Center for Open Access in Science ▪ Belgrade - SERBIA
8th International e-Conference on Studies in Humanities and Social Sciences
http://centerprode.com/conferences/8IeCSHSS.html
ISBN (Online) 978-86-81294-09-3 ▪ 2022: 213-222

Philosophical Foundations of Technological Determinism: Social Importance of Machine and Technology

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Received: 26 May 2022 ▪ Revised: 20 June 2022 ▪ Accepted: 24 June 2022

Abstract

This article examines the social-philosophy concepts in the works of Lewis Mumford, mainly in his *Technics and Civilization* (Routledge & Kegan Paul PLC, 1934), and Jacques Ellul, mainly in his *The Technological System* (1980, The Continuum Publishing Corporation, originally published as *Le Système technicien* by Calmann-Lévy Copyright, Calmann-Lévy, 1977). The first part of the article discusses Louis Mumford's concept of the Machine as a product of the historical, cultural and axiological achievements of Western civilization. The second part of the article focuses on Jacques Ellul's reflections on the differences between the classical industrial age and the "third wave" of technology. Both parts concern themselves with the tremendous social changes brought about by the technological breakthroughs. Finally, in the form of an extended conclusion, the article offers a comparison of the social effects of technological progress the way both authors see them.

Keywords: Lewis Mumford, Jacques Ellul, technological determinism, the Machine, technology.

The elements of technology (from the Greek τέχνη – skill, craft, mastery and λόγος – word, study, science) not only accompany man and society from their first steps, but are also the factor that determines their life and development. Historically, technology can be seen as a set of specific skills, tools, devices and equipment available to society, which determine its main characteristics at a certain stage of its development. Access (or not) to certain technologies in competition for resources during wars, for example, has often been a matter of life and death in the destinies of peoples and their civilizations.

Technology is the way in which human society responds to the challenges it faces – both in its interaction with nature, with the outside world, and (consciously or not) in solving problems in the field of social relations. Technology does not simply reproduce people's natural skills by increasing the accuracy and power of their movements, or by partially or completely replacing a living organism. They create new, non-existent before materials, products, tools and forms of interaction. They expand a person's capabilities and gradually free him from various physical hardships – exhausting work, slow movement in space, pain, trauma and disease. In addition, the introduction of various specific technologies in life raises new problems – environmental pollution, depletion of natural resources, climate change, restructuring of economic activities, employment, training, leisure, information, communication, and ideas about the world and the man.

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Depending on the field of knowledge and the approach to their study, the term "technology" has different specific definitions and meanings. Specifically, about industry and production, there are mining, transportation, machinery, manufacturing, information, trade, marketing and other technologies. But technologies are also a social phenomenon, regardless of the idea of their technical nature and the study of different specific processes in engineering. The concept of "technology" in its modern meaning has emerged relatively recently, rather as a summary of all available technical means in their complexity and diversity. The terms "technics" and "technology" are often confused. For example, Ortega y Gasset points out, as two permanent functions, two main factors in each human life that interact – ideology and technique: "We have two obvious truths – first, every human life starts from some original beliefs about the nature of the world and the place of man in it – it starts from them and moves within them, and, secondly, every life is in an environment with more or less technique or domination over the material environment" (Ortega y Gasset, 1994: 26). According to him, it is the technical environment, the level of available technologies that are the main difference between human generations historically.

For Thornstein Veblen, technology is crucial for the development of humanity and the transition from a state of savagery to barbarism and subsequently to civilization. He also points out their ability to lead their existence according to "the instinct of workmanship", according to their own laws of development, beyond the will of those who invent and possess them (Thornstein, 1898a: 187-201). A number of scholars after Veblen have explored the importance of technology for social development, led by the idea that this importance is not limited to the relationship between productive forces and production relations and the antagonistic class contradictions (in the understanding of Karl Marx and his followers).

1. Louis Mumford's concept of the Machine

Veblen's successor in the study of the development and role of technology in society is Louis Mumford who prefers to define himself as a writer rather than a scientist, architectural critic, historian, or philosopher, although he is a professor at Stanford University (1942-44) and Pennsylvania University (1951-59) and at the Massachusetts Institute of Technology (1957-60).

