The Karol Adamiecki University of Economics
in Katowice

Volume 2 2005

Journal of
Economics &
Management

Alojzy Czech

JÓZEF M. BOCHEŃSKI'S ANALYSIS OF "SYSTEM" AND "FINALITY" NOTIONS

The author of the famous "Formale logik" was well known from his original research expansion directed into the new, varied areas which were often very far from the previous studies. These usually unexpected turns have been justified, however, with the excellent logical and methodological tools he has, which allowed for a construction of his own theories in the areas examined with his curious eye. It was so with an enterprise as well which became a subject of sci-

entific research in relatively late period of his creative activities. The "Zur Philosophie der industriellen Unternehmung" is a concise and interesting contribution to the theory of an enterprise in general and especially of an industrial enterprise. Analysis of the notions which are basic in this field has been obviously the starting point of philosophical reflection over this area of research. The categories of "system" and "finality" appeared to be the basic notions in relation to an industrial enterprise. The application of the results of these analyses can be found in the pages of "Zur Philosophie...". The terms "system" and "finality" show, however, far wider application possibilities than these which may result from the enterprise theory needs. It is allowed by a semantic analysis of these terms. Its hidden assumptions are in the "Zur Philosophie...". They have not been put there *explicité*. Józef M. Bocheński made this semantic analysis in a computer draft. It was the basis of his numerous scientific speeches. We cannot say whether the "system" and "finality" semantic analysis was the result or introduction to the construction of his own theory of an industrial enterprise. Probably it was a parallel. On the other hand, it is undoubtedly a theoretical supplement of "Zur Philosophie..." which is based on the interpretation of an enterprise as a system, supporting the analysis of industrial enterprise's aims with a semantic analysis done. With such a mission on mind I annexed the analysis of "system" and "finality" by Józef M. Bocheński to Polish edition of "Zur Philosophie der industriellen Unternehmung". This text is an abbreviated version of that article. It was based upon draft texts in English on a system and finality and upon the lecture which had been given by Father Bocheński on 26 October and 9 November 1987 in the Copernicus Aula of the Jagiellonian University during his first stay in Poland after the World War II. The lecture, which contents surprised the large audience, was a mixture of the above mentioned notions semantic analyses and of theoretical proposals with regard to an industrial enterprise.

On system

Józef M. Bocheński led his analysis of "system" notion in confrontation, but also in co-operation with findings of the outstanding philosopher of the Argentinan origin – Mario Bunge, contained mainly in his voluminous cycle "Treatise on Basic Philosophy". J.M. Bocheński has referred to M. Bunge's system studies with great esteem. He has not, however, fully agreed with his conclusions. Father Bocheński especially appreciated that the analyses of system were taken out from the information technology ghetto and placed into the field of the philosophical analysis. Defining a system as an object with input and output, so

obvious in computer science, is in fact very restrictive. There are examples of systems without inputs and outputs, such as atom, battalion or home, if we take only few of them. They should be included in the analyses as well.

J.M. Bocheński recognition among the components of each system the elements and synthetic principle called the synthetic factor in the treatise on philosophy of an industrial enterprise. A loose pile of the elements is not a system. It must have a marshalling principle. On this occasion J.M. Bocheński remarks that there is a certain similarity between elements and synthetic principle and the Aristotelian $\upsilon\lambda\eta$ /hyle/ and $\mu o\rho\varphi\eta$ /morfe/. M. Bunge applies other terminology for components of the system: he speaks of "contents" and "structure".

Components of the system

Bocheński	Aristotle	Bunge
Elements	$\upsilon\lambda\eta$ /matter/	contents
Synthetic principle (factor)	$\mu o\rho\varphi\eta$ /form/	structure
		environment

Sources: own materials, based on J.M. Bocheński's notes

As it appears from the table, M. Bunge reckons "environment" among the components of a system. It does not seem necessary for J.M. Bocheński. It's true that many systems have connections with environment. There are, however, systems which have none. They may be closed systems like an axiomatic system or a set of chemical apparatus where non-interference from the environment is technologically necessary. Therefore, it is easier to refer to objects which are not within the borders but which are connected with the components as the external elements of a system.

