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THE DETERMINANTS OF THE DYNAMICS OF BUSINESS PROCESSES

Summary. The article presents the properties of the market system consisting of economic entities subjected to processes determined by the natural behavior of the nonlinear dissipative system. The rules of chaos govern this system, but they are associated with the system's goal to reach an equilibrium. It is done using the mechanism of emergence, phase transition, and nomicity rules. This is often accomplished at the cost of unpredictable and undefined fluctuations that even in the case of a single object may affect the balance, or even cause a crisis of the entire system. However, we can prevent this by fulfilling certain conditions and by assuming the appropriate model of bottom-up management.

Keywords: nomicity, fluctuations, phase transitions, mechanism of emergence, self-organization, dissipativity

DETERMINANTY DYNAMIKI PROCESÓW BIZNESOWYCH

Streszczenie. W artykule przedstawiono własności systemu rynkowego, złożonego z podmiotów gospodarczych, podlegających procesom determinowanym przez naturalne zachowania dyssypatywnego układu nieliniowego. W układzie tym rządzą prawa chaosu, ale są one związane z dążeniem przez układ do osiągnięcia stanu równowagi. Odbywa się to z wykorzystaniem mechanizmu emergencji, przejść fazowych i praw nomiczności. Jest to realizowane bardzo często jednak również kosztem nieprzewidywalnych i nieokreślonych fluktuacji, które nawet w przypadku pojedynczego obiektu mogą wpływać na zachwianie równowagi, a nawet kryzys całego systemu. Możemy jednak temu zapobiegać, spełniając pewne uwarunkowania i przyjmując właściwy model zarządzania oddolnego.

Słowa kluczowe: nomiczność, fluktuacje, przejście fazowe, mechanizm emergencji, samoorganizacja, dysspatywność

1. Introduction

In 1776, Adam Smith [1], the Scottish philosopher and creator of the new, whole economic system, published his first famous work "An Inquiry into the Nature and Causes of the Wealth of Nations." He proved that the best way to bring other people benefit is only when we care about our own prosperity. According to him, in fact, only constant competition between individuals concerned about their own benefits can serve all of society and lead to its prosperity. The fundamental thesis of market economy and capitalism was defined this way. However, is this theory, which assumes that economic success depends primarily on factors derived from the cause and effect phenomena, real? Long ago it was proved that regardless of the structure of a given society, none behaved in a way that confirmed the model proposed by Smith. How about a company? A company is also very similar to society in its structure, and even if we define it as a physical system of connected and mutually interacting elements, they are not determined by well-known and defined values of variables, but as practice presents, they are unpredictable, multidimensional, and associated with the process of dispersion. Otherwise, the selection of a strategy related to financing decisions (both in the short-term and long-term), including the capital structure strategy, would depend only on whether or not we acquired the relevant information and related data. This has already been proved many times before as a result of long-term research conducted by scientists, among whom we can mention, for example, S. Myers [2] or F. Black [3]. Nonetheless, despite a growing number of theories and reactive and predictive analysis tools currently available, none of the economists are no longer able to identify a verifiable way of estimating the cost of capital or dividend. We never know what their actual impact will be on a company's market value. Irrespective of the company's share capital, the ability to obtain financing, its power and competitive advantage, good economic policy, dividends payment policy, or valuable contracts, in the end, it turns out that 90% of start-ups go bankrupt within 5 years [4]. This is because in defining an objective function we are constantly looking for new, measurable entities that lead to particular results. We want to examine their impact on a particular unit, but even if we specify all the possible relationships occurring in this case, it would still only be an exemplification of specific cause-and-effect events, in order to be able to identify the specific status of the object. So far, this approach has not given the possibility to create and document a single verifiable theory in relation to the dynamics of business processes, determining and enabling to describe the conditions and the existence of a company. So, we can no longer identify specific and verifiable principle underlying the financial decision-making processes, even when we take into account

