-82.

Латур Б. Дайте мне лабораторию, и я переверну мир / пер. с англ. П. Куслий // Логос. - 2002. – № 5– 6 (35) – С. 211-242.

Латур Б. Наука в действии: следуя за учёными и инженерами внутри сообщества / пер. с анг. К. Фёдоровой; научн. ред. С. Миляева. – СПб.: Издательство Европейского университета в Санкт-Петербурге, 2013. – 414 с.

Пронина Л.А. Информационная культура как фактор развития информационного общества // Аналитика культурологии. – 2008. – №. 10. – С. 75-91.

С.Г. Валерий Савчук. Медиа внутри нас // Вестник культурологии. 2013. №2 (65). URL: https://cyberleninka.ru/article/n/valeriy-savchuk-media-vnutri-nas (дата обращения: 01.05.2021).

Смирнов Р. К. Социально-философский анализ прекариата как "могильщика" пролетариата // KANT. – 2022. – №. 4 (45). – С. 161-165.

Столярова О.Е. «Исследования науки и технологии» (STS): Философское введение. – 2016. Тощенко Ж.Т., Анисимов Р. И., Кученкова А. В. Прекариат: становление нового класса:

коллективная монография //М.: Центр социального прогнозирования и маркетинга. – 2020. – Т. 400.

Филатов В.П. и др. История и философия науки в эпоху перемен: сборник научных статей. – 2018.

Фролов И.Т., Юдин Б.Г. Этика науки: Проблемы и дискуссии. 2 е изд., перераб. и доп. //М.: Кн. дом «ЛИБРОКОМ. – 2009.

Щербаков П.С. Аддитивные технологии: философские и практические аспекты // Исторические, философские, методологические проблемы современной науки. – 2021. – С. 168-172.

Юдин Б.Г. О человеке, его природе и его будущем //Человек. Ru. – 2018. – №. 13. – С. 235-250. Юдин Б.Г. Об этосе технонауки //Философские науки. – 2010. – №. 12. – С. 58-66.

Юдин Б.Г. Перспективы человека: между прошлым и будущим //Человек и его будущее: Соотношение новых технологий и возможностей человека. – 2012. – С. 44-57.

Яницкий О.Н. Диалог науки и общества // Общественные науки и современность. 2004. № 6. С. 86–96.

Яницкий О.Н. Технонаука: природные, социальные и технологические последствия // Социологические исследования. 2020. Том 46. № 6. С. 145-154.

References

Adamowsky N. et al. History and Philosophy of Technoscience.

Buchert, L. Linkages Revisited. Higher Education and Development Cooperation - An Assessment. High Educ Policy. –1997. – № 10 – C.93–94. https://doi.org/10.1016/S0952-8733(97)89701-2

Gibbons M., Nowotny H. The potential of transdisciplinarity //Transdisciplinarity: Joint problem solving among science, technology, and society: An effective way for managing complexity. – Basel: Birkhäuser Basel, 2001. – 332 c.

Helliwell J. F. et al. World happiness report 2025. – 2025.

Joslyn C. S. Sorokin on social mobility //The Quarterly Journal of Economics. – 1927. – Т. 42. – №. 1. – С. 130-139.

Manyika J. et al. Harnessing automation for a future that works //McKinsey Global Institute. – 2017. – С. 2-4.

Nicolescu B. Methodology of transdisciplinarity: Levels of reality, logic of the included middle and complexity. Transdiscipl. J. Eng. Sci. – 2010. –№1. – P. 17–32.

Nordmann A., Radder H., Schiemann G. (ed.). Science transformed?: Debating claims of an epochal break. – University of Pittsburgh Press, 2011.– 213 c.

Nowotny H. et al. Re-thinking science: Knowledge and the public in an age of uncertainty. – Cambridge: Polity, 2001. – 228 c.

Nowotny H., Scott P., Gibbons M. Wissenschaft neu denken //Wissen und Öffentlichkeit in einem Zeitalter der Ungewissheit. Weilerswist: Velbrück. – 2004.– 339 c.