"My principal debt, throughout this study, has been to my master, the late Patrick Geddes. His published writings do but faint justice to the magnitude and range and originality of his mind; for he was one of the outstanding thinkers of his generation, not alone in Great Britain, but in the world. From Geddes's earliest papers on The Classification of Statistics to his latest chapters in the two-volume study of Life, written with J. Arthur Thomson, he was steadily interested in technics and economics as elements in that synthesis of thought and that doctrine of life and action for which he laid the foundations... Only second to the profound debt I owe Geddes is that which I must acknowledge to two other men: Victor Branford and Thorstein Veblen. With all three I had the privilege of personal contact..." (Mumford, 1934: 475).

Louis Mumford's ideas are difficult to understand without some knowledge of the life and theoretical and practical work of Patrick Geddes. In 1892, Patrick Geddes, a follower of Auguste Comte and Frederic Le Play and founder of the British Sociological Society, established the first Sociological Laboratory, the Panoramic Tower of Edinburgh (Outlook Tower). He believes that the real challenge of modern civilization is to achieve a new balance between nature and the man-made world, which is moving from physical planning to cultural evolution. His ideas for applying the theory of evolution from biology to social reality, and in particular to urban planning and regional development, have gained recognition only in recent decades. Patrick Geddes has been studied in academia, mainly for his creative interdisciplinary approach to specific societal issues, combining biology, sociology and urban planning (Munshi, 2000: 485).

Victor Branford and Patrick Gedes create an ambitious and broad interdisciplinary vision that includes geography, anthropology, economics and urban planning in addition to sociology. Sociology sees them as an integrated science, a large-scale project for social reconstruction. These ideas form the basis of the "third way", avoiding both liberalism and communism in favor of cooperation, redistribution and regional development.

In Mumford's concept of the Machine, developed in *Technics and Civilization*, Veblen's ideas about the defining nature of technological development can be found, combined with an in-depth study of the facts, as well as Geddes's humanism and aspiration for human development. Franz Reuleaux's classic definition of a machine, quoted by Mumford, states that "a machine is a combination of stable bodies arranged so that natural forces are forced by them to perform work accompanied by certain defining movements." "When I use the term the Machine I shall employ it as a shorthand reference to the entire technological complex. This will embrace the knowledge and skills and arts derived from industry or implicated in the new technics, and will include various forms of tool, instrument, apparatus and utility as well as machines proper" (Mumford, 1934: 12).

Mumford thoroughly researches the origins of specific machines and technologies from antiquity to the present, and produces a detailed index of various technical and technological discoveries (Lewis Mumford, 1934: 438-446). The development of technology, according to Mumford, goes through three phases, which he called eotechnical, paleotechnical and neotechnical.

According to Patrick Geddes, Mumford connects specific technical inventions and technologies with the main types of areas in which people develop different occupations, and they, in turn, cultivate certain intellectual, technical and moral characteristics of man (miner, woodman, hunter, herdsman, farmer, and fisherman). Mumford differentiates them into different communities (tribes), which, due to their territorial connection, interact with each other. According to the author, the various elements of civilization are never in balance, they change under the pressure and influence of life-destroying and life-sustaining functions.

In the area of rocks and caves of the mountain Mumford describes the miner, who mines ore, metal, stone for construction or for jewelry, various minerals. His work is hard and full of dangers, and life outside the mine – with entertainment for immediate consumption - drinking and gambling. Mining, respectively the mining industry, from antiquity to the present day causes the deterioration and destruction of nature and agricultural land – both during the active activity of the mine and after its completion. Mining areas around the world (except the Rhine) are synonymous with backwardness and barbarism. "Mine: blast: dump: crush: extract: exhaust-there was indeed something devilish and sinister about the whole business. Life flourishes finally only in an environment of the living" (Mumford, 1934: 74).

Technologically, the miner's tools remained primitive: hammer and pickaxe, but with the development of mining, many technical inventions were added to them (the lamp with a closed flame, trolleys, rails, etc.). However, the whole machine age is based on iron, i.e. of the product of the miner's labor, and is impossible without the mining industry. Mines have been one of the first capitalist enterprises since the Middle Ages, and the first sources of great wealth for their owners in both Western Europe and Americas.

