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## Model of an Integrated Ecological System Nature - Man - Technology - Culture

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**Abstract:**

**Purpose:** The aim of this article is to propose a synthetic approach in the form of a model of an integrated ecological system Nature-Man-Technology-Culture.

**Design/methodology/approach:** The article is theoretical. To achieve the research goal, six studies were carried out: 1. Analysis of the vast philosophical literature and the achievements of the natural, social, humanistic, technical, medical sciences and others 2. Formulation of partial conclusions in the form of identification of individual ecological relationships 3. Adoption of a systemic methodology assuming distinguishing system components and relations between them based on flows 4. Formulating ecological relations in a systemic approach - distinguishing energy-material and information flows 5. Specifying energy-material relations as flows of energy and animate and inanimate matter 6. Specifying information relations as flows human sensory information as well as economic, scientific, technical and other social information.

**Findings:** They are presented in the summary. It can be added that the proposed model of an integrated ecological system Nature-Man-Technology-Culture is real and complete and includes all the components and relationships among them that are conducted in scientific research.

**Practical implications:** A novelty is the joint approach to the relationship between man and the environment and artificial and natural. A novelty is the distinction of the Human component, covering all living people - their bodies and minds - senses, knowledge, memory and emotions. The intangible effects of the work of people's minds and their mutual communication create Culture.

**Originality/Value:** The proposed model of an integrated ecological system Nature-Man-Technology-Culture takes into account the four components of the reality of the earth's shell and all 12 ecological relations between them. Due to the multidisciplinary of disciplines dealing with human impact on the environment, there is a need for synthetic approaches enabling their mutual understanding. So far, the proposed approaches are incomplete and do not take into account the separate divisions rooted in philosophy and science into man and his environment, and into what is natural and what is artificial.

**Keywords:** Modelling of ecological systems, systemic approach, man, nature, technology, culture.

**JEL codes:** B49, C10, Q50.

**Paper Type:** Research article.

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## **1. Introduction**

At the outset, it is worth recalling that all considerations about the ecological system and relations concern the earth's nature and human population. This means that the natural and social phenomena and processes taken into account take place in the earth's shell, i.e., the geosphere and biosphere of the planet Earth, on scales from 10,000 to 10,000. km (terrestrial globe) to 10 nm (DNA/RNA), but mainly in the "human world", on scales from 1 km to 1 mm, i.e., those in which the Man creating Culture lives and the material products of his activity are perceptible, containing in the notion of Technology (Lamża, 2014).

The entire remaining macro - and micro - world (although it has an impact on the geosphere and biosphere, e.g., through solar radiation, the influence of the Moon or meteors reaching the Earth), although of course it also belongs to nature, remains outside the integrated ecological system analyzed in this work Nature-Man-Technology-Culture.

All scientific research, public debates and practical activities dealing with "ecology" as well as a thing, phenomenon or process that is attributed with the attribute "ecological" require the definition of basic names and terms. Even a cursory analysis of the vast literature on the subject shows that these terms are ambiguous and do not form a uniform conceptual system (Noja *et al.*, 2021). The purpose of this article is an attempt to construct such a system in the form of an integrated ecological system Nature-Man-Technology-Culture (Dutkowski, 1995; 2021).

Two different approaches have developed in philosophy and science, culture and art. One of them is related to the division of the experienced reality into what is "artificial", i.e. created by people, and what is "natural", i.e., created by natural processes. Sometimes the border between them is difficult to determine, e.g., an orchard, a park, an artificial water reservoir, a breeding animal.

The second approach distinguishes "man", understood as an individual (...), as a population of people living in a given area at a given time, or as a species of homo sapiens, i.e. all people who have ever lived, live and will live. In this approach, the human individual is treated as a whole, i.e. "body" and "soul", in accordance with the views opposed to the post-Cartesian tradition (Böhme, 2002).