The analysis of a system in J.M. Bocheński's explanation consist of the theorems and definitions.

Theorem 1

Each system consists of elements and synthetic principle.

$$\bigwedge_{x}\{S(x) \rightarrow \bigvee_{y,z}[EL(y,x) \wedge SP(z,x)]\}$$

where "xELy" and SP mean being an element and synthetic principle respectively.

Theorem 2

Each system has at least two elements.

$$\bigwedge_{x} \{S(x) \rightarrow \bigvee_{y,z} [EL(y,x) \wedge EL(z,x) \wedge y \neq z]\}$$

This theorem is the result of determining the mutual relation of the system notion to the class. J.M. Bocheński has been consistently of the opinion that a system is never a class. Apart from the differences between Bunge's and Bocheński's opinions in this regard[1], it must be noted that there are empty classes while there may not be a system without elements. Furthermore, one element is insufficient. There must be at least two of them.

Theorem 3

Nothing is an element of itself.

Theorem 4

If x is an element of y, then y is not an element of x.

$$\bigwedge_{x,y} [EL(x, y) \rightarrow \sim EL(y, x)]$$

The relation EL (being an element of a system) must be defined as well. The EL relation is irreflexive, asymmetric and intransitive.

Theorem 5

If x is an element of y and y is an element of z then x is not an element of z.

$$\bigwedge_{x,y} \bigvee_{y} \{[EL(x, y) \wedge EL(y, z)] \rightarrow \sim EL(x, z)\}$$

The relations of irreflexivity and symmetry are obvious. To illustrate the intransitive feature J.M. Bocheński gives the following example: a football player's leg is an element of a player, he is himself an element of a club, but his

[1] The settlements pertaining to differences in opinions on inter-relations between „system" and „class" notions according to J.M. Bocheński and M. Bunge have been omitted.

leg is not an element of a club. There is no difference in the logical type between an element of a system and a system itself. A leg of a player, a player, and even a club belong to the type of the same order.

Defining of a synthetic principle is, however, much more difficult. It is almost impracticable. The way to achieve this goes through the definition of a system which is nota bene equally difficult and desired undertaking. The order of elements is characteristic for causal dependence in real systems.

Theorem 6

A real system is an object the elements of which are in causal inter-relations.

$$\mathrm{RS} = \bigwedge_{x:S(x)} \bigvee_{y,z} \{[\mathrm{EL}(y,x) \wedge \mathrm{EL}(z,x) \wedge y \neq z] \rightarrow \mathrm{AC}(y,z) \vee \mathrm{AC}(z,y)\}$$

where "RS" is a real system, and "AC(x,y)" – "x acting on y".

It is difficult, however, to speak of causal dependence among the elements of unreal nature. Rather an abstract notion than cause is searched for to define an axiomatic or literature system. Probably, the notion of DP dependence will be suitable.

Theorem 7

A system is an object which has at least two elements which are all mutually inter-related.

$$\mathrm{S} = \bigwedge_{x} \bigvee_{\{y,z\}} [\mathrm{EL}(y,x) \wedge \mathrm{EL}(z,x) \wedge y \neq z] \wedge \bigwedge_{t,u} \{[\mathrm{EL}(t,x) \wedge \mathrm{EL}(u,x)] \rightarrow \mathrm{DP}(t,u)\}$$

$$\vee \bigwedge_{t,u} \{[\mathrm{EL}(t,x) \wedge \mathrm{EL}(u,x)] \rightarrow \mathrm{DP}(u,t)\}$$

The notion of dependence, however, is not explained to the end. Certain auxiliary explanation can be found in phenomenologists' works. It is said, for example, that the object Q_1 is dependent in relation to the object Q_2 if occurrence of a certain state of affairs in which Q_2 is a subject is necessary for existence of appearance of Q_1.

