ON THE ECONOMIC MODELLING

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Rezumat

Scopul lucrării este de a oferi o imagine asupra conceptului de model în general, şi asupra conceptului de model economic. În acest scop autorii identifică lista minimă de predicate suficiente care califică un artefact intelectual ca fiind model al realității (atât obiective, cât şi subiective). Studiul identifică de asemenea şi evaluează condiția logică pentru a obține un model (mai ales un model economic). Pe baza definițiilor şi a condiției logice a unui model, autorii prezintă predicatele suficiente ale procesului de modelare şi le analizează din punct de vedere calitativ. Modelarea modelului este un concept alternativ folosit în lucrare pentru a regăsi criteriul poperian de respingere.

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Abstract

The paper is aimed to deliver an abstract view on the concept of model, generally, as well as on the economic model concept. In this end, the authors identify the minimal list of sufficiency predicates that qualify an intellectual artefact as a model of the reality (bot objective and subjective). Also, the study identifies and assesses the logical condition to get a model (especially an economic model). Based on the definition and the logical condition of a model, the authors introduce the sufficient predicates of the modelling process, and perform a qualitative analysis of them. The modelling of the model is an alternative concept that the paper uses in order to re-find the rejection Popper criterion.

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4. Setting the problem

The problem of modelling as method of knowledge is extremely complex and not yet fully elucidated (there is no point of view shared by the vast majority of the researchers in this matter). Our study cannot start without trying to clarify, at least for the limited necessities of the purpose of our research, the matter of modelling in general, and of the economic modelling, in particular. Therefore, this research is dedicated to the formulation of a point of view in the model and modeling .

5. What is the model?

In order to see what modelling is, we need first to ask another question: what is the model?

5.1. Elements of definition

First, the model is an object assigned to another object. Therefore, the model doesn't actually exist; rather, it is the pendant of an object from reality (existing or possible). If we cannot assign the

examined object to a real[1] object, then we have a common object (another object which appeared in the world).

Second, the model is an intellectual construction. There are no models in nature; only objects exist in nature. It results that the model must not necessarily have physical objectivity (for instance, it may be a system of equations).

Third, the model is an artefact. Being an artefact, it is the result of purpose objectification[2]. The objects which are not artefacts cannot be associated to a purpose. At the same time, not all artefacts are models. Most artefacts are objects, not models[3].

Fourth, the purpose of the model is not intermediated. By not intermediated purpose we understand a purpose which is the proximal link to model objectification. This is the reason why, as shown in the previous footnote, the child is not a model of its parent, although its birth can be planned consciously.

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[1] *Reality can refer both to the inner reality of the knowing subject, and to the reality which is exterior to the knowing subject.*

[2] *It is possible, for instance, to find in nature two object which are perfectly alike, even if at a considerable difference of scale (the immediate question would be: from what point of view are they alike? But we will ignore it for the time being), but this doesn't mean that one of them is the model of the other (of course, it is by no means obligatory that the smaller object is the model of the larger object; the reversed situation may also happen, as for instance the atom model). Think of the animal cubs, the whale calf, for instance: although the difference of size is enormous, the whale calf resembles perfectly its mother, and yet, it is not the model of the whale (and not vice versa, of course). The reason why we don't have models in the nature is because nature doesn't have purposes, therefore, the natural objects are not caused (generated) by intentions. What about the situation of the "human infant"? Although giving birth to a child may be generated by a purpose (of course, there also are accidents, situations in which there was no purpose to give birth to a child), the child is not the model of the parent, because the birth of the child is the result of a physiological act which is not under the rule of conscience, therefore we don't have a true purpose here. We will resume this discussion at another moment.*

[3] *For instance, a robot built for specific activities is an artefact object. However, if the purpose of the robot is to simulate the walking of a man, it becomes a model of the human walking physiology.*