Thus understood, "man" is given a special place, which is often associated with religious justification, and the remaining part of this reality is treated as the

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environment, distinguishing the part directly related to a given individual, population and species as its "environment". For the human species, the environment is the entire planet Earth, and even the entire solar system, and perhaps even the Milky Way and other galaxies (Ditfurth von, 1976). Thus, in each integrated ecological system there are four components and at least two types of relations: "man - environment" and "artificial – natural”.

In this paper, both approaches are considered important. Key concepts such as "ecological system" or "ecological relations" are not synonymous with the concepts of "ecosystem" or "energy-material relations between biocenosis and biotope" or even "anthropopressure".

They refer to both natural and non-natural - economic, legal, scientific, ethical, aesthetic and religious consequences and aspects of the existence of nature, people as psychophysical units, their culture and the objects and objects they create. An "ecological relationship" is the interactions between components that are essential to the description and understanding of interdependencies in an ecological system.

## **2. Environmental Approach "Man - Environment"**

The distinction between "man" and his "environment" comes from ecology, i.e., the field of biological sciences that deals with the flow of matter and energy between an animal or plant organism (or a group of organisms) - a biocenosis, and the immediate environment, called the environment - a biotope. The transfer of such an approach to the study of the relationship between people and their natural environment brought about a significant progress in knowledge, but at the same time caused some conceptual confusion.

Animals and plants mainly adapt to the environment, people mainly transform it according to their needs using tools and machines, i.e., through technology. Humans differ from animals in the ability to accumulate information and pass it on to the next generation by means other than the genetic code, i.e., the ability to create culture. Thanks to this, they were able to make better use of the resources and values of nature than animals.

By transforming objects found in the surrounding nature into artificial objects (e.g., a lump of quartz into a flint knife, a branch into a bow, clay into a pot), they repeatedly led to such a significant transformation of their environment that it prevented further use of its resources and values in a given place. Of course, there are plenty of examples of animals creating their environment (e.g., building nests, anthills, lodges), but we cannot talk about conscious actions or improving this influence as a result of gathering knowledge and exchanging information between individuals.

However, it is certainly influenced by the flow of genetic information in evolution. Some animals have amazing abilities to learn how to shape their environment.

In the concept of "man - environment" one should not identify "man" with what is artificial, cultural, and "environment" with what is natural. Unfortunately, quite often the "man-environment" approach misses one of these aspects. When encountering such an approach, it is necessary to check what definition of "man" and "environment" has been adopted, although it is not always expressed directly.

The relationship between "man" and his "environment" existed in the age of hunters and gatherers, it exists in the age of satellites. However, its nature and spatial range of connections have changed. Initially they were local, now they are global. Initially, they consisted of limited exploitation of living resources, waters, minerals and soils.

Currently, they lead to the depletion of resources, destruction of values and disturbances in the functioning of nature on the scale of planet Earth. The most important change, however, is that an increasing part of the "environment" is under the influence of people, which does not mean that it is under their control.

### **3. Social Approach: "Artificial - Natural"**

The division into what is "artificial" and what is "natural" has been valid from the beginning of human thought to the present day and applies to all areas of life - from everyday objects, through fashion and cuisine, ways of spending free time, to individual and collective patterns of behavior. He spoke exhaustively about the natural and artificial order (Amsterdamski, 1983).

In the social sciences, this issue appears as a dispute about the meaning of "culture" and "nature" in collective and individual life. In the legal sciences, there is talk of "natural law" and "positive/statutory law". In medical science, the concept of "prosthesis" is used as an artificial component of the body. In geography, the concepts of the environment and the "natural" (also called natural) and "artificial" (also called urbanized, cultural, industrial, etc.) landscapes have been discussed for years.

The line between "artificial" and "natural" is difficult to draw. He commented extensively on this subject (Pinker, 2005), presenting disputes about human nature. It runs "inside" every human being, both inside his body and his psyche and states of consciousness, "inside" the surrounding material world and "inside" the world of products of thought (culture). The concept of "three worlds" was used here (Popper, 1998).