The issue of division of the systems requires supplementation. J.M. Bocheński said in his "Philosophical remarks on an industrial enterprise" about two divisions: according to the criterion of nature of elements and according to the criterion of the system's behaviour[2]. In result, breakdown to homogenous vs. heterogeneous and static vs. dynamic systems appears. Two further breakdowns are equally important. Where synthetic principle is a criterion, we have centralised systems (the vertebrates) and non-centralised ones (a house). With the nature of environment taken into consideration the systems are divided into closed ones (axiomatic system) and open ones (living cell). Both these divisions find their place in analyses of building and functioning of an industrial enterprise.

The centralised systems are especially interesting though, as far as it is known, they have not been sufficiently elaborated from the scientific point of view. A centralised system is a system in which all elements depend in certain specific way on one, central element. All organs of a living organism depend on central nervous system and all soldiers in a company depend in their activities on their captain's orders. It seems very probable that centralised systems may be spoken of with regard to dynamic systems only. Carving out two kinds of dependencies is necessary to develop a theory of centralised systems:

1. the dependence that occurs between each element and the remaining ones,
2. the dependence between the central element and the remaining ones.

Open systems seem to attract the research workers' attention most strongly. It is their characteristic feature that each open system is an element of a bigger system. So, atom which is a system of electrons is itself an element of a particle. The particle is an element of a living cell of which in turn organs are built which are then the elements of a human living who is a member (i.e. an element) of a society. J.M. Bocheński, unlike other authors, did not develop this problem, though he could see here a lot of interesting questions. One of them is whether the world as a whole is a system. The positive reply formulated in the form of "Ontology of the world of systems" came from M. Bunge for whom this is the main research problem.

Basing upon "Philosophical remarks on an industrial enterprise" one may be convinced about the usefulness of the system's ontological analysis for an industrial enterprise. First of all, this is a good example of operationalisation of the highest abstraction knowledge which is a theory of systems into the sphere of an economic concrete called an enterprise. Having also the ability of own view

[2] J.M. Bocheński: Zur Philosophie der industriellen Unternehmung. Bank Hoffmann AG. Zürich 1985, p. 12.

of the industrial empiria and an excellent research and verification tool in the form of logic Bocheński fixed the frames of industrial enterprises' potential systems. The formula providing for as much as 64 theoretically possible methods of managing a company[3] has been filled to mediocre extent according to today's state. Its capacity exceeds all limits known in current practice. Many solutions which cannot be imagined today and which will be brought by the future may find their places within the framework of the Bocheński's formula. The evolution of technology development and the further trends in economy will show if and how it will take place.

J.M. Bocheński's reasoning as to the structure of an industrial enterprise is run in opposition towards the classical analysis which assumes that the essence of the economic reality changes lies in a dialectic antagonism of capital and labour. At the same time, using the theory of systems output J.M. Bocheński indicates that the old concept is out-dated and inadequate and presents a simplifying approach to the economic phenomena.

On finality

The notion of a finality is another notion analysed very carefully by J.M. Bocheński. The research activities pertaining to this term seem neglected. The finality in science has been questioned and systematically removed since Galileo. Physics, this model discipline in sciences, functioned without the notion of a finality, often enforcing imitating it by the other disciplines. At that time these were not all sciences that such situation was favourable for. For example, it is very difficult to speak of progress in biology, and especially in the social sciences without validated category of finality. Generally, one can do little in the social sciences without the notion of a finality. Relatively rich literature pertaining to the finality of an industrial enterprise may be an example. This proves the vivid nature of the finality notion in the sciences dealing with the human activities. The situation seems pretty bad, especially with the neglected analysis of the "finality" notion itself. Putting this problem in a certain order and removing doubts is, therefore, both urgent and troublesome task.

[3] J.M. Bocheński: Zur Philosophic..., op. cit., p. 21.

The finality has very many meanings. However, certain number of definitions may be made upon the basis of a wide literature on organisation of an industrial company. So:

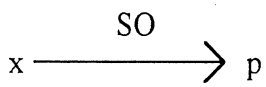
1. Finality is a relative name, it always states something in relation to somebody or something, as in the case of the name of "father". **2.** The relation of finality is binary C(x,p), or it at least contains one. **3.** The subject p of the relation of being a finality is not a thing, but the state of thing(s). **4.** The state of thing(s) is unreal, at least at the moment it appears. Further – J.M. Bocheński performs the analysis of the finality notion using the scholastic method of analogy of attribution[4]. It is best to use the principle of analogy in differentiating particular meanings of finality. The term of "health" already analysed may be given as an example. We have the health of an organism and this is the primary meaning. But we have also healthy food and healthy urine. These are the secondary meanings of "health". The food is healthy provided that it contributes to the health of an organism. The urine is healthy exclusively as a symptom of a healthy organism.

