

THEORY OF ECONOMIC CONSTRUCTIVISM

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Abstract

In this paper, a new tool for economic analysis and improvement of economic theories – the Theory of Economic Constructivism (TEC) – is considered. TEC is based on epistemological constructivism, duality theory, second-order cybernetics and network analysis of economic systems. From a single point of view based on an analysis of dual self-reference systems, emerging economic phenomena – autopoietic systems, circular and transit processes, communication networks – are described. The concept of closed, circular processes, as invariants of economic systems, ensuring sustainable economic development, is elaborated. A theoretical substantiation of the place, role and significance of closed structures at different levels in a management system is carried out. A network-based improvement of the balance model, taking into account the structure of linkages in the economy, is proposed. Examples illustrating the possibilities of calculating stable variants of structures are provided for different types of model economies. Using the topological apparatus of dual networks, the main variants of cash flows associated with the production sphere of the economy are considered. On the basis of the presented theoretical provisions, practical conclusions for improving the economy under the conditions of innovation and globalisation are drawn. The interrelation between exchange and contractual economies is affirmed. By contrast with contracting, exchange establishes relations between goods, recording the relations between operators exactly in those areas where they can only function jointly, supporting each other. When a chain of enterprises becomes isolated, forming a cycle that is balanced in its all nodes, a closed structure emerges, one that is absolutely independent from the external price landscape. A very significant part of the further progress of TEC can be connected with the formal characteristics and stability conditions of such closed loops (space cycles).

Keywords: *constructivism, self-replication, duality, second-order cybernetics, network analysis, autopoiesis.*

1. Subjective realities in economics

In economics, what is under consideration are not some distant, abstract events, but worlds generated by our activities. In contrast to the natural sciences, theoretical approaches in social sciences may affect the functioning of relevant systems. In physics, when the paradigm of classical Newtonian mechanics was replaced by that of modern quantum mechanics, the behaviour of atoms remained unaltered. However, the economic theories developed by A. Smith, K. Marx, J. Keynes, M. Friedman and others certainly did alter the behaviour of economic systems. Every time an observer analyses a subject, proposes some planning, criticises, dictates, devises actions or imbues them with sense, he observes in the active capacity of observer, and this gives rise to effects that are absolutely independent from his statements, whether they are true or not. This is why many economic realities that we encounter in the real world are not initially fully defined. Their determination requires steps to be taken, the framing of which includes the involved subject. In reflexive theory, such realities are designated as subjective (Lepskiy, 2009): any knowledge or ideas about things and the world consist in subjective constructions. In this connection Schumpeter noted “if there is any motive that encourages us to see the facts in this way, and not otherwise, we cannot doubt that we will see them in the way we want” (Schumpeter, 2004, p. 39). Economists recognise that the behaviour of these systems changes as

a result of the action of new knowledge. How can we take into consideration effects that arise when addressing “objective” reality if the whole context considered as constituting that reality was designed by our consciousness prior to the question being posed? In respect to this matter, the present status of economic theory is vague and obscure. Clearly, there is a problem; what is less clear is whether there is a solution – or, at least, an idea that might help to approach it? We affirm that there is such an approach: in this paper, an attempt is made to structure the available resources in epistemological constructivism (Knyazeva, 2008; Harre, 2006), duality theory (Popkov, 2004) and network analysis (Popkov, Baturin, 2007) in order to create a new interdisciplinary zone – TEC. It is hoped that this may turn out to be very fruitful for improving economic analysis and elaborating theoretical economic thought. We define economic constructivism as the deliberate construction of economic reality in accordance with the axiological preferences of a social subject (whether individual or collective), which takes into account the structural and parametric interfacing of subject and object on the basis of the principles of self-reference, duality, circularity and cyclical causality.

Although the concept of “constructivism” sometimes arouses bewilderment even among experts, this doesn’t imply that the conceptual orientation is new and unknown. The epistemological fundamentals of constructivism are validated by concrete scientific data, obtained within the framework of natural and humanitarian theories, such as A. Bogdanov's empiriomonism (Bogdanov, 2003), H. von Foerster's second order cybernetics (Foerster, 1973, 2003), G. Spenser-Brown's indication calculus (Spenser-Brown, 1974), G. Bateson's ecology of mind (Bateson, 2005), J. Piaget's constructivist psychology (Piaget, 2004), N. Luhmann's theory of social systems (Luhmann, 2007) and bio-cognitive research carried out by H. Maturana and F. Varela (Maturana, Varela, 2001). All these names are globally well known among scientific circles; however, economists have yet to pay serious attention to these research areas.