Culture as understood in this work belongs to the "third" world. In the debate and environmental policy, the symbolic, evaluative and emotional meaning of "artificiality" and "naturalness" is very important.

Depending on one's worldview, professed religious faith or recognized ideology, aesthetic preferences, emotional state, but also views and beliefs, attitudes and interests, more value is given to either what is "artificial" or what is "natural".

Therefore, in some circumstances, including historical ones, what was "artificial" was valued more, and in others what was "natural". In today's post-modern and global society, there is conceptual confusion and a certain hypocrisy in this area. Civilization progress and ever-increasing demands on living conditions require the introduction of an increasing number of artificial objects into the environment, and even into human organisms. Food, clothing, medicines, building materials, home furnishings, etc. are artificial. There is also an artificial cornea, artificial teeth, joints, and even hearts, etc.

Nevertheless, natural objects are highly valued, from mineral water, through shoes to roofing, natural behavior (so-called looseness) and natural beauty (often created with the most artificial treatments and substances). In connection with the values attached to what is "natural", a social and cultural need has arisen to protect inanimate and living objects, and consequently areas considered "natural". This is best expressed in the legally sanctioned nature protection system. Protection also covers those objects and natural areas that are not fully natural, as they were created by humans (e.g., city parks).

#### **4. Integrated Approach - Model Nature-Man-Technology-Culture System**

As it has been shown above, models of ecological systems found in the literature on the subject, due to the main dividing line of the studied reality assumed in them, can be divided into two approaches. In the first approach, named above, the environmental one, distinguishes a man understood as individuals, their communities, including societies and states, and even the entire species of homo sapiens and the part of reality outside them, called the environment. In the second approach, called social, the natural order is distinguished from the artificial order, i.e. the order created consciously by people.

Different models can be found in the literature, mainly in environmental, sometimes social, and mixed, although rather inconsistently. They can be divided into two-component and ternary. However, the list below illustrates the conceptual confusion and difficulties in any scientific discussion of ecological systems.

Simple two-piece models include:

- "man - nature" (Glacken, 1967; Siefert, 1989)
- "man – environment" (Chojnicki, 1988; Lisowski, 1989)

The more common three-element models include the following:

- "society – person – environment" (Kolipiński, 1978; 1980; Mogej, 1981; Steiner, 1988; 1993).
- "humanity - artificial nature - primal nature" (Zabierowski, 1979)

- "society - technosystem - nature" (Huber, 1987)
- "civilization - species - nature" (Girenok, 1987; Vernadskij, 1989)
- "man - economy - nature" (Kostrowicki, 1991)
- "society - economy - natural environment" (Domański, 1992)
- "society- technology - biosphere" (Sachsse, 1984; Boyden, 1993; Kluge, 1985).

The overlapping of both approaches – environmental and social – leads to an integrated model of the ecological system. It is true not in the universal sense, but in the scientific sense, i.e. simple, useful and, as a whole, consistent with experience (Quine van, 1986). Such a model consists of four components whose names are slogans: Nature, Man, Technology, Culture, and the relations between them. In order to avoid misunderstandings and due to a certain terminological tradition, the text uses the terms "Nature" and "natural environment" as well as "Technology" and "artificial environment" interchangeably, and also develops and supplements the terms "Culture" and "Man".