The same is with the finality. We have the personal finalities which are for the conscious subjects only. This is the primary meaning. But we have also the finality of action and the tool finality. They are of the secondary meanings. It does not mean, of course, that they are less important.

The semantic analysis is necessary for being effective in research on notions. This is also true with regard to the notion of finality and the relation of finality. The name of "finality" is at least two-segment, relative expression. If at any time we are dealing with finality, there is always somebody who is tending towards certain finality and something which is tended towards. This somebody will be called a subject x while this something will be an object p of the finality relation. The structure of the finality relation may be shown in a symbolic formula:

1. SO(x,p)

or as a graph:



[4] The kinds of analogies including the attribution analogy – see J.M. Bocheński: Introduction to the theory of analogy. Lublin 1948.

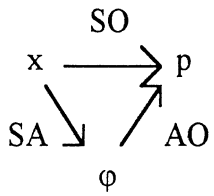
As it has been said, the object p of the finality relation is not a thing, but a state of things. Though it happens that while going to travel I am saying: "my goal is Cracow", it means that actually my purpose is "to be in Cracow", i.e. the state of thing being in this concrete example myself. This state is not real. The subject tending towards it assumes it is becoming real.

The subject of this relation of finality is a conscious being, able to determine and realise a finality. A subject is always an individual person. It is never a collective. Collective is not a conscious being. When aims of a collective are mentioned it means that either all its members or leaders are tending towards the same finality.

However, tending towards a finality is insufficient. For accomplishing it an action is needed through which the finality can be achieved. Therefore, the relation is a tertiary one. It exists among the subject x, its action φ and the finality p. We may express it:

2. $\mathrm{SAO}(x, \varphi, p)$

or:



SAO, as a tertiary relation, contains three binary relations: SA between a subject and an action, AO between this action and an object (finality), and already known SO between the subject and the object itself. Assuming that SAO relation is primary partial relations can be defined. Personal finality is one of them:

3. $\mathrm{SO}(x,p) \equiv \bigvee_{\varphi} [\mathrm{SAO}(x,\varphi,p)]$

The second important partial relation is the AO relation between the action and the object:

4. $\mathrm{AO}(\varphi,p) \equiv \bigwedge_{x} [\mathrm{SAO}(x,\varphi,p)]$

It appears from the comparison of definitions of a personal finality and aim of action that there is an identical object, i.e. the state of things to be realised in both relations. The difference is in the first segment: instead of a conscious subject we have an action, or, more generally, a process.

As long as the analysis is performed within the context of the three-argument relation SAO everything is clear and accepted. However, the AO binary relation existing between the action and the object understood as a finality may be considered apart from the personal finality relation SO. Each process in its nature itself tends towards the end. Hence, e.g. a ball rolling on a regularly inclined surface moves continuously from one place into another until it reaches the lowest point. Reaching the end of this rolling is a kind of a finality, independent from any conscious subject. In another case it is said that the finality of the action which consists in rising of the discount rate is attracting capital or, that the finality of killing several hostages is to terrorise certain population. Of course, with the ternary SAO relation taken into consideration it is known that it is a bank's director who desires to attract capital through such an action, or it is a gangster that terrorises a population. However, it indicates the possibility to analyse the finality of an action independent from the personal finality.

The identity of the second segments in both finality relations is sometimes the cause of their being frequently mixed with one another though the formal analysis does show the difference between SO and AO. People imagine that each process tends towards the finality in the exactly same way as a conscious subject. It is not so, even though it happens frequently that the end of the process is the same as the state of thing(s) assumed as a finality by a conscious subject. Let's take a throw with a stone as an example. Let us suppose, that I am throwing a stone aiming at a certain place. If I hit my conscious finality is identical with the place my stone reached. An illusion may appear that the stone hits the place by itself, independent from the personal finality, as it must reach some place finally. Even in Latin originated languages (Italian, French, Spanish) the some word (finis, fine, fin) is used to describe a conscious finality and the end of the given action[5].

