

SYSTEM ISOMORPHISMS. THE SYSTEMIC TRANSDISCIPLINARY ASPECT

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Abstract

The article is devoted to the substantiation of systemic isomorphisms. The rationale is based on the fact that the universe is a single ordered environment and this order is manifested in every fragment of the universe. The definition of a system as an order that determines the unity and integrity of an object and the uniqueness of such an order made it possible to formulate an epistemological model in which the "system in general" is an object that transforms matter, energy and information. Functional and structural isomorphism is substantiated with the help of translational disciplinary models of order. The systemic dualism of the system consists in the fact that the system exists simultaneously in two guises - as a standard and as its embodiment in reality or systemic dualism. It is shown that in order to perform the main transformation function, the system must have a structure as a set of interrelated elements. The use of these isomorphisms for the analysis of the socio-economic development of mankind is shown. As a result, man and his household are designated as the basic elements of humanity. The systemic goals of the development of social and economic relations are outlined. It shows how the goals of human development and the goals of human development as a system, studied as a system, are interconnected. It is shown that the results of human development completely depend on how much managerial influence corresponds to isomorphisms - the development of the system is possible only with the coevolutionary development of all basic elements and represents a consistent change in the state of the basic elements and the connections between them in accordance with the standard in time and space. The transdisciplinarity of the described isomorphisms and order models makes it possible to analyze and predict the state and development of both systems.

Keywords. general systems theory, system isomorphisms, order models, system-transdisciplinary concept.

Introduction

A key concept in general systems theory is isomorphism. Isomorphism is a concept expressing the sameness of forms (isomorphism; from Greek isos – the same and morphe – form). Strictly speaking, two objects are called isomorphic (located in relation to isomorphism) if a one-to-one correspondence exists or can be established between their elements, as well as functions, properties, and relationships. However, in the world around us we see a huge variety of objects and phenomena. What should be the expression of a one-to-one correspondence or similarity of forms? How can we reduce all this diversity to some kind of one-to-one correspondence? In our opinion, L. Bertalanffy pointed out how to do this. *"Rather, we are interested in the principles applicable to systems in general. Having posed the question in this way and successfully defined the concept of a system¹, we will find that there are models, principles, and laws applicable to generalized systems, regardless of the characteristics of their type, elements, and binding "forces."* (Bertalanffy, L von. 1968.p. 33). In this sense, *"isomorphism should be understood primarily as a relationship between epistemological models, rather than between real-world systems themselves."* (Øgland, P. & Kaasbøll, J. J. 2026).

Please note that L. Bertalanfi explicitly pointed out that before discovering "principles applicable to systems" it is necessary to formulate a "successful definition of the system". This is a very important remark, since about 100 definitions have appeared since the term general theory of systems was coined [Dori, D., & Sillitto, H. 2017.pp.207-219]. Such a number of definitions indicates that there is currently no generally

¹ Highlighted by the author

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accepted concept of a system. This does not allow us to discover the principles applicable to "the system in general," regardless of whether they are physical, biological or sociological, and to develop transdisciplinary epistemological models that will allow us to correctly select and study an object as a system.

1| Method

1.1. | Philosophical and ontological substantiation of systemic isomorphism

The synthesis of the philosophical principles of holism (Ya Smuts) and unitricism (Vlad Mokiy) made it possible to formulate a systemic paradigm.² (Mokiy M.S. 2025). The basic idea is that the whole World is a One order Medium. In order³ for the World to remain one, the order that exists in the world must manifest itself in every object and phenomenon. The postulation of a single order allows us to assume the existence of a one-to-one correspondence, that is, an isomorphism of the forms of origin, existence and development of all objects, processes and phenomena in the world.

Within the framework of the system-transdisciplinary concept, a system is understood as an order that determines the unity and integrity of an object.

Within the framework of this concept, a "system in general" is an epistemological model of an object that transforms matter and energy. That is, the main function of the system is the transformation process. In this regard, it should be noted that there are researchers, for example, Lynn Rasmussen, who define the system as a process (Rasmussen, Lynn 2024). These authors identify the functional aspect as an essential feature of the system. (Duran, G.J.P. 2020. p.14) However, this is not entirely correct, since the implementation of any transformation process requires a mechanism, that is, a set of interrelated elements that allow functions to be performed. It is the totality of interrelated elements that is noted in many definitions of the system as an essential feature. But the above suggests that studying the system requires studying both the structural and functional aspects.