J. Schumpeter noted that any analytic work was preceded by a pre-analytic learning stage, which supplies the material to be analysed; he referred to this stage in terms of a “vision” (Schumpeter, 2004, p.38). We propose economic constructivism in terms of just such a “vision” of economic reality. It is understood that such a vision not only precedes any analytic work, but also encroaches on already existing theories. Nevertheless, no one would dispute the benefits of “viewing” things in a new light, often not conditioned by conventional facts, methods and results, which is characteristic of the prior stage of science development. Comparisons are necessary, not for reviewing theories, but for verifying realities. Thus, the false position into which economic science (as opposed to the “exact” sciences) sometimes falls when striving for an explanation of everything “existing” may speak against reality as opposed to its own theoretical underpinnings.

2. Correspondence and constructivist theories of cognition: reality of the second order

The approach to the study of economic realities that arose during the era of mechanicalism – and which remains well established today – rests upon the so-called correspondent theory of cognitive development. According to this theory, the brain, functioning as a perceptual system, receives signals from the environment, which contain certain significations (information) having no innate connection with the brain: all the brain has to do is accept this information, filter it out and actively process it. However, following numerous experiments in the field of sensory physiology, psychophysics and neurobiology (see, for example, Maturana, Varela, 2001; Harre, 2006) it became clear that that which leads to the stimulation of sense organs does not contain any predetermined reciprocal effects: the significations of the signals are entirely constructed by the brain. Thus the brain comprises a system for *producing* information, not passively consuming it. Knowledge cannot be obtained in a passive way, but is actively constructed by the cognising subject.

These brief theses form the basis of contemporary constructivism. According to the studies carried out by H. Maturana and F. Varela, no environmental factor can be perceived, evaluated or “cognised” as it is; rather, any such activity must be limited to the degree and tendency of the environmental factor's influence on a living organism. Thus, any reality consists in a structure, *constructed directly by the mental activity* of a person, who *supposes* that in so doing he or she is discovering and studying that reality. Thus the cognitive function is adaptive, conducing to establish a world of experience, rather than discover an ontological reality. As such, that knowledge is “true” which maintains the viability of the system and ensures its continuing survival. This conceptual substitution of the notion of “true” with that of “viability” completely alters the orientation of the cognising subject. There is no longer any sense in arguing about what is true or false, right or wrong; the only thing that may be discussed is whether or not the constructed knowledge and any activities based thereupon may support the viability of the system.

The relatively new constructivist school of epistemology has been developing within the interdisciplinary space of contemporary natural and humanitarian sciences since the 1980s. While the term “constructivism” may not be the most felicitous, it has much in common with the already adopted notion of “constructive mathematics”. It may be noted that the general ideas that underlie the constructivist approach have yet to be accepted by the general public. On the contrary, their seeming radicalism makes them attractive and repellent in equal part.

Paul Watzlawick, the author of the book “How real is real?” (Vatzlavick, 1977), responding to critics, argued that in constructivism we are coping with our existential state of *ignorance* by *inventing order*, subsequently forgetting or not noticing that we have invented it ourselves and then experiencing it as something “beyond” (or outside of us), which we call reality. In actuality, our thinking appertains to the same world we are thinking about. Thus, the arguments relied on to provide evidence to support the correctness of theories about the structure of the Universe may themselves be confirmed by reasons which depend on those same arguments (self-referentiality). An essential property of the self-referentiality of consciousness is its self-sufficiency: a person cannot sense the lack of any kind of reality that he or she has not yet constructed, i.e., pose to oneself questions that cannot in principle be answered. *seen*. Here arises what Watzlawick called the reality of the second order. The reality of the first order deals with strictly physical, objectively established properties of things and is closely associated with the correct sensory psychic perception, and also with matters of so-called common sense, i.e. with objective, reproducible, scientific verification.