the interaction of all components of the capital or the financial policy conducted by the entity. We are also unable to indicate all the conditions relevant for a specific moment because we should consider the whole structure associated with them as a living organism, which is a set of non-measurable values creating a coincidence circuit. This system has a nomic character (determined by the laws of the universe) because it is not only subject to the rules of causality, but also the rules of all-union events. We do not have to deal with the current values of each attribute but with the phenomenon of phase transitions, fluctuations in equilibrium, or emergence (defined as the formation of qualitative new forms and behaviors between single elements), enabling to upgrade the rationality field. Therefore we have the same situation as in the case of DNA, which is the primary carrier of genetic information, but – contrary to popular opinion – also a structure that does not originally have the updated features or specific individual predispositions. This update is related only to external stimuli and the available environmental conditions. This was also demonstrated and derived by Professor Randy Jirtle [5] and his colleague, Rob Waterland. They proved experimentally that taking supplements during pregnancy alter the genetic destiny of offspring, by excluding specific gene expression (in this case it was the agouti viable yellow Avy gene). Others, following their steps, also confirmed this with respect to other genes. As a result, it became clear that it was not Charles Darwin who was right but Jean Baptiste Lamarck, who was thus far criticized by the scientific world, who already in 1802 proclaimed that the environment is primarily responsible for the characteristics acquired, and also inherited by successive generations. So, shouldn't any functioning of the body (including the company), having the ability to process information be considered also in a similar way? Then, the relationships available in the field of rationality will define the opportunity to comment specifically updated terms, and the problem domain will be considered only in the environment striving to maintain equilibrium.

2. Nomicity and field of rationality

Despite four industrial revolutions (related with steam, electricity, computers and intelligence in the broad sense, leading to the transformation of knowledge into expected wisdom), determining continuous technology development and creating new conditions for the construction of increasingly complex devices, no attempt to transform any type of energy into another has led to the creation of a device that would minimize the loss of the deduction of the original amount to a level lower than 20%. However nature copes with the problem well. Even a simple living organism like a plant produces both oxygen and carbohydrates, taking advantage of precisely every photon reaching it (efficiency never drops below 98%). This phenomenon becomes even bigger, when we consider the results of recent experiments

conducted at the University of California at Berkeley by Professor Graham Fleming [6]. Using the methods of ultrafast spectroscopy, he discovered that absorbed solar energy reaches the goal it tests all possible options at the same time, and when it finds the best solution, it acts as if another solution never existed. This is the so-called random walk, which means that potential energy exists in many places at the same time (it is in the superposition state) and strives from chaos to order (low entropy). This potential can be measured only when there is a specific reference system, but in that situation we have its other properties. The whole system is an indivisible set in which components are aware of each other, and the information acquired by one object becomes at the same time also available for the others. The unit therefore represents a set and the set represents the unit, which means that we are dealing with so-called nomicity, meaning that between the types of states of affairs there are the same relationship as between individual states of affairs. So, we have to deal with a situation when we should always consider everything in the context of sustainability. It is a natural state for wildlife. Is this not, however, only characteristic of microscopic systems but also macroscopic systems? If the number of elements of such a system is very large, the fluctuations that correspond with unequal distribution almost never occur. Then, when there is an event in our economic system, or on a smaller scale, in a company, and we are dealing with a large fluctuation or wrong prediction, it means that we considered inappropriate relationships and associated components or chose the wrong reference system, and thus we cannot see the actual properties of the analyzed problem domain.

The research results of the analysis carried out in every developed and developing country by Richard Wilkinson and Kate Pickett, published in "The spirit level: why more equal societies almost always do better" [7] present that living standards of the rich are the highest where there is equality. In practice, this means that the more we have to deal with hierarchy and the associated injustice, the more we have to deal with a situation where the rich are also affected by illnesses, direct crime, violence, ecological problems, and even mental illnesses. Searching for and introducing artificial rules that are incompatible with the harmonious win/win principle may thus lead to mock success in relation to the individual but at the cost of imbalance resulting from nomicity laws of a healthy ecosystem. No community or company is composed of autonomous individuals, but they are both complex, self-organizing bodies, which are unpredictable as the system of quanta but also as they are, as it is already defined, we can consider only harmonious relationships being equivalent to the quantum superposition. Only a company with its own potential, which is internally properly integrated (Fig. 1), will create the best possible relationships with similar companies, defining new market opportunities.

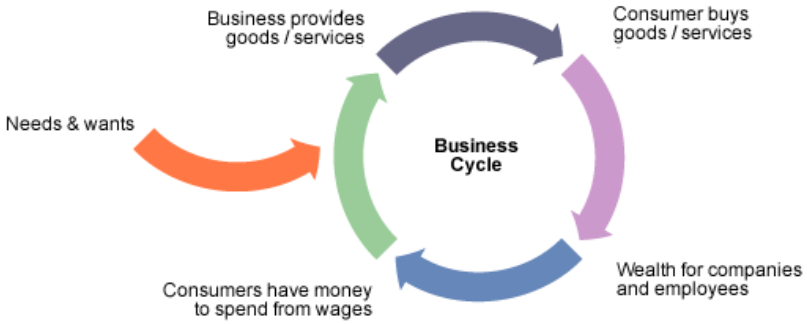

Fig. 1. The economy, natural synergy, and new possibilities
Rys. 1. Gospodarka, naturalna synergia i nowe możliwości