Definitions of the system as the order that determines the emergence, existence and development of an object allowed to develop models of this order (Mokiy V.S. 2011)

The universal principle of understanding all epistemological models and models of order is the concept of the "informological dipole" (Fig1). Just as in the Chinese philosophy "everything is yin-yang", in the informological dipole, the complete state of an object should be described by quantitative and qualitative information

complete information	
quantitative information	qualitative information
Yang	Yin

Fig1. Informological dipole model

Hence the epistemological model⁴ or isomorphism - systemic dualism. The system exists in two guises at once - as a "single" - the standard of the system, as quality (noumenon according to Plato) and as a "whole" - the manifestation of this standard in time and space, as quantity (phenomenon according to Plato).

It is easy to see that this epistemological model finds its confirmation in reality. Growing a tree, driving and repairing a car, cooking, treating a patient – any process requires a reference. The question of where the standard is located or what it should be is a separate question for each fragment of the world and requires

² By the term "paradigm" we mean the basic idea

³ The order in our article is strict certainty in the location, placement of something and a certain sequence, the course of something.

⁴ A model is a human—created likeness of the objects, phenomena, and processes being studied, reflecting essential features.

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a separate study. But the study of objects as systems, the development of the object and the management of development is possible only if there is a standard.

If this system dualism is taken as a basis, then each type of information can be described by the same dipole. The necessary and sufficient level of differentiation of information is the decomposition of light into the colors of the rainbow. Then the information model "unit of order" is a reference unity of features of complete information. (Fig.2).

In other words, to study the content and condition of an object using this epistemological model, it is necessary to identify either 2, 4, or 8 features.

Extrapolating the patterns of the information model to time allows us to build an epistemological model for studying the development of a system over time or a temporal model of a unit of order. That is, in the duration of the complete transformation process, it is necessary to identify either 2, 4, or 8 stages of system development.

Complete Information							
Quantitative Information				Qualitative Information			
quan- quan		quan- quan		quality- quan		qualit- qualit	
1	2	3	4	5	6	7	8

Fig 2. The information model unit of order

The postulation of the existence of functional and structural aspects in the study of objects as a system determines functional and structural isoformism.

1.2.| Epistemological model of functional isomorphism

By postulating a system in general as an object whose main function is the transformation of matter, energy, and information, and using the above-mentioned epistemological models, one can designate a functional isomorphism.

The fulfillment of the main function requires the fulfillment of two functions – the function of self-preservation and the function of system development. The parameters of the main function, embedded in the standard, determine the parameters of the functions of the existence and development of the system. At the same time, the following eight functions should be performed at each stage of this process⁵:

- the function of continuous analysis of the parameters of the external and internal environment;
- the function of assessing and predicting the consequences of parameter changes;
- decision-making function;
- the function of evaluating options for action;
- action function;
- the function of evaluating the result of an action;
- comparison function with parameters;
- the function of neutralizing malfunctions.

These functions are well known to people who are involved in management theory and practice. However, it is obvious that without this set of functions, no conversion process is possible.

1.3.| Epistemological model of structural isomorphism

As we indicated earlier, the execution of functions requires an appropriate structure.

The structure of the system "in general" is a set of elements and connections between them, which form a mechanism for performing these functions. Each structural element is formed from the so-called basic

⁵ This classification was developed on the basis of the work of P.K. Anokhin (P.K.Anokhin 1973).
http://www.bio.bsu.by/phha/downloads/anohin_obscaia_teorija_fs.pdf

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elements. Strictly speaking, the transformation of matter and energy is carried out by its basic elements. And the development of a system is a change in the quantity and quality of the basic elements and the connections between them. The systemic need for the development of an object is coevolutionary, that is, the joint directed development of all basic elements. The requirement of coevolutionary development provides for the determinism of matter and energy consumed by each element of the system. The quantity and quality parameters of the basic elements are set in the reference. Violation of this principle is perceived by the system as a dysfunction that needs to be eliminated. To do this, there is a mechanism for neutralizing dysfunctions.

Then we can draw an important conclusion: the development of all the necessary basic elements is the basis for the implementation of the functions and development of the system, or only with the development of all the necessary basic elements is the development and functioning of the system possible. Participation in the transformation process generates essential and status needs for matter and energy for each element of the system (MokiyV.S., 2015). Satisfaction of essential needs makes it possible to realize the function of self-preservation. Satisfaction of status losses allows you to realize the development function. Essential needs have a quantitative attribute, status needs have a qualitative attribute.

2. Results

Let us show how the application of the considered isomorphisms can be used in the study of humanity as a system.