**Table 1.** *Integrated model of the ecological system Nature-Man-Technology-Culture*

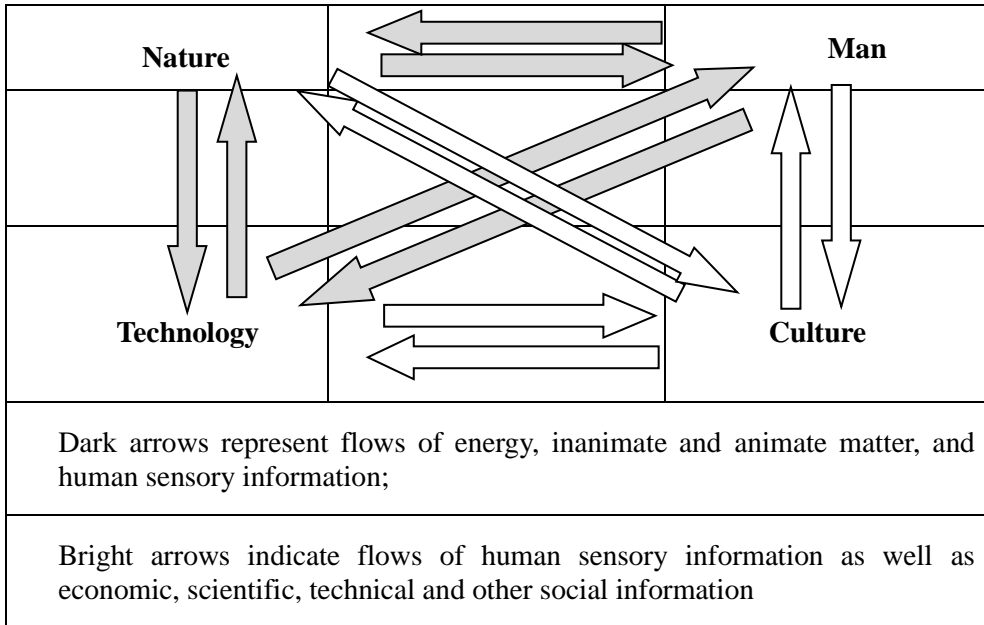
		Environmental Approach	
		Environment	Humanity
Social Approach	Natural	<b>Nature</b>	<b>Man</b>
	Artificial	<b>Technology</b>	<b>Culture</b>

*Source: Own study.*

The following definitions of the components of the integrated ecological system were adopted (Table 1):

- Nature, i.e., what is natural in the human environment (other names: biosphere, natural environment, natural environment); (Bohme, 2002);
- Man, i.e., what is natural (passed on by inheritance) in human individuals - their organisms and psyche (also at the level of organs, cells and genes), populations, the human species (humanity), (other names: people, body and soul/ spirit/mind) (Olson, 2003);
- Technology, i.e., what is artificial in the human environment (other names: artificial environment, anthropogenic environment, built environment, artifacts), serving mainly to meet human existential and material needs, but also artifacts serving to meet intangible needs, mainly of a religious nature, symbolic and artistic (Lizut, 2014; Zacher, 1986);
- Culture, i.e., what is a product of social order in individuals, human groups and society (other names civilization, society): language, knowledge (including scientific and technical), aesthetics and morality, social relations, especially economic, political, legal, technology, worldview, religious beliefs, ideas, literature, art, practical skills, customs and others.

**Figure 1.** Relationships in Integrated model of the ecological system Nature-Man-Technology-culture



*Source:* Own study.

The Culture component only has information flow connections. The Nature component has mutual energy-material connections with the Man and Technology components. For ecological problems related to the Human component, mutual energy-material relations with the Technology component are important.

It is worth noting that many relationships between the Nature component and the Human component run through the Technology component and are controlled by the Culture component.

## 5. Influences of Nature

***The influence of Nature on Man through the flow of energy, inanimate and animate matter and sensory information:***

This type of influence of the natural environment on the organism and psyche of the human being, population and the entire species of homo sapiens is common to all living creatures. The human body obtains the oxygen, water, food and heat energy necessary for life from the natural environment. The effects of uncontrolled and excessive flow of matter and energy to the human body are the causes of injuries and death of people.

***The influence of Nature on Culture through flows of sensory information:***

The flow of sensory information about Nature is a condition for the survival of individuals and human populations. Direct observation is the material of nature-inspired art and literature as components of Culture. On this basis, patterns of Nature are built within the Culture, beautiful but also ugly, friendly and dangerous, familiar but also alien, tasty but also poisonous. This type of products also includes such cultural phenomena related to the recreational or tourist qualities of nature.