The primitive engineer, the woodman, according to Mumford, inhabits the forest belt of the mountains and has wood as a resource – a material with many properties and applications. It can be easily extracted, easily transported, processed in various ways. In its natural form it is a plant, different types of wood serve different purposes. Dry wood sustains fire, "a few twigs and we have a hearth, and an altar, a shelter for the body and a shelter for the spirit, a major source of energy for man since ancient times." The technical inventions of the woodman are the ax, the

wheel (pottery, cart, mill wheel) lathe, boat, cart, glue, etc. The inhabitant of the plain - the peasant, invented agriculture and animal husbandry, knitting, weaving, etc.

The most significant contribution to the development of technology, according to Mumford, give the heirs of the ancient hunter – the military (aristocracy). In purely technological terms, hunting and war are associated with the development of the two main types of weapons - long-range and hand-to-hand combat. The hunter's social characteristics are far more influential, because the role of the hunter is "anti-vital" – like a predator whose skills are developed in the act of killing. The instinct of rude survival (man alone against the forces of nature) does not disappear with the advent of agriculture and animal husbandry, clashes for food with other groups continue, and the passion for winning loot and trophies shifts from the hunting ground to the accumulation of wealth. "Robbery is perhaps the oldest of labor-saving devices, and war vies with magic in its efforts to get something for nothing – to obtain women without possessing personal charm, to achieve power without possessing intelligence, and to enjoy the rewards of consecutive and tedious labor without having lifted a finger in work or learnt a single useful skill. Lured by these possibilities, the hunter as civilization advances turns himself to systematic conquest: he seeks slaves, loot, power, and he founds the political state in order to ensure and regulate the annual tribute, enforcing, in return, a necessary modicum of order" (Lewis Mumford, 1934: 83).

The author considers the fact that military work is the main distributor of the Machine – from the poison arrow to the poison gas, from the chariot to the tank, from the Greek fire to the flamethrower, from the catapult to the artillery. With its military inventions, the Roman Empire was much closer to the Machine, i.e., to modern technological society than with aqueducts and baths. The army, moreover, is a body of ideal consumers (the basis of industrial capitalist production). In peacetime, it needs food, equipment and shelter to provide "protection". In times of war, the military is not only a consumer of goods, but a negative producer – instead of abundance, it causes poverty, mutilation, destruction, terror, hunger and death are the main characteristics of its "product". "War is the chief instrument by means of which the ruling classes create the state and fix their hold upon the state. These ruling classes whatever their military animus and origin, alternate their outbursts of prowess with periods devoted to what Veblen in his Theory of the Leisure Class called the ritual of conspicuous waste" (Mumford, 1934: 94).

The industrial age, according to Mumford, did not begin with the invention of the steam engine by James Watt, but was the result of ten centuries of cultural training in the societies of Western Europe where the various prerequisites that made modern technical and industrial development possible are built and combined. Among these prerequisites are the invention of instruments and the transformation of processes such as the measurement of time, space and objects, the development of the natural sciences, as well as man's knowledge of himself. All these phenomena became possible in the societies of Western Europe with the invention and entry into everyday life of people of various machines and inventions. For example, clocks allow the measurement and organization of time during the day, and maps, the focal point of perspective in the pictures, maps of the movement of celestial bodies, etc. – the measurement and organization of space. Mumford quotes Mark Kepler, who in 1595 described this process as follows: "As the ear is made to perceive sound and the eye to perceive color, so the mind of man has been formed to understand, not all sorts of things, but quantities. It perceives any given thing more clearly in proportion as that thing is close to bare quantities as to its origins, but the further a thing recedes from quantities, the more darkness and error inheres in it" (Mumford, 1934: 25).

The social development of the West, based on the exact sciences, inventions and industry, as well as geographical discoveries (expansion to other parts of the world), puts money at the center of society as a universal measure of all worth and values. The Machine makes this process possible by constantly deepening and accelerating it. The city, as a product of human civilization, to the greatest extent shows both the advantages and disadvantages of modern technology.