The fact that humanity as a whole and every human being has been transforming matter, energy, and information since its inception is obvious. This allows us to consider man and humanity as a system. The basic element of this system is a human being. Man transforms matter, energy, and information every second of his existence. For a human being to exist as a biological being, a certain amount of matter and energy is needed in the form of a certain number of calories, proteins, etc. This need implements the function of self-preservation and forms existential needs. The parameters of goods for satisfying essential needs are determined by the laws of nature. For example, the amount of air or chemicals consumed is limited and violations of this volume will lead to illness or death.

To meet essential needs, people began to form groups, because together it is easier to provide themselves with the necessary amount of goods. The inevitability of combining system elements is due to Hamilton's universal principle, according to which combining ensures the performance of functions at the lowest cost. The result of the merger was the division of labor. This, in turn, necessitated the distribution of benefits and their exchange between people. Social relations have emerged between people in the process of creating, distributing, and exchanging goods. They are called economic relations.

If we consider economic relations as a system, then the basic element of this system is a person-the creator of goods and his household. Households are the ultimate consumers of all goods. It should be noted here that household is not synonymous with family. Even if a person lives alone, he has a household. Then, a change in the state of economic relations is a change in the well-being of each employee and his household. The unification of people into groups required the development of rules for the appearance of people in society. To do this, it is necessary to indicate the status of a person in society. The status of a person (parent or child, head of a clan or an ordinary member, superior or subordinate, patrician or plebeian, noble or commoner, king or vassal) determines the needs and benefits that emphasize the status - the number of feathers in the headdress, crowns, tattoos on the body, special services, honorary titles, etc. These status needs arise on the basis of the significance formed in a person's mind, the need for something, that is, value. In other words, the need for food is a physiological need, and the need to "eat on a golden platter" is a status need and it is formed by existing values in society. It is on the basis of a set of values formed in a person's mind that desires arise – as a meaningful experience of needing something. The presence of values allows for an assessment of needs and causes a desire to receive benefits to meet them. However, the formation of values in the human mind is impossible without society. As Niccolo Machiavelli noted, "the king is made by the retinue." First the family, then the street, the school, etc., that is, the social group forms values. The set of values determines the needs, which in turn determine the interests, motives, and preferences in people's behavior. If we consider social relations as a system, then the basic element of this system is a

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person as a member of a family, clan, nation. A change in the state of society is a change in the state of every person - a member of society and, above all, a set of values.

But everyone is simultaneously a participant in economic and social relations. If we consider a person as a system, then his systemic goals are his self-preservation, development and improvement of the well-being of his household and family.

The coordination of interests in human communities is based on rules (laws, regulations, customs, traditions, morals, concepts, morals) and enforcement mechanisms to comply with these rules. That is, the existence of any social group requires a system structure in the form of governing bodies that will allow it to perform all the necessary functions (see functional isomorphism). Managing people's behavior at any level presupposes the presence of authority among decision makers. By authority, we mean the ability and ability to force people to do something, even if they don't want to. Authorities at any level are groups of people who have been assigned (or who have appropriated the right) to exercise authority. At the state level, such bodies are the parliament, the government, various regulatory authorities, courts, law enforcement agencies, etc.; at the organizational level, the directorate, administration, etc.

In this sense, power is a systemic necessity for the existence of a human community. The exercise of authority – that is, the impact on people – presupposes the availability of quantitative and qualitative indicators describing the necessary results (as a benchmark). In terms of functional isomorphism, the government should work out the parameters of the main function. And these parameters are mandatory for all members of society. Violation of these laws is dysfunctional and threatens the integrity of the system and hinders its sustainable development. Therefore, people must follow the rules of behavior and subordinate their interests to the interests of society. Methods of eliminating dysfunctions at the social level (expulsion from society, fines, demotion, dismissal, imprisonment, etc.) in any case reduce the level of well-being of a person and his household.

In other words, on the one hand, a person as a system strives for stability and self-preservation. This presupposes a person's desire to ensure their own survival and improve the well-being of their household.

On the other hand, a person (as a system) intuitively feels the systemic goals of economic and social relations, as aimed at ensuring the well-being of all households and educating a person as a comprehensively developed personality. Therefore, the slogans "freedom, equality and fraternity" are the slogans of all revolutions. And justice and improving the lives of the people, that is, individual citizens and their families, are the election promises of the overwhelming majority of contenders for power.

Human behavior in society is based on a constant comparison of the goals of the development of society (from the organization to humanity as a whole) and their own goals.