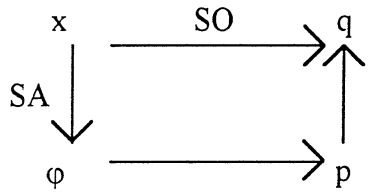
When discussing the relation of finality it is necessary to remind of a classical differentiation between a finality of an action (finis operis) and a finality of a person who undertakes an action (finis operantis) which was successfully used

[5] The differentiation of a finality and result of an action applied in newer management and organisation literature allows to avoid possible misunderstanding.

in scholastic dissertations. Finis operantis – is the state of things to which the subject is tending through a certain action. A situation which illustrates well this division is the example of washing a car described by J.M. Bocheński. The differentiation, however, introduces a new argument to the finality relation. We have a subject x, action φ, indirect finality of an action (finis operis) p and a final finality of a subject who undertakes the action (finis operantis) q. This relation will be described as OPP.

5. $\mathrm{OPP}(x, \varphi, p, q) = \{[\mathrm{SAO}(x, \varphi, p) \wedge \mathrm{SO}(x, q) \wedge q] \rightarrow p\}$

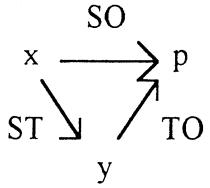
or in the form of a diagram:



The relation between an indirect finality of an action p and a finality of a subject q is the implication $(p \rightarrow q)$.

Last, there is the third kind of finality – attributed to a thing. We say that the finality of a watch is to show time and the finality of a knife is to cut. This kind of finality is an instrumental finality because the things to which it is attributed always perform a role of a tool. Finality of a thing is equal to finality of a tool. Speaking in another words: where finality is attributed to things there is always somebody who uses them as tools.

Talking initially, instrumental finality is a tertiary relation among a subject x, a thing y and an object p. We may write it as STO (x,y,p). Its basic structure is isomorphic to SAO:



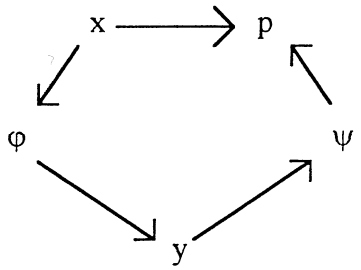
Apart from the known relation of a personal finality SA contains two new ones: a one existing between a subject and a tool ST and a one between a tool and an object TO. They may be defined:

6. $\mathrm{ST}(x, y) \equiv \bigvee_{\varphi} \mathrm{STO}(x, y, \varphi)$

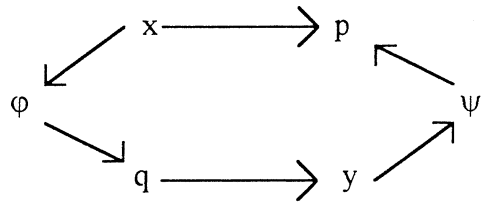
7. $\mathrm{TO}(y, \varphi) \equiv \bigvee_{x} \mathrm{STO}(x, y, \varphi)$

The expression ST means using a tool while TO means instrumental finality considered in an abstract way. It must be further said that the subject of the instrumental finality is a thing, an individual, but not a conscious thing (unlike in the SO). The object is then the state of the things which needn't be, however, identical with the object of the SO relation.

Nevertheless, the problem is more complex. A tool which is a subject has its own activity which must be taken into consideration equally to the subject's activities. Hence, we have the five-argument relation among x, its action φ, tool y, action of the tool ψ, and the object p:



However, even the above diagram is a simplification. In reality the subject influences the tool, aiming at causing its defined state of thing. For example, a smith takes a hammer and rises it up to certain required position in result of a given indirect intention of the subject. This should be included in the analysis as well. In result, in the instrumental finality relation there are participating: subject x, its action on a tool φ, the state of the tool q, the tool itself y, its action ψ, and the object p (which is, by the way a personal finality).