2. Jacques Ellul's reflections on technological society

Jacques Eloul is a French thinker and public figure, with ancestors from several European countries, a member of the French Resistance, a lawyer by education, author of nearly fifty books and numerous articles, theologian, sociologist, public figure, active environmentalist. *The Technological Society*, the first volume of his trilogy on the subject, appeared in France in 1954. This book was discovered and promoted by Aldous Huxley, the English author of *Brave New World*, and brought him fame in American universities ten years later.

Ellul witnessed the division of Europe and the world after the Second World War and the opposition of the two systems during the Cold War in all spheres – military, economic, political and ideological. It was the continuous and accelerated development of new technologies, mainly between the 1950s and 1980s, that led to an increase in the economic and social well-being of the West and the fall of the Iron Curtain in Europe in 1989.

In *The Technological System* (1980, The Continuum Publishing Corporation, originally published as *Le Système technicien* by Calmann-Lévy), Ellul argues with the notions of society and technology of a number of authors – both his contemporaries and those of the recent (then) past, published in both French and English. The focus of their thinking is how to determine the state that comes after "industrial society" (Raymond Aron's concept). A number of authors define it with different concepts – the technological transformation according to Georges Seurat, (*Réalités du transfert technologigue*, 1976), the technological revolution according to Radovan Richta (*Člověk a technika v revoluci našich dnů, Man and Technology in the Revolution of Our Day*, published in 1963), "a permanent revolution of processes" (de Jouvenel, 1968), and others.

In his concept of the technological system, Jacques Ellul prefers not to give a specific definition, but to distinguish it from both his earlier idea of the "technological society" and the "industrial system" (classical industrial production of the 19th and early 20th centuries described by Raymond Aron). "What is needed is not so much a more precise knowledge of the system, but rather a way of relating it to mankind and the overall society and of examining the fundamental choices that must now be made" (Ellul, 1980: 5).

Only a clear concept of technology per se can allow for its objective study, Ellul said. Technology is an inevitable part of the world and it evolves according to the given economic, political and intellectual context. Only the knowledge of the phenomenon in its entirety can allow readers to explore both its novelty and its limits. He criticized the attempts to anthropologize technologies and fantasies about their endless development, which, according to him, involved some authors, especially D. Rorvik (*Brave New Baby*, 1972 and *As Man Becomes Machine*, 1971).

We can talk about a technological society from the 60's and 70's, when the impact of technology goes beyond the specific fields of science and industry and spreads throughout society. "We can thus say that the technological society is one in which a technological system has been installed. But it is not itself that system, and there is tension between the two of them. Not only tension, but perhaps disarray and conflict. And just as the machine causes disturbances and disorders in the natural environment and imperils the ecology, so too the technological system causes disorders, irrationalities, incoherencies in the society and challenges the sociological environment" (Ellul, 1980: 18).

Industrial societies create centralized, hierarchical systems with linear growth, division of labor and separation of goals from resources. Mechanization creates additional jobs, but makes human labor more exhausting. The goal of the industry is stable reproduction, which needs masses of people to integrate in the process of industrialization. Modern technology goes against each of these features, says Ellul, because it allows free action, leads to decentralization and flexibility, is far from division and hierarchy, in practice bridges the gap between executive

and managerial activity, implies polyvalent and nonlinear growth, integrates goals and funds, and reduces jobs and the cost of labor.

The value factor (added value) is not human labor, but scientific discovery and technological innovation. In this sense, we can no longer use Marx's theory of added value, the source of which is labor power. Technology, according to Jacques Ellul, although an abstraction, procedure and organization, should be considered mediation rather than tool (Ellul, 1980: 34).

The technological object is a stable mixture of human and natural, of concrete and abstract, of matter and knowledge. Technological activity creates a world of technological objects, universalizes the objective mediation between man and nature and connects man with nature with a much more inseparable and rich connection than that of collective labor, according to Gilbert Simondon (*Du mode d'existence des objets techniques,* Paris, Aubier-Montaigne, 1956).