3. Phase transitions and fluctuation

Companies, similarly to objects at the subatomic level, are connected by relationships, forming countless patterns of possibilities. They are not associated with any constancy and certainty but strive dynamically towards equilibrium and have this potential. They are subject to change so often having a non-linear character, which significantly hinders the identification of factors that have a direct impact on the noticeable result in the moment. These changes are called phase transitions. So far, many economic analyses assumed that the approximation of very weak nonlinearities makes no sense, and furthermore may even lead to very large errors. The economic system is, however, a complex system of the multi-dimensional, and this structure ensures that even very small changes of one of its components may determine and significantly affect the characteristics of the whole system. An example could be the pursuit of economic growth with the strategy to increase expenditure in the period of stagnation and reduction in a period when we are dealing with growth, where very often we see an uncontrolled increase in the fluctuations amplitude.

According to the second law of thermodynamics, when the system approaches the most disorderly state, it still aims to a state in which it is in equilibrium. The energy of no object is thus fixed because it fluctuates (Fig. 2), but the system will always strive to ensure that the average energy of the object is the same as the average of any other. All dynamic systems are therefore similar in the discreet mapping character.

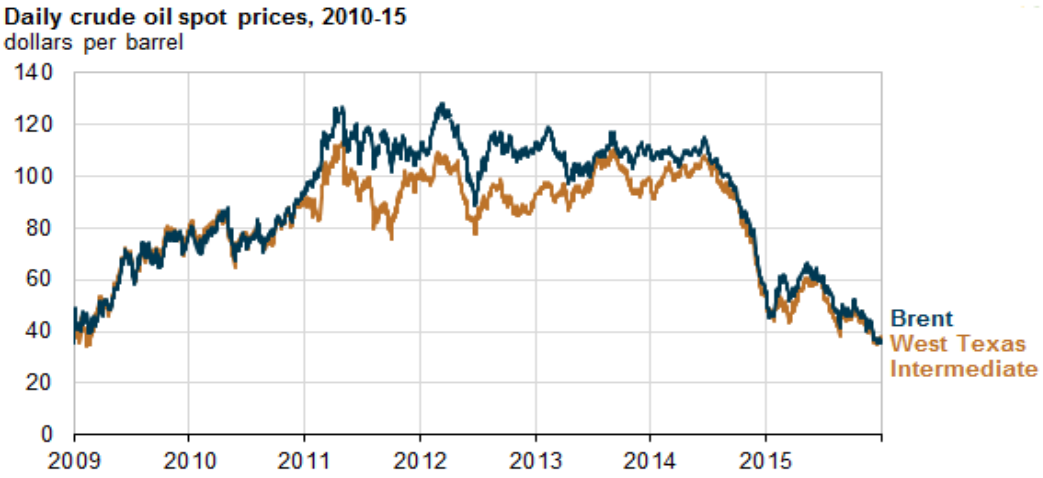

Fig. 2. Fluctuation processes which strive for equilibrium and a system of stability
Rys. 2. Procesy fluktuacji, które dążą do równowagi i stabilności systemu
Source: http://www.eia.gov/petroleum.

Local economic systems are the objects of the global system, thus changing the potential of one of these objects and the associated fluctuations of energy averaging of other objects affect non-linear dynamics of the entire system in an unpredictable way, which means that they repeatedly cause an economic crisis on a global scale. Local transformation causes changes influencing the whole field containing the possible relationships that can be presented as a wave function Ψ and saved as a complex number (1), (2).

$$\Psi = (re\,\Psi) + i(im\,\Psi), \tag{1}$$

$$\Psi = a + ib, \tag{2}$$

If the transformation is always associated with the interference effects, it will not be able to be compensated. In this case, the non-linear interactions of the system components lead to the formation of economic trajectory. These in turn, according to KAM theorem (Kolmogorov-Arnold-Moser) [8], depend on the initial conditions and often determine the chaotic events which is called the butterfly effect (Fig. 3). We are therefore facing an account of events (non-relativistic perturbation theory), where problem A written as (3), which cannot be solved precisely, can be presented as a part (power series) giving the direct solution and deviation element represented by standard deviation €.

$$A = A_0 + €A_1 + €^2A_2 + \cdots + €^nA_n, \tag{3}$$

In the formula (3) A_0 is the exact solution as part of an undisturbed problem, while factors A_1, A_2, etc. successive elements of the available solution, which already represent a disorder. For small values of deviation €, factors of further orders are no longer relevant.