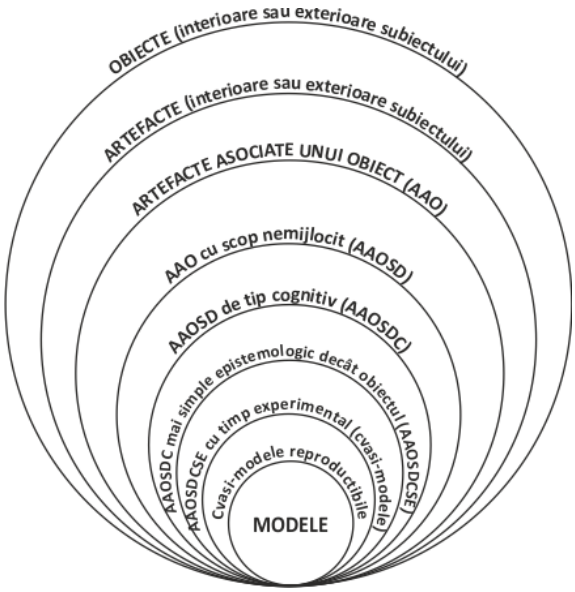
Fifth, the model is (or should be) reproducible, independently from other subjects. This means that the model has a public relevance. If this requirement – of the independent reproducibility – is not verified, then we don't have a model, rather an object.

An object which has these defining characteristics will be therefore called a model . The defining features that we mentioned are the sufficient predicates of the model. The simultaneous verification of the sufficient predicates qualifies an object as model of another object.

The general diagram of the "place" of the model within the objects can be represented as shown in Figure no.1:

Figure no.1.

General relation object - model



Using the diagram from Figure no.1, one may extract a general definition of the model: *the artefact associated to a real object (existing or possible), with the, not intermediated, purpose to simplify epistemologically the procedures of knowledge, in experimental time*

and in a reproducible way of the real object. This definition will help us show the logical conditions of the concept of model.

5.2. Logical conditions

Let's examine the logical conditions of a model and draw some important conclusion regarding this special type of method[4]. The logical conditions of existence (or, rather, of construction) of a model refer particularly to the connections that should exist between the model and the object to which it is assigned.

First, between the model (M) and the object to which it is assigned (OA), there should be a structural isomorphism. This means that the subject has information about the structure of the object, which means that there is at least a pre-knowledge of it. We will call this pre-knowledge, pre-theoretical or pre-scientific knowledge. It may come either from the previous direct empiric interaction of the subject with the object, or from the examination, by the subject, of a set of pre-existing information about the structure of the particular object. Anyhow, this logic condition shatters seriously the presumptive claim of the model to form a method of knowledge[5].

Second, between the model (M) and the object to which it is assigned (OA) there must be a causal analogy. If we accept the conjecture according to which the structure of a system generates the functions[6] of that system then, the knowledge of that object's structure should provide accurate information about the causal links within the object or about those pertaining to the integration of the object within its general environment. As the term says, the causal analogy doesn't involve any kind of homogeneity of nature between

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[4] *We will not develop here further the idea that the model is a species of method of knowledge.*

[5] *Any pre-knowledge is a knowledge, which means that at the moment when the model appears the object to which it is assigned is known, at least as supposition (hypotheses) or conjectures. As far as we realise, the model appears, most times, within the margin of conjectures.*

[6] *In a rigorous expression, the structure of the system generates (or at least conditions) the functionality of the system (the intra-system) interactions) on the one hand, and its behaviour (the interactions between the system and the system's environment), on the other hand.*

the inherent causality of the object and the causality induced within the model. This second logical condition of the model rejects irrevocably any claim of the model to represent a method of knowledge. In our opinion, the model is no more (and no less) than a method to test the hypotheses of conjectures about the object. In other words, the object is already known or, anyhow, there is a theory about it and the model has the role (crucial if we are to follow closely Karl Popper) to test the pre-existent theory (particularly to refute the observable consequences of the theorems of that theory). The fact that between the two causalities (the real, ontological one and the modelled, epistemological one) there is analogy means that it is of no importance the way in which the ontological causality is reproduced in the model – it is important that the causal relation functions analogously: for instance, although in the objective reality the causality can be energetic, in the model it may be reproduced by an adequate equation.

Third, the model (M) must have functional stability. This means that the model can be used, according to its purpose, a large number (potentially unlimited) of times without hereby decreasing its specific performance: the relevance of its results[7]. If this logic condition is not met, the model can be used just one time, or a number of times which may be judged as sufficient to consolidate the tested hypothesis/conjecture.