To this Ellul ads that this connection becomes exclusive and unique, all other connections – poetic, magical, symbolic – disappear. Technology is not only a means, but a total and universal mediation – both of the human-nature relationship and of the human-human relationship with the group.

Technology has the character of a system. The system is a set of elements interrelating in such a way that any evolution of one trigger a revolution of the whole, the elements composing the system have a sort of preferential disposition to combine among themselves rather than with outside factors. They are in continuous dynamic and can enter into relationships with other systems. One of the essential traits of a system is the feedback, or rather the "feedback structures," which do not, however, make up the system itself (Ellul, 1980: 77-78). According to Ellul, it is pointless to look at isolated individual technological phenomena because they cannot be understood outside the technological system (p. 107).

According to Ellul, the transformation of technology into the immediate "environment" of man has three main consequences for the characteristics of the environment – autonomy, sterility and immediacy, i.e., it is not mediated in the interaction with humans. By "autonomy" it is meant the property of technology to spread without an evaluative moment on the part of man or society – technology, like nature, enters with its own laws and is not subject to limitation. As an example, Ellul points out that it is clear to everyone that if the factory speed of cars is limited to 100 km/h, the number of deaths in car accidents will be practically zero. But no one can impose such a restriction, and society will not support it, because everyone is used to technology and expects cars to be safe and fast. "Sterility", according to the author, is the property of technological communication to transmit "pure" information, unlike previous forms of communication, which are polyphonic, unstable and with rich and creative roots in the collective unconscious. (In fact, this feature cannot be attributed to the dominant form of modern communication via the Internet and the so-called "social networks"). "Immediacy" means that individual and collective consciousness are formed directly by the presence of technology, through the absorption of man into the technological environment without the mediation of culture. The connection with technology is immediate, "The medium is the message", as says Canadian communication theorist Marshall McLuhan in the name of the first chapter in his *Understanding Media: The Extensions of Man*, published in 1964. The message that man is trying to convey becomes a pure reflection of the technological system, of technological objects, reflections and discourses. Thus, the mediating technological system becomes a universal mediator, excluding all communication except its own.

According to Ellul, the technological environment becomes a given for man and requires knowledge and skills to adapt to it, as well as the natural environment does. New knowledge replaces the first and man ceases to know the natural environment. Technological consciousness is radically different from the primitive (savage) – thought processes are the same, but relate to different areas. Primitive consciousness is defined by the natural environment – it

determines both the relationship of man to the environment and the relationship between human society and the natural environment.

The technological environment is not only an environment, but it is an interpreter of the relationship between man and the natural environment and between man and other people. The technological environment is not just a set of tools that we use for work or entertainment, but a coherent ensemble that "tightens" us on all sides, that invades us and without which we can no longer. It is already our only living environment (Ellul, 1980: 42).

But the old environment has not disappeared because man cannot live without air and water. This is causing a systemic crisis, as Jacques Ellul sees it. Man has gone through a decisive turn – he used to live in a natural environment, using technical tools to do better in it, now he lives in a technological environment, and the old natural environment provides only space and raw materials. The technological environment is supposed to replace the natural environment, providing man with all its functions.

Technology as an environment makes every problem look technological, even when it is not, misleads the search for technological solutions to non-technological problems, and creates new technological problems that require solutions. According to Ellul, after the socio-political problems of Western society as a whole, the main, if not the only, determining factor is the technological system (Ellul, 1980: 55).

Data on various specific social problems can be used to confirm one or another trend – but the explanation of the phenomena is rooted in the technological phenomenon. Regarding the role of the state (statism), for example – data can be found both to strengthen and reduce its role. The modern state has nothing to do with the state in the 18th or 19th century. It is much more complex, with many more features and impacts in many more areas, but the difference is not so much in scope as in the complexity of the impact. Thus, the administrations become more specialized, but the more they become fragmented, the greater the need for unified and coordinated governance – that is, there is a process of centralization of government. This is because more and more specialized knowledge is needed in the assessment of various problems, more and more complex coordination with other spheres of public life – tasks that require analysis and processing of many data and processes. In fact, all so-called decentralization efforts simply produce deconcentration, which actually intensifies centralization, i.e., the need to control and synchronize processes. The consequence of the technology in this field is the diminishing importance of the political sphere at the expense of governance technology, and this applies to both citizens and politicians. Regardless of public opinion and the wishes of the citizens, according to Ellul, radical political changes are difficult to achieve through elections or even referendums. People are increasingly integrated into the political system, but with fewer and fewer opportunities to influence decision-making. The same applies to politicians (senators, ministers) who are much less free in their actions, i.e., their actions are less and less dependent on their will and intentions. If at the beginning of the 20th century it was possible to achieve a radical change in the foreign policy orientation and in the strategic alliances of the state with a political decision, in the 60s this was almost impossible.