Realities of the second order are comprised of the notional and axiological properties of things, based on a communication context: *within this world, there are no objective criteria (we do not know what we do not know, and often do not want to know)*. Researchers in physics, biology, philosophy and sociology (this list can be continued) have for a long time and increasingly persistently raised the question – so, what happens to the world when an observer appears in it? What then can be said about the economic theories generated by people who take actions on the basis of such theories and then derive their arguments from the obtained reality in order to justify the self-same theories?

In economics, the attempt to rely on facticity as a criterion of truth is not justified since theoretical approaches in social sciences may alter observed phenomena. G. Soros (Soros, 2001, p.6) quite reasonably affirms that when cognising participants participate in an event, the analysed object is no longer limited by facts, but also comprises the perceptions of the participants. The perceptions of the participants, in turn, correlate not with facts, but with the situation, depending on their own perceptions, and therefore cannot be treated as factual. Classical economic theory tries to get around this problem by introducing the idea of rational

behaviour. People are considered to behave in such a way as to make the best possible choices. *However, for some reason, the distinction between facts and the perception of alternatives is not taken into account.* Soros does not disclose the mechanism of this error; however, as has been shown, it results from the duality of the process of cognition (Popkov,2004).

For a human being, a *concept* is always a *word (name)*: human language constantly asserts that things external to us possess qualities and attributes. The names of things come to us at a time when we are learning to speak: it happens so naturally that we do not even suspect that there may be some kind of trap concealed there. And this continues over the course of an entire lifetime: everything that we find out about has its own name. Any discrete thing derived from reality is projected onto the screen of consciousness with its own unique name.

Conversely, special markers or symbols are not used to designate existence. For the observer, everything that appears on the screen of consciousness by virtue of its name comprises that which exists (whether in the imagination or in reality). According to conventional perception, we cannot use anything for the designation of existence or nothingness – actual space has not taken care of the correct filling of the tableau of consciousness, as reality does. When an observer wishes to rely on the assumption that something does not exist, he simply does not apply a marker to it. To indicate that he acknowledges the existence of something, the observer uses the marker (name); to indicate that he doesn't acknowledge its existence, he uses nothing. At the same time, he never reflects upon the fact that what he considers to be his *acknowledgement of existence* consists only of his marker, but continues to act as if he had taken *existence into account*. However, – *and this is of principal moment – the marker of existence and the fact of actual existence may differ*. Furthermore, if a marked state exists, it at once indicates the appearance of the dual state of which cognisance is not taken. These two states correspond to the two types of observers (insiders and outsiders) and to the two absolutely different questions: “What's going on” and “what's behind it”?

The German sociologist N. Luhmann justly remarked that it is “hard to maintain the unity of the discipline when its questions differ so much” (Luhmann, 2002). This can also be fully applied to economics. Let's take, for instance, the unceasing debates between supporters of non-interference of the state in the economy and defenders of state regulation of the economy, each of whom is certain that their position is “correct”. Both parties, in appealing to one and the same reality, proceed from a very controversial (as we have already shown) premise: that the anchoring of empirism [the theory that certain capacities or abilities are not innate, but are acquired by learning] to the external world may help to reveal what is true and what is false. Of course, the fact that each party has marked its own side in its perception of economic reality, disregarding every other possible difference, is strenuously ignored. Thus, for each party, a game naturally comes into play between internal research freedom and arbitrary external referents.

3.Second-order cybernetics, circularity and closedness

N. Wiener's first order cybernetics (Wiener, 1983), in distinguishing subject from object, refers to some hypothetical independent or “external” world and in so doing postulates the necessity of an unambiguously described “objective world” (its existence). In one of the central points of Wienerian cybernetics, namely, the concept of “feedback”, a signal is a circulating factor, while circularity refers to “feedback closure” and “circular causality”, which presumes the concept of *final aim (causa finalis)*. A signal, taken from the output and forwarded back to the input, is formed according to the rules, which are established by an external observer, who behaves in compliance with some predetermined aim.

However, if Wiener considered circularity as referring to “feedback closure” and “circular causality”, H. von Foerster saw it, first of all, in terms of self-reference (von Foerster, 1973, p.

35). Second order cybernetics – or the cybernetics of cybernetics – is of a circular nature: an individual learns to view him or herself as a part of the world that s/he observes – i.e., we are now dealing with the unambiguously described (in the sense of selected once only) “subjective world” – the world, which includes the observer. The closed circle of causality, which includes the observer, constructs a bridge across the abyss between effective (*causa effective*) and final (*causa finalis*) causes, between motive and aim, *between what is due and what is real*.