***The influence of Nature on Technology through flows of energy, inanimate and animate matter and technical information:***

Modern industrial civilization is based on the constant collection of various types of raw materials from the natural environment, which are then introduced into a complex production system. Only products are used by people and partially introduced into their bodies. The basis of every economy and civilization is energy. Most of the flows of matter and energy are fully controlled, but they can flow from the natural environment to the artificial environment and affect people staying in it also in a violent way.

**6. Influences of Man**

***The influence of Man on Culture through flows of economic, scientific, technical and other social information:***

The main form of this impact consists in transferring to Culture sensory information obtained by Man directly or indirectly by means of technical devices on the state and changes of Nature and Technology and the relationship between them.

On this basis, science is created that enables the economic use of environmental goods, as well as political, legal and social institutions regulating such exploitation. Information reaching the Culture concerning the natural, and especially bodily, including innate aspects of human existence, including their diversity, especially sexual, is also important.

***The influence of Man on Technology through flows of energy and technical information:***

The human body can function efficiently in quite narrowly defined environmental conditions. By creating an artificial environment in closed buildings, people try to recreate the optimal conditions of their existence, avoiding the conscious introduction of harmful or life-disrupting factors.



Man is fallible and constructors of buildings, structures, machines and devices must take this into account. This is especially important in complex and large technical systems, the failure of which can cause great losses or casualties.

Flows of technical information from Man to Technology are an obvious condition for its creation and existence. Initially, it was practical information, as knowledge progressed, from the 16th century, a science emerged that enabled the emergence of technologies that are a component of Culture. People are the creators of science and technology and the transmitters of information contained in them to both Nature and Technology, as well as to Man, but nowadays mainly through Technology.

***The influence of Man on Nature through the flows of energy and inanimate and animate matter as well as sensory information:***

A common feature of all living organisms is the need to excrete energy (in the form of heat) and substances unnecessary for the functioning of the body. After the cessation of life activities, each organism transforms into substances that return to the natural environment.

Obtaining water and extracting mineral, forest and agricultural resources requires physical labor. Particularly large amounts of physical labor were required in the phase of agrarian civilization, based on land cultivation and animal husbandry. At the end of the eighteenth century, the industrial revolution began, which replaced manual work with machines. Only less and less muscle energy went to Nature, and more and more to the tools and machines that acted on Nature.

Currently, the flow of energy from the human body to Technology is insignificant and results rather from care for health and physical fitness than from existential needs. personal and communal were at a very low level. It was not until the 19th century that waterworks, sewage systems and municipal cemeteries were built in cities, followed by sewage treatment plants.

However, the secretion of pathogenic bacteria, viruses, parasites, etc. by human organisms into the air and water is still a cause of epidemics.

## **7. Influences of Technology**

***The influence of Technology on Nature through the flows of energy and inanimate and animate matter:***

In many studies, the entire ecological issue is reduced to this type of relationship, although it is a serious narrowing down. They consist in the emission of artificial substances as waste mainly from production equipment. Most of these pollutants are local in nature and may adversely affect the health of local residents.

Some, however, affect the global ecosystem, leading to disturbances in the functioning of nature on an unprecedented scale. This mainly concerns climate change caused by carbon dioxide emissions. Pollution of rivers, lakes, coastal sea waters and oceans is also a serious problem. In cities, as a result of emissions from industry, heating furnaces and combustion vehicles, the air quality is bad and poses a threat to people's health.

***The influence of Technology on Man through flows of energy, inanimate and animate matter as well as sensory, scientific and technical information:***

Modern people live in an environment composed of natural and artificial components. However, most people in high and medium developed countries live mainly in an artificial environment - in buildings and vehicles. Only a few food products come directly from Nature. The main problem here is the addition of chemical substances to food products that enable their long-term storage and long-distance transport.

