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CIVILIZATIONAL THRESHOLDS AND THE TRANSFORMATION OF SCIENTIFIC KNOWLEDGE

Shamsutdynova-Lebedyuk Tetiana
Ph.D., Associate Professor
Rivne state university of the humanities,
Lebedyuk Yelizaveta
teacher of a separate structural unit,
"Kostopil Technological Vocational College",
National University of Water and Environmental Management
Shamsutdynov Bakhodir
Ph.D., Associate Professor,
Fergana State Technical University

Abstract. *This paper examines the epistemological and ethical implications of technogenic civilization's accelerated development, focusing on three interrelated global crises: the threat of self-annihilation through weapons of mass destruction, the ecological destabilization of the biosphere, and the anthropological crisis manifesting in the erosion of human subjectivity. It argues that the traditional paradigm of scientific–technological progress, oriented toward unlimited growth and instrumental rationality, has reached its civilizational limits, generating existential risks unprecedented in human history. Special attention is devoted to emerging biotechnological and neurotechnological interventions, whose potential for altering human corporeality and consciousness raises profound ethical dilemmas. The article contends that overcoming these crises requires a paradigmatic shift toward a new form of scientific rationality integrating humanistic values, ecological sustainability, and ethical responsibility, thereby enabling the coevolution of humanity, nature, and technology in the 21st century.*

Key words: *technogenic civilization, scientific rationality, global crises, ecological sustainability, anthropological crisis.*

The elevated epistemic status of science has catalyzed the proliferation of its increasingly sophisticated forms. A systematic examination of these forms, alongside an analysis of the evolving functions of science within the sociocultural milieu, enables the delineation of its fundamental epistemological characteristics, its potentialities, and its intrinsic limitations.

The issue of such limitations has acquired particular salience in the contemporary epoch. The trajectory of technogenic civilization has approached critical thresholds, delineating the boundaries of this mode of civilizational advancement. This became evident in the latter half of the twentieth century with the advent of global crises and transnational challenges. Among the myriad global issues engendered by technogenic civilization—threatening the very continuity of human existence—three principal problem clusters may be distinguished.

First, the problem of human survival emerges in the context of the continuous evolution of weapons of mass destruction. The nuclear age has confronted humanity with the specter of self-annihilation—a consequence that may be construed as an unintended byproduct of scientific–technological progress expanding the horizons of military capability.

Second, the escalation of the ecological crisis on a planetary scale reflects the antagonism between two dimensions of human existence: humanity as an integral component of the biosphere and humanity as an active agent transforming nature (Shamsutdynova, 2025). The erstwhile paradigm positing nature as an inexhaustible repository of resources has been rendered untenable. Humanity evolved within the biosphere—a complex system emergent from cosmic evolution—not merely as its external observer or exploiter, but as a subsystem whose activities increasingly disrupt the dynamic equilibria of this planetary whole (Cirkovic, 2025). At present, anthropogenic interventions have attained a magnitude sufficient to destabilize the biosphere's systemic integrity. The impending ecological catastrophe necessitates the formulation of novel strategies for scientific–technological and sociocultural development—strategies premised upon the principle of human–nature coevolution.

Third, the problem of preserving human subjectivity—human beings as biosocial entities—arises amidst intensifying processes of alienation. Frequently described as the anthropological crisis, this phenomenon reflects humanity's paradoxical condition: the more extensively it restructures its material and social environment, the more frequently it engenders autonomous forces beyond its capacity for control, with transformative and often deleterious consequences for human existence (Mamela,2025).

Already in the mid-twentieth century, H. Marcuse identified the emergence of the "one-dimensional man" as symptomatic of industrial mass culture's capacity to manipulate consciousness and erode critical rationality. In this context, both the manipulators and the manipulated become entrapped within cultural mechanisms of their own making, analogous to actors in an immense theatrical apparatus animated by human-generated phantoms.

Accelerating technological transformation exacerbates the complexity of processes shaping personality formation and socialization. Under conditions of cultural pluralism and rapid systemic change, individuals experience fragmentation of identity, disintegration of traditional value systems, and increasing existential dislocation. Paradoxically, while global communication networks collapse spatial barriers, they simultaneously intensify social atomization and alienation (Jaffe, 2025).

Moreover, contemporary technological civilization imperils the very biogenetic foundations of human existence. Prolonged life expectancy and advances in medical science have coincided with the attenuation of natural selection mechanisms, thereby magnifying the long-term genetic risks associated with mutagenic environmental factors. Proposals invoking genetic engineering as a potential remedy entail profound ethical and ontological dilemmas: the capacity to modify the human genome not only invites utopian aspirations of "improving" human biological nature but also introduces unprecedented risks of instrumentalizing human corporeality and consciousness for political or technocratic ends (Delaney, 2025).

Parallel developments in neuroscience reveal possibilities for direct neurophysiological modulation of affective states, memory, and perception, raising further concerns regarding the autonomy, integrity, and authenticity of human subjectivity under conditions of technological manipulation. The cumulative psychosocial stresses of technogenic modernity, combined with the proliferation of psychopharmacological and neurotechnological interventions, generate an unprecedented nexus of ethical, medical, and existential challenges.

These convergent crises collectively undermine the legitimacy of the developmental paradigm underpinning industrial–technological civilization. Accordingly, numerous philosophers and futurists posit the necessity of a civilizational shift of comparable magnitude to humanity's transition from the Stone to the Iron Age—a transformation entailing the reconfiguration of value systems, epistemic frameworks, and anthropological orientations.

Within this discourse, the role of science and technological progress acquires particular ambivalence. Radical anti-scientistic critiques attribute global crises to the

very logic of technoscientific rationality, at times advocating for its deceleration or reversal—proposals incompatible with the demographic and material imperatives of the contemporary world. The viable alternative lies not in the negation of scientific–technological development but in its reorientation toward explicitly humanistic ends, necessitating the emergence of a new mode of scientific rationality integrating ethical and existential dimensions.

This raises fundamental questions: through what epistemological and institutional mechanisms might extrinsic value orientations be integrated into scientific inquiry? Could such integration compromise the autonomy and objectivity of theoretical knowledge? Are there endogenous tendencies within science itself conducive to such a paradigmatic transformation? And what implications might this hold for the future of scientific rationality, its sociocultural legitimacy, and its epistemic autonomy?

Addressing these issues requires a rigorous analysis of the invariant characteristics of science—those features that persist across historical transformations of rationality regimes—without which the very identity of science vis-à-vis other modes of cognition (artistic, religious, everyday, or philosophical) would be obliterated.

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