It is considered that the economic sphere generally controls material flows (resources, goods) as well as prices and legal provisions etc. that stipulate the processes of directing these flows into those things required by people to sustain their lives. However, the economy is not indifferent; on the contrary, its development is determined by what is considered to be due: something that we plan, something we are going to do to solve some problem, and the existing material sphere to a large extent stipulates the realm of what is considered due. That realm, although it is not always obvious, comprises those due things for which we strive: our wishes, needs, passions and so on – everything that lies in the field of human psychology, morality and human intercommunication. The category of the due is always aimed at our problems and, specifically, wishes. Conversely, the category of the real refers to what we already have.

This global problem, which is very persistent, but still very far from being solved, concerns how to integrate the world of potential (the due) with the world of real things. In our opinion, it is precisely here that the answer to the question about the sources and essence of economic crises is concealed. *The principle of circularity or cyclical closed-loop causality* is specifically implemented in the functioning mode and arrangement of a system referred to by von Foerster as a “*nontrivial machine*” (NTM) (von Foerster, 2003, p. 311). A *trivial machine* (TM), on the other hand, definitely and unmistakably associates certain causal events (input values) with particular consequences (output values) by means of its operations. Operations performed by an NTM depend in each case on its “internal state”, which, in turn, depends on the preceding operations. An external observer is fundamentally incapable of solving the problem of analysing the internal state of a nontrivial machine. Because the rules for regulating transformations of the machine depend on preceding events, i.e. on its history (evolution), it seems impossible to figure them out. If a nontrivial machine re-uses things it outputs in the capacity of inputs, there comes into being some form of circularity. It is such a circular arrangement of nontrivial machines that von Foerster defines in terms of *organisational closedness*, meaning the privacy, autonomy, self-sufficiency and identity of the initial and the final.

The consequence of circularity lies in the fact that there is no noticeable effect of the initial operation on the final result; once having been activated, the circular cycle maintains itself, levelling oscillations (disturbances) in the input within certain limits. The general cybernetic sense of closedness lies in the fact that the nontrivial machine has neither “inlet” nor “outlet”. All processes take place within the closed cycle, which cannot be broken without the loss of all those processes. Any gaps in the cycle come under the function of the observer, which, in accord with its own point of view (and properties), can provide autonomous systems with attributes of *inlet* and *outlet*, *external* and *internal*.

4. Autopoiesis of economic systems: units of viability

Maturana transformed the concept of circularity into that of autopoiesis, having emphasised the property of circularity. The idea of autopoiesis was first set out in its completed form, but still without the introduction of the term itself, in von Foerster's 1969 paper entitled “Neurophysiology of knowledge”.

Systems described as autopoietic are those that are able to recreate themselves. Let a given economic system consist of a number of elements. These elements are in some way active and

interact with each other. The action and interaction of the elements are arranged in such a way as to support their existence as well as their repeated action and interaction. Elements serve to construct a function, which function, in its turn, serves to produce elements, which serve to construct the function, and so on, ad infinitum, in a closed circle (circularly).

Thus, the circular organisational management of a company or group of interrelated companies (suppliers and consumers of goods) forms a homeostatic system with the capability of producing and maintaining that self-same circular organisation. This function is realised thanks to the fact that its specifying components consist of those whose synthesis and maintenance are provided by that very circular organisation. Any deviation of the system's activity from such scheme would result in the termination of the system and therefore also its activity. The main factor, which must be constantly maintained, is the organisation itself (the integrity) of the given system, without any aims or purposes dictated from without.

The internal stimulus for a company thus consists neither in production, nor in the sale of something, but the maintenance of autopoiesis. The most characteristic feature of an autopoietic system consists in its capability to pull itself up by its bootstraps, so to say; in other words, it isolates itself from the environment through its own dynamic processes. The integrity of autopoietic systems is an attributive integrity; that is, the system is entire not merely because we (observers) consider it to be entire in our minds, but because the aggregate of its own dynamic properties (described by some parameters) and constituent parts (structures) allow us to call it so. Integrity is that which is maintained by an autopoietic system during its entire lifetime.