Vyrovceva E.V. Infotejment v nauchno-populjarnoj obuchajushhej kommunikacii: strategii vovlechenija i vovlechennosti [Infotainment in popular science educational communication: strategies

of involvement and engagement]. //Cifrovaja zhurnalistika: tehnologii, smysly i osobennosti tvorcheskoj dejatel'nosti. - Ekaterinburg, – 2024. – S. 315-317. [in Russian]

Gorohov V.G. Problema tehnonauki-svjaz' nauki i sovremennyh tehnologij [The problem of technoscience - the connection between science and modern technologies] //Filosofskie nauki. – 2008. – №. 1. – S. 33-57. [in Russian]

Gureeva A.N. Teoreticheskoe ponimanie mediatizacii v uslovijah cifrovoj sredy [Theoretical understanding of mediatization in the digital environment]//Vestnik Moskovskogo universiteta. Serija 10. Zhurnalistika. – 2016. – №. 6. – S. 192-208. [in Russian]

Dzhubatchanova I. Fenomen tehnonauki s tochki zrenija processual'noj racional'nosti [The Phenomenon of Technoscience from the Point of View of Procedural Rationality]/Kazanskij social'no-gumanitarnyj vestnik. – 2024. – №. 1 (64). – S. 107-112. [in Russian]

Dzhubatchanova, I. Process mediatizacii tehnologizirovannoj nauki [The Process of Mediatization of Technologized Science]/ I. Dzhubatchanova // Filosofija v XXI veke: novye strategii filosofskogo poiska:

Sbornik statej X nauchnoj konferencii studentov, aspirantov i molodyh uchenyh, Moskva, 05–09 dekabrja 2022 goda. – Moskva: OOO "MAKS Press", 2024. – S. 81-84. – EDN ISPNRJ. [in Russian]

Dzhubatchanova, I. Transdisciplinarnost' kak vazhnejshaja harakteristika tehnonauki [Transdisciplinarity as the Most Important Characteristic of Technoscience] / I. Dzhubatchanova // Osnovy jekonomiki, upravlenija i prava. – 2023. – № 4(39). – S. 24-26. – DOI 10.51608/23058641_2023_4_24. – EDN EJQCNA. [in Russian]

Kozin S.V., Zhidjaeva T.P. NOVYE ZNANIJa V IZUChENII ROSSIJSKOGO PREKARIATA (RECENZIJa NA KNIGU: ZhIZNENNYJ MIR RABOTNIKOV: USTOJChIVOST'' VERSUS PREKARNOST''/POD RED. ZhT TOShhENKO. M.: VES'' MIR, 2024. 462 s.) [NEW KNOWLEDGE IN THE STUDY OF THE RUSSIAN PRECARIAT (BOOK REVIEW: THE LIFEWORLD OF WORKERS: STABILITY VERSUS PRECARITY]//Nauka. Kul'tura. Obshhestvo. – 2025. – T. 31. – №. 1. – S. 85-93. [in Russian]

Kordonskij S. Krizisy nauki i nauchnaja mifologija [Crises of Science and Scientific Mythology] // Otechestvennye zapiski. – 2002. – №. 7. – S. 71-82. [in Russian]

Latur B. Dajte mne laboratoriju, i ja perevernu mir / per. s angl. P. Kuslij // [Give me a lab and i will turn the world upside down /trans. From English by P. Kuslij] Logos. – 2002. – № 5-6 (35) – S. 211-242.– 2002. – № 5-6 (35) – C. 211 - 242. [in Russian]

Latur B. Nauka v deistvii: sleduia za uchenymi i inzhenerami vnutri soobshchestva / per. s ang. K. Fedorovoi; nauchn. red. S. Miliaeva. – SPb.: Izdatelstvo Evropeiskogo universiteta v Sankt-Peterburge, [Science in Action: Following Scientists and Engineers Within a Community / trans. from English by K. Fedorova; scientific ed. by S. Milyaev. – St. Petersburg: Publishing House of the European University at St. Petersburg,] 2013. – 414 p. [in Russian]

Pronina L. A. Informacionnaja kul'tura kak faktor razvitija informacionnogo obshhestva [Information culture as a factor in the development of the information society] //Analitika kul'turologii. – 2008. – №. 10. – S. 75-91. [in Russian]

S.G Valerij Savchuk. Media vnutri nas [Media within us] // Vestnik kul'turologii. 2013. №2 (65). URL: https://cyberleninka.ru/article/n/valeriy-savchuk-media-vnutri-nas (data obrashhenija: 01.05.2021). [in Russian]