Fourth, the model (M) must be characterised by epistemological simplicity in relation with the object to which it is assigned[8]. This

[7] *We draw attention of a possible confusion with the so-called law of the large numbers. Our example is not about the fact that the model supplies a testing which is asymptotically true as the number of the runs with the same model increases. Actually, the model provides, from the very first run of the test, the „verdict" on the tested hypothesis/conjecture: it either verifies (validates) it, or disaffirms (falsifies) it. The problem is that the results of the subsequent runs of the model must not be influenced by the previous runs. Although we might raise here the importance of the bottom-up learning (the model self-develops by self-learning generated by its use), it is not what we wanted to point out here, rather the preservation of the model's quality during its several runs of the test.*

[8] *This is the logic reason why, for instance, the clone cannot be accepted as being a model of the object it reproduces. The clone and the object to which it is assigned*

means that subject has higher probabilities to get true answers to the interrogation of the model, in relation with the similar interrogation of the corresponding object (in many cases these chances are much higher)

Fifth, the interrogation of the model and its answer to the interrogations take place in experimental time, not in real time. We must not mistake this logical condition with the introduction of a specific time (inner time) of the model in relation with the object to which it is assigned. Actually, each class of objects from reality has its specific time (own, inner). Usually, the physical time, the clock time, is associated to the physical, non-living objects (and processes around them), although the general theory of relativity introduced here the... relativity. The classes of complex objects, such as the living objects or the social objects have specific times revealed long time ago. Therefore, it is not this aspect of time that is of interest here[9], rather the fact that the time in which the model is interrogated and in which it answers to the interrogation is an experimental time, not a real time (be it independent of the process of dependent on the process)[10].

are of the same epistemological complexity. We may bring a counter-argument to the proposal to retain this logic condition of the model: from ethical reasons, some procedures of knowledge cannot use the human being (or natural beings, generally) as object. In this case, the use of the clone would function analogously with the use of a model to know the object to which it is assigned (actually, as shown before, not to know that object, rather to test is pre-existing knowledge). We give up discussing the legal condition of the clone (there are situations when the clone is considered to be a person). We reject, however, the mentioned counter-argument because the ethical criterion is not one of the logical conditions if the model, therefore it has no relevance for our discussion. Irrespective of the non-logical criteria which would lead to the use, in any way, of the clones in the process of knowledge, they are not models of the objects to which they are assigned: they still are objects.

[9] *The problem of the specific time of the classes of objects will be resumed when discussing the problem of modelling, when we will need to build the time within the model as specific time depending in the process it measures/quantifies.*

[10] *For instance, the Leninist socialism could not be studied on a model (in which the time of answer would have been infinitely shorter than the about 70 years needed for the emergence of the conditions which invalidated that social project) and, therefore, it was necessary to run throughout the entire historic time (a specific*

Sixth, the model must allow the retroversion of the result of model (RM) into result of object (RO). This means that the answer given by the model to a specific interrogation must be of the same nature with the answer that might be implemented in the object to which the model is assigned. For instance, if a model which is assigned to a fiscal object gives an answer in the nature, say, of a temperature, then this answer (RM) is incompatible with that object: we cannot change a temperature hoping in a reasonable function of response from the fiscal object. The condition of retroversion of the result of a model seems much weaker than the other logical conditions that we mentioned, but we consider that failing to meet this condition creates difficulties of the same magnitude as the failure to meet any of the other five conditions. In other words, the model doesn't lose its quality of model, but its utility is arguable, because the reason to be of the model is to stand in the place of the object in order to obtain results which to be used by the object itself.

In the end of this paragraph we would like to ask the following possible question: is not any theory about reality a model of that reality?

Our answer to this presumptive question is the following:

- In its broadest meaning, the meaning in which a theory about reality is considered to be an intellectual representation of that reality, we might indeed say that any model is a theory, because the model, in turn, is a representation of the reality. However, we should notice that the theory represents not so much the reality as it is, but rather the reality as it may be described in an intelligible way, while the model is a construction, also intellectual, which aims to verify (test) the consequences which the theory prescribed about the reality. This means that the model might be considered a theoretical routine associated to those components of the reality that may be trustfully used to test the theoretic prescriptions (which means implicitly that not any component of the reality described by the theory is susceptible to modelling). It is thus

time, but a real, non-experimental time) in order to get an answer to the question whether the Leninist socialism is viable.

obvious that not any theoretical description of the reality may be modelled and tested; only those descriptive components that may ensure the verification of one of the criteria of truth: the corresponding-truth. With this meaning, therefore, the model might be a sub-multitude of the theory.

- In the narrow meaning, the model is just an extension of the theory or, rather an intellectual construction based on theory, as showed in detail above.

5.3. What is modelling?

Modelling is the intellectual process of model construction – the process by which a new object appears in the real world (exterior or interior to the subject), which verifies the sufficient predicates and which meets the logic conditions of a model, as they have been proposed above.