These are not all the aspects of the instrumental finality relation. Any product made by a human being may be used with other intentions than the aims for which it is designed. A drilling machine designated for making holes may be used for hammering nails. Differentiation of immanent and transcendent aims of a tool is necessary. The transcendent aim is another meaning of "finis operantis" and the immanent aim is, of course, "finis operis" of a tool used in action.

The very basic problem is a question of a choice between immanent purposes. It seems that economic usefulness or cost of the use of a given tool is the most frequently used criterion. We will say that p is the immanent aim of the tool y only when any subject using y for achieving p may gain this state of things with less effort, lower cost, etc. than in case of having not used it. The immanent tool aim is such a purpose which may be achieved with lower cost than without this tool.

Having introduced the notations: "IA (p,y)" read as "p is an immanent aim of y", and: "CS (k,y,p)" for "k is a cost of achieving p by y" we can define:

8. $$\mathrm{IA}(p, y) \equiv \bigwedge_{x,k_1,k_2} \{[\mathrm{STO}(x, y, p) \rightarrow \mathrm{CS}(x, p, k_1)] \wedge \sim [\mathrm{STO}(x, y, p) \rightarrow \mathrm{CS}(x, p, k_2)] \wedge k_1 < k_2\}$$

It may be further said that "TA (p,y)" read as: "p is a transcendent aim of a tool y" is only when we have a subject x tending to achieve an object p through an immanent aim y:

9. $$\mathrm{TA}(p, y) \equiv \bigvee_{x,q} \{[\mathrm{IA}(q, y) \wedge \mathrm{STO}(x, y, p) \wedge p] \rightarrow q\}$$

Developing further the analysis of a tool aim it must be said that there are two kinds of transcendent tool aims. We will refer to them as "proper" (just) and "improper" (incidental). Robbing a safe through drilling a hole in it is the proper transcendent aim while killing at this place an undesirable person with the drill is the transcendent improper aim. The difference is that in case of a proper transcendent aim it may be achieved through reaching of the immanent aim. The holes must be made to get the money out of the safe, but when hammering nails with a drilling machine the holes are unnecessary. It may be said that p is a proper transcendent aim only when p is a transcendent aim of y and gaining of immanent aim y is the necessary condition to achieve p.

Using the notation of "TP(p,y)" where "p is a proper transcendent aim of y" we have:

10. $TP(p, y) \equiv TA(p, y) \wedge \bigvee_{q} \{[IA(q, y) \wedge p] \rightarrow q\}$

The improper (incidental) aim TI is also transcendent:

11. $TI(p, y) \equiv TA(p, y) \wedge \sim TP(p, y)$

or:

12. $TI = TA \wedge \sim TP$

It is time to sum up the results of the analysis of the finality relation. According to J.M. Bocheński there are three kinds of a finality: personal, action and tool. Two- and three-argument relations SA and SAO have been indicated within the framework of the personal finality. Also, it has been said that the personal finality is the "finis operantis" within various aspects of instrumentalised activities. The relation of finality of action AO was defined in general sense (definition 4). It was also stressed that it is the "finis operis" (definition 5). Instrumental finality was also defined abstractively (definition 7). The division of a tool aim into immanent one IA and transcendent one TA was made, accompanied with definitions (definitions 8 and 9). Additionally, transcendent aim of a tool may be proper – TP (10) or improper – TI (11 and 12).

J.M. Bocheński put the notion of the finality so defined upon the issue of an industrial enterprise in a dynamic cross-section. The effects have been presented in chapter 4 of the "Zur Philosophie...". Supplementing this, it seems desirable to add that an enterprise which is not a conscious being might not be considered within the aspects of personal aims. Also, an enterprise is not a typical tool as a hammer or drilling machine. However, its aims should be considered in conformity with the instrumental finality concept; carving out of immanent and transcendent aims is especially important. This allowed to cover with the analysis the aims of the particular groups which make up the whole activities of an industrial enterprise. No matter what reception of this undoubtedly interesting proposition is, one thing seems sure: one cannot just pass it in the further studies.