Smirnov R.K. SOCIAL''NO-FILOSOFSKIJ ANALIZ PREKARIATA KAK" MOGIL''ShhIKA" PROLETARIATA //KANT. [SOCIAL AND PHILOSOPHICAL ANALYSIS OF THE PRECARIATI AS THE "GRAVEDIGGER" OF THE PROLETARIAT //KANT] – 2022. – №. 4 (45). – S. 161-165. [in Russian]

Stoljarova O.E. «Issledovanija nauki i tehnologii» (STS): Filosofskoe vvedenie. ["Science and Technology Studies" (STS): Philosophical Introduction] – 2016. [in Russian]

Toshhenko Zh.T., Anisimov R.I., Kuchenkova A.V. Prekariat: stanovlenie novogo klassa:(kollektivnaja monografija) [Anisimov R.I., Kuchenkova A.V. Precariat: the formation of a new class: (collective monograph)] //M.: Centr social'nogo prognozirovanija i marketinga.– 2020. – T. 400. [in Russian]

Filatov V. P. i dr. I90 Istorija i filosofija nauki v jepohu peremen: sbornik nauchnyh statej. [History and philosophy of science in the era of change: collection of scientific articles] – 2018. [in Russian]

Frolov I.T., Judin B.G. Jetika nauki: Problemy i diskussii. 2 e izd., pererab. i dop [Ethics of Science: Problems and Discussions. 2nd ed., revised and enlarged //M.: Kn. dom «LIBROKOM.] – 2009. [in Russian] Shherbakov P.S. Additivnye tehnologii: filosofskie i prakticheskie aspekty [Additive technologies: philosophical and practical aspects] // Istoricheskie, filosofskie, metodologicheskie problemy sovremennoj nauki. – 2021. – S. 168-172. [in Russian]

Judin B.G. O cheloveke, ego prirode i ego budushhem [About man, his nature and his future] // Chelovek. Ru. – 2018. – №. 13. – S. 235-250. [in Russian]

Judin B.G. Ob jetose tehnonauki [On the ethos of technoscience] //Filosofskie nauki.– 2010. – №. 12. – S. 58-66. [in Russian]

Judin B.G. Perspektivy cheloveka: mezhdu proshlym i budushhim [Human Prospects: Between the Past and the Future] //Chelovek i ego budushhee: Sootnoshenie novyh tehnologij i vozmozhnostej cheloveka. – 2012. – S. 44-57. [in Russian]

Janickij O.N. Dialog nauki i obshhestva // Obshhestvennye nauki i sovremennost'. [Dialogue between Science and Society // Social Sciences and Режимrnity] 2004. № 6. S. 86–96. [in Russian]

Janickij O.N. Tehnonauka: prirodnye, social'nye i tehnologicheskie posledstvija [Technoscience: natural, social and technological consequences] // Sociologicheskie issledovanija. 2020. Tom 46. № 6. S. 145-154. [in Russian]

Авторлар туралы мәлімет / Information about authors / Сведения об авторах

Жұбатжанова Іңкәр Тарихқызы – Қазан Федералды Университетінің аспиранты, Кремлевская к-сі, 35, 420000, Қазан, Ресей Федерациясы, jubatchanova@gmail.com, https://orcid.org/0009-0000-0403-9074

Jubatchanova Inkar Tarikhovna – postgraduate student of Kazan Federal University, Kremlevskaya St., 35, 420000, Kazan, Russian Federation, jubatchanova@gmail.com, https://orcid.org/0009-0000-0403-9074

Джубатчанова Инкар Тариховна – аспирант Казанского федерального университета, ул. Кремлевская, 35, 420000, Казань, Российская Федерация, jubatchanova@gmail.com, https://orcid.org/0009-0000-0403-9074

Мақала туралы ақпарат / Информация о статье / Information about the article Редакцияға түсті / Поступила в редакцию / Received by the editorial office: 09.06.2025 Рецензенттер мақұлдаған / Одобрена рецензентами / Approved by reviewers: 12.06.2025 Жариялауға қабылданды / Принята к публикации / Accepted for publication: 18.06.2025