A pertinent question thus arises: where then is the boundary of the coherent entity located? The environment of a particular coherent entity is always determined by the entity itself (and never by an external observer) as an area in which it is realised as an integral whole. The environment determined by an external observer, on the other hand, i.e., the area in which some coherent entity or other is defined as an isolated unity, is referred to as the *environment* of that given entity. Now we may affirm that the economic system, which we perceive as a "coherent entity in its environment", is a "viable" entity within the concept of economic constructivism. Such survival unit comprises potential and preparedness for changes, which may be constructive and promote survival as well as be potentially disastrous: an economic system that destroys its surrounding environment in so doing also destroys itself.

A system also constitutes a differentiation form, which means that it has two sides: the system itself (comprising the internal side of the form) and its environment (the external side of the form). Only in acting together are both sides able to produce the differentiation, generate the form and derive the concept (Spenser-Brown, 1974). Thus, the environment is as important and as necessary for that form as the system itself. This means that everything that is observable and describable by means of this differentiation refers either to the system or to the environment. Here, already, something unusual catches our attention. That which separates the two sides of the form – the boundary between the system and the environment – is what delineates the integrity of the form and it is for exactly this reason that it cannot refer to one side or the other. For example, the difference between paper and wood lies neither in paper, nor in wood. It is also obvious that the difference is not located either in space or during some specific period of time (in the latter case we might refer to the ensuing changes). Consequently, Gregory Bateson concludes that the difference consists in an abstract notion: it is an idea, a mental structure (Bateson, p.174). The boundary serves only in terms of a directive to cross it – either from inside to outside, or from outside to inside. As a rule, effects in natural sciences are induced by impulses, forces and other quite concrete things. Conversely, in the mental world, i.e. the world of communication and organisation, effects arise as the consequence of differences; in the word of mind *nothing* (in the sense of what does not exist) may become a cause of actions. For example, a tax return that has failed to be submitted may cause certain actions of tax officials.

That is to say, an unwritten letter, which does not exist and is not a source of energy, may launch an action. It can be seen that the central mechanism of economic systemic circularity entails basic production process being carried out not linearly and unidirectionally, but cyclically: M – C – M' [money – commodity – money]. However, this well-known formula was introduced with the sole aim of showing how added value is generated within a circular process. In reality, each circulation of one product intertwines with circulations of other goods. The total motion of all those numerous intertwining circulations generates the circulation of goods (material flows) within an economy. It is this circulation that maintains the system's internal structure as a comprehensive whole, itself the result of the processes initiated by that self-same structure.

Now we are faced by a peculiar situation: on the one hand, we observe a certain dynamic network in which transformations of material flows produce its own components, with these flows simultaneously providing the condition for the synthesis for that coherent entity. The more complex an economic system becomes, the more compound and differentiated the intertwining of the circulations. On the other hand, as we have already seen, it is not possible to explicitly determine the boundary that permits a transformation network to exist as a comprehensive whole. Is, for example, a semi-finished product (raw materials) sent by a supplier and still on the way part of the integrity of a given enterprise? Apparently, yes, since its absence or lateness can lead to a discontinuity in the circularity. Delimitation – intersection of boundary or structural transition (conceptual or actual) – changes the internal dynamic parameters of the system and leads to its reorganisation. A supplier's refusal to supply forces the enterprise to reconstruct its internal production processes for other raw materials and changes its system of external relations.

5.Communication as autopoiesis: money as a communication medium

This section follows the logic of system analysis by Niklas Luhmann, the author of one of the most original versions of the systems approach to sociology (Luhmann, 1997). Each social system (politics, law, economy, science, religion) represents a differentiation between internal and external, but not an identity, an “internal as such”, independent of any external. The key point of Luhmann's theory is the establishment of the following elements of social networks as communications (Luhmann N.,2007). Such communicative networks are self-replicating or autopoietic. Each communication generates additional thoughts and senses, which, in turn, give rise to further communications. Thus, the network as a whole generates itself; in other words, it is autopoietic. Replicating through countless reciprocal links, communication generates a common system of beliefs, explanations and values (the semantic context), which is constantly sustained by further communications.

It is through such a common semantic context that individuals acquire identity as members of a social network; in this way, the network establishes its own boundary. This is not a physical boundary; rather, it is the boundary of expectations, confidentiality and loyalty, constantly sustained and revised by the network itself. Thus, Luhmann concludes that a communicative system is a completely closed system, producing the components of which it also is comprised (Luhmann, 2007, p. 134). In this sense, a *communicative system is an autopoietic system*; as a consequence, everything that appears for the system as a unity is produced and reproduced by the system itself.