According to Ellul, technologies should not be confused with their economic application, despite the changes they are causing in the economy. Technology also requires efforts to create and maintain an environment in which to develop. "For, in order to be technicized, a society must create a whole set of organizations permitting the development of technologies. It is impossible to simply 'graft' a certain technological power on a 'natural' society. A growth of production technologies requires a transportation network, organization facilities, distribution machinery, etc." (Ellul, 1980: 64).

New technologies cause changes in the very essence of the development of society: "One technology, writing and printing, gave birth to a civilization. Another technology, namely

television, has, as Marshall MacLuhan shows, changed the field of the brain. Still another, the computer, has carried us from the civilization of experience to the civilization of knowledge" (p. 73). It should be noted that Ellul's views on the future role of computers in society are significantly different from the reality we already know.

According to Ellul, only in the modern age are the productive forces, i.e. technology becoming a determining factor, and not at every stage of social development, as Marx argues. The productive forces, which, according to Marx, are only the basis (infrastructure) of the social relations on which the superstructure appears. According to Ellul, technology is also becoming a social superstructure because "they can develop and keep advancing only if there is a social infrastructure of organization capable of both producing the research indispensable to such progress and receiving this progress into the social body. The mechanism of production is now conditioned by services. It is no longer the interior of the technological world, the determining factor" (p. 64).

According to Ellul, one of the most important changes determined by technological development is that in the field of labor and employment – it requires great flexibility, mobility, retraining and changing professions, in fact professions are largely disappearing, there are mainly jobs and activities. He points out a number of other changes for man and society, but one of the main conclusions for the future is that "But for a long time, we will be stuck with work, we will be wasted and alienated. Alienation, though, is no longer capitalistic, it is now technological" (p. 73).

3. Conclusion

When comparing concepts in the field of technological determinism, one must always take into account the specific level of technological development at the time when the works were written. Because technologies evolve by their own logic, they are difficult to philosophize and "love" to refute predictions about their development and the impact they have on man and society.

Although of different generations, Louis Mumford (1895-1990) and Jacques Ellul (1912-1994) are contemporaries of the dynamic changes in society in the 20th century – unprecedented technological advances and two world wars. Mumford's concept of the Machine was developed in the 1934 edition of *Technics and Civilization*, and the first edition of the *Technology System* was in 1977. In just over four decades, many changes occur the technological environment that serves the both authors as a source for their observations and summaries.

In the early 1930s, the main sources of energy were fossil fuels, classical industrial production dominated, the media environment was determined by the periodical press, and mass culture by cinema. In the late 1970s, in addition to conventional water and heat, more powerful nuclear plants were added to the energy sources, and the chemical industry, semiconductors, information processing machines, and computers changed traditional industries and created new ones. In the field of communication, television has a leading role both in terms of information and entertainment. Changes in specific technologies (which are much more than those mentioned here) caused both societal change and serious research interest.

By his own definition, Mumford uses the term the Machine as an abbreviated name for the entire technology complex – i.e., includes knowledge, skills and arts acquired from industry or new technology, as well as various forms of instruments, tools, apparatus and useful goods, as well as machines themselves. In his conception of the technological system, Jacques Ellul prefers not to give a specific definition, but to distinguish it from both his earlier idea of the "technological society" and the "industrial system" (classical industrial production of the 19th and early 19th centuries). 20th century, described by Raymond Aron). According to him, the numerous definitions of this new type of society used by various authors do not precisely define its essence.