Here it is necessary to clarify the concepts of "justice" and "injustice" from the perspective of a systemic transdisciplinary concept. This is closely related to the fact that the condition for maintaining the unity of the system is the coevolution of the development of the elements, which implies strict determinism of the consumed substance and energy. The amount of matter and energy in the form of quantity and quality of required goods is determined by the status or importance of a particular person for society. Just as, for example, the human brain occupies about two percent of a person's weight, but consumes about 20% of energy, so most people quite easily put up with the fact that the president of the country is accompanied by a large number of guards and traffic is blocked during the passage of the presidential motorcade. But if the ways of creating, exchanging and distributing goods are aimed at satisfying only individuals and their households, and the freedom proclaimed in society is declarative, awareness of this state of society is perceived by a person as "injustice." Up to a certain point, this situation is characterized by conformist behavior of people. But when the number of people who realize this reaches a critical mass, the mechanism for neutralizing dysfunctions manifests itself in the form of dissatisfaction with the actions of superiors, in the form of strikes, social unrest, uprisings and revolutions.

Models of information and temporal units of order allow us to identify eight signs of economic relations (fig 3).

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Needs and values	people are creators of benefits	labor items	tools of labor	a way to create benefits	benefits	a way to exchange benefits	a way of distributing benefits
1	2	3	4	5	6	7	8

Fig 3. Attributes of the economic relations system

According to the temporal model, the standard for the development of socio-economic relations should include eight stages of development. (Fig 4). At the highest stage of development, all system goals are achieved.

The primitive	Primitive communal	Slavery	Feudal	Capitalistic	Post-industrial	intro Noospheric	Noospheric
1	2	3	4	5	6	7	8

Fig 4 Stages of development of socio-economic relations

A systematic justification of the reference goals of socio-economic development and the goals of human existence and development as a system allows us to conclude that the success of development at the national and global levels will depend on how much:

- the stated goals, values and rules correspond to the systemic goals of socio-economic development – improving the well-being of every household and the comprehensive development of every person;

The values and needs of each person that are being formed will ensure the evolutionary development, that is, the jointly directed development of all people.

Let's show this dependence using the example of the development of some countries.

So, since the formation of the United States, at the end of the 18th century, the country has rapidly repeated almost all stages of the development of the global economic and social system. One can observe both subsistence farming and the slave-owning stage of development. However, the set of conditions laid down in the Bill of Rights and in the US Constitution, which declares equal rights to all citizens without any restrictions, was significantly closer to the reference stage of the development of society and the economy as a system. That is, to the stage when the totality of conditions in society will ensure an increase in the well-being of all citizens and their households (the noospheric stage). In our opinion, this was one of the main reasons why the United States moved from the category of developing countries, a former British colony, to the developed countries in a hundred years by the end of the 19th century. By the end of the 20th century, it became the first economy in the world to provide its citizens and their households with one of the highest levels of well-being.

Even more striking is the history of Russia. October 1917 swept away class distinctions, declared social equality and, thus, predetermined the strongest scientific and technical breakthrough of the USSR. Indeed, in 1917, tsarist Russia was a peasant country weakened by the World War. Only forty years have passed, which includes the Civil War, the Holodomor, and the Second World War. Despite this, in October 1957, the USSR launched the world's first space satellite. By the 70s of the twentieth century, the level of household wealth had increased significantly, although it was far from American. However, the idea of social equality and the all-round development of each person was most consistent with the development of society as a system. In this sense, the goals of society's development and the goals of each individual's development coincided. The fact that the majority of citizens realized that the real state of affairs did not correspond to the declared equality of citizens was the main reason for the weakening of the economy and the collapse of the USSR. From this point of view, the reason for the viscous course of economic reforms in modern Russia is the awareness of citizens that the existing rules for the creation, exchange and

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distribution of goods are aimed at improving the well-being of only individual households, and institutional provisions do not ensure the development of each member of society.

From the perspective of the patterns outlined above, the reason for many economic "miracles" was that management decisions were based on ideas whose essence is very close to the systemic goals of economic and social development.

For example, **Singapore**. The basic idea is: *"If the power of the state that we control is used not to improve the lives of the majority, but to line the pockets of a minority from the power hierarchy, then we will have a bad time."*⁶ As a result, despite all the criticism of the Lee Kuan Yew regime and its authoritarianism, the republic ranks eighth in terms of GDP per capita, 85% of residents live in state-owned apartments. Lee Kuan Yew believed that the most important part of the population was the well-educated middle class. No corruption, no crime. The laws and regulations are simple and clear, and most importantly, they are accepted by the majority of citizens of the Republic.