It is often supposed, more or less implicitly, that communication is aimed at consensus and has as its goal the securing of agreement. However, Luhmann offers a different explanation. While it is obvious that no communication can take place without the consent of two or more parties, neither does it take place in the absence of controversy: communication intensifies the question as to whether the communicated and comprehended message is accepted or rejected. A particular message is either believed or not: communication creates this alternative at the outset. In this

way, communication doubles reality. It creates two variants for itself: the variant “yes” and the variant “no”, thus compelling a choice to be made. Moreover, each time that something is about to happen, the autopoiesis of the system is established in such a way as to provide itself with its own continuation.

The concept of communication allows any social system to be viewed as an effectively closed system, consisting of its own operations, and producing additional communications from communications. Referring to the concept of communication, it may be argued that an economic system is self-describing and self-observing. Simple communication is already possible, but only in a recursive network comprising preceding and subsequent communications. Since all this only happens from the network's perspective in the operational form of communication, such a network can assign itself themes, inform itself about its own communications, subject information to interpretation, question assumptions, normalise communications as acceptable or not, etc. Now we may define the notion of the economy as a comprehensive system of all communications, which reproduce themselves autopoietically, while still producing new (and each time different) communications within the recursive network of communications.

Having defined the organisation of social systems as a self-reproducing network, let's now turn to the structures created by such networks and the character of the relations that arise in this context. In the theoretical context, considering social systems in general – and economic subsystems in particular – as systems of communicational reproduction, Luhmann believes it natural to suppose that money came into circulation first of all as a means of communication (Luhmann, 1994). This doesn't contradict the possibility of considering money also in its traditional interpretation as a means of exchange, since the use of money as an exchange medium is one of the possible forms of communication and is experienced only in terms of communication. The difference that is worked through by this communicative means (money) consists, first of all, of that communication that takes place between a seller and a buyer. This implies the realisation on the part of both the seller and the buyer that they are acting interdependently. Both parties realise that they can behave in the desired way, or differently, as they jointly and severally determine. Thus, the socioeconomic relation doubles in on itself. Each participant creates its own image of the two participants. The other difference is connected with a desire, i.e. the acquisition value – the more desired a thing (i.e. a good) is, the higher the incipient price tension. Emerging on one side – that of the purchaser – it forms the buyer's market.

The presence of money provides an opportunity to differentiate a special functional system of management on the basis of a primary operation: monetary payment. In that event, the system acquires a binary code, since the working up of the payment transaction also allows for its possible converse (nonpayment); consequently, the result of such elaboration is ambiguous. All operations performed by an autopoietic system of management are determined by the difference between payment and nonpayment; they reveal themselves to an observer as essential in relation to that difference. With any type of encoding, doubling implies both positive and negative values of the code. It neither implies that payment is preferable to nonpayment, nor that nonpayment consistently turns to be better than payment. More importantly, the code contains a question concerning precisely the uncertainty of its value, leaving its solution to the programmes of the economic system and also, not least, to the emerging situation.

6.Duality of economic systems: circular and transit structures, flows and tensions

Now we have everything we need to produce a synthesis of ideas concerning economic systems as a twofold entity – i.e. a unity of circular and communication processes. The duality of the economic system consists in *the existence of two phenomenologically non-intersecting areas*, corresponding to these processes and the two types of observers: internal and external. The area

of internal states is characterised by circularity and closedness: although it participates in interactions with environmental factors that act as initiators of continuous structural changes that determine the dynamics of its states, the circularity and closedness of the economic system is always preserved. It is characterised by *continuous parameters*, which can be well described parametrically, and can adequately answer the question – “what’s happening?” The other area consists in interaction with the environment, which is carried out in a communicative way such that money with a binary code (payment – nonpayment) acts as a common communicative means. It is characterised by discontinuity, discreteness, yes or no, 0 or 1. It provides the possibility of answering the question – “What is behind this”?