Both authors consider as the main feature of technologies (Machine, technological system) their autonomy and their ability to develop regardless of the will and desires of people, as well as to create new social problems, regardless of whether and to what extent they solve the existing ones. They both take it for granted the technological phenomenon which has been specific to Western civilization it is characterized by consciousness, criticalness, and rationality.

Exploring the development of technology as a "mediator" between man and his environment, both reach the two limits of the development of technology – man in his human nature and the limits of the natural environment (so far, the planet Earth) with its limited resources. For both authors, the indisputable price that humanity pays for the development of technology is the continuous destruction of the natural human environment both as an immediate environment (through urbanization and concentration of the population outside rural areas) and through depletion of non-renewable resources and industrial pollution of air, water and soil.

They have a similar attitude to the problem, although they express it differently. According to Mumford, "mankind behaved like a drunken heir on a spree" (Mumford, 1934: 138). The habits of indiscriminate exploitation and unreasonable extravagance remain even after the resources are exhausted and damage not only nature but also the minds of people. "The psychological results of carboniferous capitalism – the lowered morale, the expectation of getting something for nothing, the disregard for a balanced mode of production and consumption, the habituation to wreckage and debris as part of the normal human environment - all these results were plainly mischievous" (p. 158).

For Ellul, the obvious truth is that "everyone knows that they asked the tough question about the limits of technological growth: Do any physical limits exist for the population expansion and the industrial expansion at the rate that has been noted for the last twenty years? We know the answer. The arable surface of the earth is limited, the expansion of food output is tied to nonrenewable resources, and it is calculated that the reserves are not considerable" (Ellul, 1980: 283).

Both the Machine and the technological system, with their power and autonomous development, subject to their own laws, have long exceeded the role of mediating force between man and nature, causing changes not only in nature but also in man – changes whose justification and both authors' dispute. The solution to these problems cannot be found "inside" the world of technology, but remains the responsibility of people and society, i.e., beyond the philosophical concepts of technological determinism.

The study of technologies as a whole from a philosophical and social point of view is a huge challenge for scientists and the public – not only because of the complexity of the object of this study, but also because of the responsibility for conclusions and decisions arising from such analyses. The concepts of the machine and the technological system attract the attention of researchers today, both because of the correctness of certain conclusions and because of the inability to answer the question why, after decades of development and entry of more advanced technologies around the world, people and societies retain significant values and cultural differences. The issue has not only theoretical but also practical significance, because the development of technology poses common challenges to humanity – climate change, which, although it affects everyone, cannot cause adequate and effective joint action.

Acknowledgements

This research did not receive any specific grant from funding agencies in the public commercial, or not-for-profit sectors.

The author declares no competing interests.

References

Aron, R. (1968). *Progress and disillusion: The dialectics of modern society*. New York: Praeger.

Charbonneau, B. (1969). *Le jardin de Babylone*. Paris: Gallimard.

Ellul, J. (1980). *The technological system*. The Continuum Publishing Corporation.

Jouvenel, B. de (1968). *Arcadie, essais sur le mieux vivre*. Futuribles, S. É. D. É. I. S.

Mumford, L. (1934). *Technics and civilization*. Routledge & Kegan Paul PLC.

Munshi, I. (2000). Patrick Geddes: Sociologist, environmentalist and town planner. *Economic and Political Weekly*, *35*(6), 485-491. http://www.jstor.org/stable/4408911.

Ortega y Gasset, J. (1994). *Po povod na Galiley*. Riva Publishing House, 2004, transl. EN TORNO A GALILEO, Herederos de Jose Ortega y Gasset, Revista de Occidente, S. A. Madrid 1947, Alianza Editorial S. A. Madrid, 1982, 1994.

Simondon, G. (1956). *Du mode d'existence des objets techniques*. Paris, Aubier-Montaigne.

Veblen, Th. (1898a). The instinct of workmanship and the irksomeness of labor. *American Journal of Sociology*, *4*(2), 187-201.

Veblen, Th. (1898b). *The theory of the leisure class: An economic study of institutions*. https://web.mit.edu/allanmc/www/veblenintro.pdf.