Another problem is the occurrence of such substances in drinking water as a result of insufficient treatment of polluted water from natural sources. Another issue is the chemicals found in the air, cleaning products and cosmetics. Another hazard, of particular concern due to the impossibility of observing them with the human senses, is related to ionizing radiation and electromagnetic fields.

Also, the ubiquitous noise and noise in the artificial environment has a clearly negative impact on the human body, especially on the nervous system. The most serious threats to health and life, however, are the result of accidents, failures and industrial, communication and construction disasters.

***The influence of Technology on Culture through flows of economic, scientific, technical and other social information:***

These interactions take place, as mentioned above, through the Man who creates the Culture. The artificial environment, regardless of the basic economic functions it must perform, is an expression and source of Culture with a long-term effect. Residential houses, public buildings, temples, roads and bridges last for hundreds of years, change their users and functions, but their cultural significance does not decrease.

The artificial environment, especially those remembered from childhood and youth (including the natural environment) is a permanent element of biographies and national, regional and local identity. Technical objects are also the subject of artistic creation, painting, photography, literature and poetry.

## 8. Influences of Culture

### *The influence of Culture on Technology through information flows, economic, scientific, technical and other social:*

The artificial human environment consists of objects produced by people and permanently placed in an area. The artificial environment also includes spatially limited fragments of the Earth's surface on which natural objects occur, but the way they are interconnected, as well as functioning and development is largely under the control of Man. dramatically increased human intervention in the natural environment.

### *The influence of Culture on Nature through technical and social information flows:*

Therefore, the influence of Culture on Nature is indirect – through Technology and Man. The relationship of man to nature has evolved along with the growing possibilities of controlling the natural environment. The main reason for the strong influence of Culture on Nature is the emergence and development of science. The results of scientific research enable the production of artificial objects - including machines and devices - from the creations of Nature.

Technology has enabled the production of substances that do not occur in nature, which, after getting into the environment, mainly as waste, began to change the composition and functioning of the natural environment. First locally, then in more and more areas, and finally on a global scale, the negative effects of industrialization, urbanization and increasing consumption began to be noticed.

Nature objects began to be protected, ecological policy developed. The relationship of man to nature has also changed. However, the treatment of Nature as an inexhaustible source of raw materials and waste receiver still prevails.

### *The influence of Culture on Man through the flow of sensory, economic, scientific, technical and other social information:*

Information relations Man - Culture are the essence of the human world and the subject of social sciences and humanities. In these considerations, even a small part of these dependencies is not taken up, but only those that are ecological in nature, i.e. they are related to the natural and artificial environment (Nature and Technology). As already indicated above, a significant part of this information is a processed message of information coming from direct and indirect observations of Nature and Technology.

Some, however, concern the very essence of man and his (disputed by some thinkers) division into body and soul. The way of perceiving and understanding

corporeality depends on the level of scientific knowledge and is culturally conditioned. Already what is considered "natural" in people's body-related behavior changes over time and is defined differently in different societies.

At different times and places in the world, the attitude towards the human body, illness, and physical aspects of death varies. Diseases, and especially mental and nervous diseases, are not just an objectively determined abnormal state of an organism, but the result of a prior, socially conditioned definition of health and normal well-being.

## **9. Conclusions**

Ecological problems play an increasingly important role in the economy, social life on a global scale and the daily existence of human beings. In order to solve them, in addition to pro-ecological technologies, appropriate theoretical approaches and corresponding models are necessary.

Their inconsistency leads to misunderstandings in the public debate and erroneous environmental policy. Most general models of such relationships are incomplete.

The main result of research conducted for years (Dutkowski, 1995; 2021) formulated in this article is the confirmation of the reality and completeness of the proposed model of integrated ecological system Nature - Man - Technology - Culture. It includes all 4 components of the reality of the earth's shell and all 12 relations between them - 6 energy-material and 6 information.

This makes it possible to interpret each object and result of empirical research in terms of systems.

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