How can such a twofold essence be investigated? Modern mathematics, for example, treats oppositions such as internal – external, continuous – discrete, resources – problems, goods – services and others as *dual-conjugate* structures. In many areas of modern science (mathematics, physics, logic), the method of identifying dual-conjugate structures is a fully recognised method of research, which has proved its fundamentality, effectiveness and promising potential. However, it would be premature to assert that duality as a method of theoretical analysis and synthesis has been fully understood and mastered by economists. Of course, these bases have fairly concrete guises for each subject, and their selection is a rather challenging and by no means formal task. Be that as it may, one of the bases is always directly or indirectly congener to the applied force, tension and stored (potential) energy, while the other one is congener to the mass, inertness and inertial (kinetic) energy of the withstanding reality.

Binary relations of selling – buying generate communicative networks. However, unlike social networks, in which people exchange immaterial ideas, economic networks tend to be quite material-based, forming structures in which material flows spread under the impact of their dual essences – money and the provision of material flow circulations. A company, like any other *process*, has two sides: on the one side it consists in a directed *flow* of something material; on the other, the realisation of some *potential*; for example, a price difference between a company’s inputs and outputs is comparable to the potential difference at the terminals of a conductor. Flows and potentials are reciprocally dual structures, dispersing differently within the economic system. Flows are structured and coordinated towards a reduction in the dimensionality of structural levels: from a whole to parts, from a particularity to an abstract, from depth to surface. This direction aims at the *differentiation* of the whole. As for potentials, they are coordinated backwards to growth of dimensionality, through structural elements of the highest dimensions. The world is assembled, integrated, joined and “concretised” by means of *tensions*.

Viewing economic systems as networks (Popkov, Baturin, 2007) helps us to consider so-called economic *hierarchies* in a new way. Since economic systems represent networks at every level, we may now consider the economy as a network, in which separate (to be more exact, separated by us) systems interact with other systems (networks) in accord with the same network principle. For example, we can schematically depict an economic system in the form of a network with several nodes. Each node is a viable system, such that zooming in on it will reveal it as a network in its own right. Each node in this new network can represent an entity that will, in turn, grow into a network, and so on. Despite all the variety of networks, the set of elementary networks is limited to only three types: nodal (“tree” type), contour and mixed. In other words, economic systems consist of networks within networks. At every level, if sufficiently “enlarged”, network nodes appear as smaller networks.

In general, observers try to construct those systems by putting them into larger systems and hierarchically arranging the larger systems over the smaller ones in a (reverse) pyramid structure. However, this remains an anthropic construction. In nature, there is no “above” or “below”; hierarchies do not exist. There are only networks embedded in other networks. The properties of

the network's parts are not intrinsic, but become clear only within the context of a larger whole. Broadly speaking, this whole represents a multidimensional (combinatory) complex, consisting of *cells* – oriented elements of various dimensions (nodes, branches, fragments of surfaces, volumes and so on), which adjoin each other (Popkov, Baturin, 2007, Popkov et al., 2015).

Let's take an arbitrary network of companies. It may be a global, national or regional economy, a territorial production complex, or a city-forming enterprise with an adjacent social structure. Here, network analysis would reveal two groups of circuits – a group of open circuits and a group of cycles (closed cyclic processes). Each open circuit connects a pair of nodes (actually, a pair of node sets with both inputs and outputs). The node here is, conditionally, a “store” of a certain product or resource. An open circuit of enterprises consisting of a “black box”, transforming one set of products (resources) into another in accord with the output coefficients, is a classic statement of all balance models. The only motive of such “transit” production processes is to obtain added value, consisting in the difference between input and output (nodal) prices.

This presentation, which can be referred to as the “input-output paradigm”, has become firmly entrenched in minds of economists, typically along with linear balance models. According to this model paradigm, companies and branches appear as linear operators, transforming inputs and outputs in accord with the output coefficients. Operators compete with each other for access to limited resources, minimising inputs and maximising outputs to achieve equilibrium prices. As a result, chains of enterprises and production programmes are constructed that provide the maximum “input-output” effect at the scale of the system given restrictions on initial resources. The attention of subjects of the market economy remains fixed exclusively on resources, products, goods, exchange of goods, markets, prices, added value and profit, with economic theory following some distance behind them.