Israel. As a state, it emerged in the late 40s of the twentieth century in the Palestinian desert. Golda Meyer outlined the main social idea: *"If you want to build a country where people will leave only during the holiday season, if you want to build a country that will not have a sense of fear for the future, then take just two steps.:*

- 1. Equate corruption with treason, and corrupt officials with traitors, up to the seventh generation.*
- 2. Make the three professions the most highly paid and respected. These are the military, teachers and doctors..."*⁷.

Actually, these ideas were the basis of social and economic policy. As a result, the gross domestic product per capita in Israel was last recorded at \$42596.08 in 2025. The GDP per capita in Israel is 337 percent of the global average. In 2023, Israel ranked 27th out of 193 countries on the UN Human Development Index (0.919), one of the highest indicators in the world.⁸

China. After the country's leadership adopted a poverty eradication program in 2001. Of course, this program included many aspects, but what is very important is that China has moved from universal subsidies to work with every household. For this purpose, personal archives were created, the causes of poverty were analyzed, and specific support measures were selected. Provision was made for food and clothing, compulsory schooling for children, access to basic medical care, and safe housing. China has now adopted a long-term program for the establishment of a middle-class society, Xiaokan. This is a state of society where every family has a balanced standard of living, where people have their basic needs met, there is comfort, security and opportunities for development not only in the economy, but also in the social, cultural and environmental spheres. Obviously, these parameters are the closest to the goals of the development of the economy and society as a system. Of course, one can talk about a specific understanding of individual freedom in China, but one cannot deny the fact that household wealth is growing in this country.

The scope of the article does not allow for a detailed analysis of the development of many countries, but there is reason to believe that in those countries that have preserved in some form class distinctions, privileges and other social inequalities, economic development is very sluggish. An example of this is some Latin American countries, the post-Soviet states of Central Asia or the Middle East with their class, clan, and tape structures and chauvinistic policies that are transferred to socio-economic relations.

3. Discussion

It should be noted that the use of these isomorphisms is typical for developing objects. These are likely to include natural, biological, and social sites. However, the issues of what quantity and quality of basic elements should be in accordance with the development standard have not yet been sufficiently investigated.

⁶ Lee Kuan Yew — 227 quotes by the author <https://citaty.info/man/li-kuan-yu-0>

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https://aif.ru/society/history/kak_golda_meir_predlagala_sdelat_lyubuyu_stranu_velikoy?ysclid=mrt9ivyo3958267274

⁸ GDP per capita of Israel <https://ru.tradingeconomics.com/israel/gdp-per-capita>

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Well, for example, will the world's population grow or should it stabilize at some level? Although the experience of developed countries indicates a decrease in the birth rate.

Unfortunately, I cannot give in this article examples of the application of functional and structural isomorphisms and order models for many other objects due to my incompetence. However, for example, as a person and researcher of systemic isomorphism, I can conclude that many human diseases begin at the cellular level as a result of impaired developmental coevolution. In fact, cells are the basic elements of an organism considered as a system. It is in cells that matter and energy are transformed. The coevolution of development and strict determinism of the consumed substances and energy for all cells of the organism is obvious. Violation of the determinism of substance and energy consumption leads to illness. Of course, investigating the causes of such a violation requires special research, including using an epistemological model of information balance and imbalance.

Conclusions

It is easy to see that the use of system isomorphism and order models provides new tools for system analysis not only of human society as a system. Their versatility makes it possible to use these isomorphisms in the analysis and study of objects of any nature. There is reason to believe that the proposed definition of the system and the postulation of a single order that occurs in all fragments of the World made it possible to formulate isomorphisms in the form of models, principles, and laws applicable to generalized systems, regardless of the characteristics of their type, elements, and binding "forces." This will make it possible to correctly identify the object under study as a system. It is an object that transforms matter and energy, and allows you to identify the basic elements, elements of structure and function in this object.

The isomorphism of the order and its models will allow:

- to identify systemic patterns in objects for which search and verification experiments are possible, and then extrapolate these patterns to objects and processes where conducting such experiments is impossible or very costly;
- when solving multifactorial tasks, it is possible to interpret the knowledge gained through disciplinary methods from a single point of view;
- to identify the relationships between the elements that could not be identified using disciplinary research methods.

The transdisciplinarity of isomorphisms allows us to identify and study self-organizing objects as systems, from the atom to the universe. For objects created by humans, these patterns are a guideline for finding a compromise between the elements.

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