The sufficient predicates of modelling are the following:

e. *Conscious process*: this sufficiency predicate result immediately from the sufficiency predicate of the model itself, which calls that the model is an artefact, an intellectual product „endowed" with a cognitive non-mediated purpose; this predicate limits the possible area of modelling to the man (a computer or any device with artificial intelligence cannot have purposes, just finalities predetermined by the programmer);

f. *Praxeologic process*: this sufficient predicate distinguishes between knowledge and modelling – modelling is not a process of knowledge, rather an actional, praxeologic process which objectifies an intention (obtaining a model) by a practical intervention in nature;

g. *Creative process*: this sufficient predicate narrows once more the possible area of modelling to the man. A computer (or any other artefact of artificial intelligence, no matter how evolved it may be[11]) cannot actually create

[11] *Maybe the most adequate way to quantify the feature of "evolved" regarding the artificial intelligence regards the self-learning capacity of the artificial intelligence*

anything, it may just exploit (ultimately, discover) the possibilities allowed by the software. Therefore, a device of artificial intelligence (DIA) cannot accomplish modelling actions, therefore it cannot produce models[12];

h. *Process of cognitive abstraction*: the previous three sufficient predicates cannot distinguish between accomplishing an iconic model of the man and the production of an art work whose „model"[13] is a living man, but the purpose is purely artistic. Therefore, we need to introduce an additional sufficient predicate. This might be a predicate which "demands" the abstract modality in which modelling is performed. Abstracting is not enough, however, because, for instance, the modern art frequently uses abstracting as a manner of artistic representation[14]. Therefore, we need a

device by running its software. Self-learning (which may mean, of course, self-programming) is, nevertheless, circumscribed by the basic software of the device: self-learning stretches as far as the self-learning software allows, while self-programming stretches as far as the self-programming software allows). Therefore, the artificial intelligence cannot be creative in principle, and not just depending on the given technological ort knowledge level at a particular moment. Although we may also discuss about the natural limits of the human creativity, for the time being we would just like to show that, principially, creativity can only be associated to the humans. By creativity we understand, of course, the emergence of novelty (the artificial intelligence cannot go beyond the stage of morphological combination – and the morphological combination cannot create novelty, it may only discover what is potentially possible. In other words, invention is associated exclusively to the emergence of novelty, to creativity).

[12] Obvious, the fact that the computers of the DIA are used as instruments (prosthetic devices) for the practical accomplishment of the models (therefore in the process of modelling) changes none of our statements.

[13] Here, the significance of the term „model" is entirely different; it denotes an inversion of position between the object and the model: the object (the living human) is the model, and the model (the statue) is in fact an object. Ignoring the difficulties generated by the imprecision of the natural language, we must accept that, in principle, a statue which mimics a man should be considered, according to what we said so far, a model of the man (if, for instance, the purpose of making a statue is to investigate scientifically something about the living man).

[14] For instance, the sculptures of Brâncuși, which don't aim an iconic representation, rather an essential representation, based on abstracting

cognitive abstraction which ensures the cognitive purpose of modelling;

6. Modelling the model

The problem here is the second order modelling. This means that once a model is accomplished, it becomes a new subject in the world. Is it possible that someone who doesn't know that it actually is a model, and mistakes it for a random object from the reality, can make a model of it? In principle, the answer is affirmative. Modelling the model, as it results from the necessity of the epistemological simplicity of the model in relation with the modelled object, will accomplish an additional epistemological simplification: the second order model will therefore be even simpler epistemologically than the first order model. What we can say about the case in which the cognitive subject knows that it has a model in front (a first order model, using the terminology used before)? In principle, modelling a model, in full awareness, is possible and may even be useful for the process of knowledge in some situations. Logically, modelling the models of different orders cannot be limited (a limitation can be imposed only from practical reasons). The second order modelling, in full awareness, is meant to test the first order model, not to know the reality (of the zero order model). Of a particular epistemological importance is here the proposition of the philosopher Karl Popper regarding the test of falsifiability: actually, when we try to reject factually a scientific hypothesis[15] we only build a meta-model of the tested model, and we use this meta-model to experiment the factual that we have in mind.

(representation of the flight instead of the bird). Not to speak of painting, where the abstraction is much stronger.

[15] *According to the theory of Popper, a hypothesis can never be verified (attested); it may just be rejected (and, if the factual conditions observe exactly the conditions from the scientific hypothesis, the rejection is unique and final).*