At the present time, this narrow view is being progressively broadened by the efforts of institutional theorists, who recognise that the moment of *exchange* of goods, while considered as a “moment of truth”, is preceded by a large number of important circumstances and *relations between operators*, which are by no means reduced to the act of buying and selling. More than that, those continuing relations and the fixing of contracts play an increasingly important role in economic life relative to the “point” of commodity-monetary exchange. This is especially evident in the developed nucleus of the world-economy, in which contractual relations – i.e. services – are not only the most promising economic sector, but also already the basis for all other economic activities. In this connection, it is precisely the extreme development of goods markets that has revealed their considerable defects and allowed institutional theory to separate contractual relationships out into a special field. However, the “contractual economy”, having gained all dominant positions in real life, still feels itself to be a junior relation to the goods market in which the theory is applied – a “branch”, whose only role is only to analyse transactions and the state of market equilibrium.

Within the framework of economic constructivism, on the other hand, we can consider the relation between exchange / contract (or goods / services) economies as having a more principled character. Here *exchange* establishes the relation *between goods*, whereas an operator in a goods market is present as a seller or a buyer, transforming one type of goods into another. As for the *contract*, it also registers the relations *between operators* in exactly in those aspects where they can only *function* together, *supporting* each other's activity.

7. Discussion and Conclusions

a) *Subjectivity and (or) objectivity of economic constructivism.* The classical scientific paradigm considers a theory to be scientific to the extent that it is objective, which means here that the

characteristics of the observer during the process of observation are not taken into account. Since in economics observer-independent observations are unrealisable, the conclusion is necessarily drawn that the whole of economic knowledge is subjective, while “objectivity” becomes a kind of distributed subjectivity.

b) *Accounting for the observer.* Scientific progress occurs with the introduction of a new or previously ignored parameter. If we are to be able to rely on the ideas of economic constructivism, it’s quite clear that the “observer accounting measure” is the best candidate for this parameter. When considering the measure of attention paid to the observer, the main aspect is reflexivity, which can be understood in two types: 1) the self-reference of a person (I think that I think...); the attention paid to the observer, in this case as to a biological object, is analogous to the replacement of the concept of representative knowledge by that of an internally consistent constructivism; 2) as mutual self-reference involving other people (I think that she thinks...); the attention paid to the observer as a social agent, or to the difference between the construction of knowledge as an individual activity and its construction as a social activity, as well as the need to coordinate them.

c) *Duality of human knowledge in general and in economics in particular.* Economic reality, since entirely constructed by human being in accordance with his or her value preferences (which can considerably deviate from rational ones), must become an *object for itself*; such a transformation of a pure subject into an object for itself is impossible without primary duality residing within the person (the person is at the same time both the subject and the object of nature). This duality cannot be reduced, since, being the general condition of conceiving economic phenomena, it is also, according to our theoretical approach, the *principle* of every theoretical explanation. Now every theory need be aimed solely at reducing all opposites of the economy to the primary opposition of the cognising subject, who is no longer himself, but appears as a manifestation of economic phenomena. Economic systems, also like living systems in nature, maintain themselves through a process of eternal turnover, separating on the one side from what they connect with on the other, and connecting here with what they separate from there.

d) *Money as a means of communication.* The conventional definition of money is given through the various characteristics of its functions. All existing models consider money as a parameter, or a number of parameters (its quantity and rate of change, for example), and are implicitly based on the concept of money having “no smell” (i.e. its neutrality). However, if viewed from the standpoint of the proposed conceptual-theoretical principle (money as a means of communication), such an interpretation of money loses its cogency. Now the central object becomes discovering how symbolical communicative interactions in the form of money are connected with energetic interpretations (material flows). Or, in other words, the problem lies in the creation of an “interface” between the structures of economic systems (“hardware implementation”), in which the dynamics are performed by means of energy interactions, and their functions (“software”), where the dynamics are performed through the sequencing of interchangeable symbols.

e) *The fundamental role of circular, cyclic processes in the economy.* The explanation is as follows: analysts, when studying the economy, are looking for something that remains unchanged behind the visible changes. That revealed unchangeable value always turns out to be a cycle (though attention is not always focused on this fact). That’s how there appear various laws and principles of economy, in which everything *existing* is explained. It appears to be possible to construct a nontrivial machine within a single enterprise, which maintains the existing output despite the fact that the input action changes. This has to do with the fact that a productive cycle is separated from money (from the point of view of an internal observer).

However, as soon as we come out to a new higher level, the cycle immediately involves money, which is a reality of the second order.

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