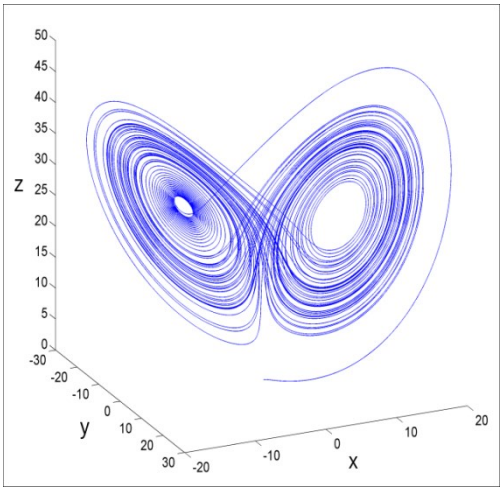

Fig. 3. The butterfly effect – Lorentz attractor
Rys. 3. Efekt motyla – atraktor Lorenza

This means that the non-linear dynamic system is sensitive to even very small disturbances which can in turn lead to unpredictable changes, or even chaos. That system in the long run will behave in a random way. Its rambling however, applies only to a subset of the relationship of the phase space. Therefore, we can identify a subset of capabilities, to which the evolution of the system will strive. This subset is called an attractor. In mathematics, the attractor is an attractive fixed point of the tested transformation. But the most complex, and therefore also the most interesting, are so-called strange attractors (like the one shown in Figure 3 – where x, y, z represent the reference system – the Lorentz attractor, similar to the butterfly form). They attract trajectories (which are present in every dynamic system) from the outside, and the traffic inside them is chaotic and unpredictable. This is a characteristic of complex systems. After all, the economic system is also of that kind. It has a very large number of components with many degrees of freedom, and this causes that the behavior of these elements can never be predicted or calculated. Therefore, this leaves us with the tendency to conservative self-organization, i.e. to achieve the stability of the structures having an emergent character.

4. The mechanism of emergence

Nonlinear interaction of objects on the macroscopic structures of the open system (dissipative) refer to emergence – the mechanism of self-organization associated with the synergistic interaction of all elements of the system. If there was no the phenomenon, reaching of too large nonlinearity of the interaction in the system, and excessive dissipation would cause its destruction. This mechanism of emergence, which is essential for the survival of the system makes it possible to eliminate the existing degrees of freedom for stable objects. Then we will

be able to observe the amplitudes of unstable elements, which are so-called parameters of ordering. In analyzing the evolution of the parameters we can try to explain the phenomena occurring in the specific dissipative system. We will not find, however, the universal rules that govern all such systems, even with respect to only one field.

The economic emergence is determined by the novelty, unpredictability, irreducibility of properties underlying the mechanism of supervenience. With respect to irreducibility, the property W is irreducible to the property $w_1, w_2, ..., w_n$, where the property W may be derived from the most complete knowledge about the properties $w_1, w_2, ..., w_n$. In contrast, supervenience should be understood that if anything has properties $w_1, w_2, ..., w_n$, it must also have the property W. Irreducibility, in turn, means that if any property W supervenes on the properties $w_1, w_2, ..., w_n$, it is not reducible to them, which in practice means the inability to derive the properties from the most complete knowledge having the properties $w_1, w_2, ..., w_n$.

Dynamic business processes in the economic system may involve many different possible paths of self-organization. They are linked with the property, which is the heterogeneity of the system in relation to any spatial and time scale for the possible interactions. Interactions that on the lower level often lead to the emergence of surprising properties of the system at a higher level. Therefore, in conclusion, the efforts leading to a complete change in a particular situation will be associated with a high probability of failure, and the creation of appropriate conditions for change by regulating its parameters has a chance for success. This means that by changing the attractors of the system, we simultaneously minimize the interference with the same layout. Thus starting, for example, at the very bottom of the pyramid, where the worker is located, allows him to adequately communicate and understand, and leading to the best combination of human values with the business and market environment, we can activate a dynamic process, the result of which will be qualitative change, drawn through adjusting the parameters. That will give us new, emergent entities and opportunities. So, again we are dealing with the laws of nature understood as nomicity defined in the article. Even according to biologists, as exemplified by Mae-Wan Ho [9] "stability of organisms depends on whether all parts of the system are properly informed and properly act and are properly involved in sustaining life of the whole. Organic stability is thus freed from local system constraints. This radical nature of the organic (not mechanical) whole is owed to the maximization of global consistency and local freedom, when each part is responsible for overall control because they are all guided by a sense of responsibility for the whole." This, in turn, is after all nothing more than a desire to obtain a balance between chaos and order. It means that productivity and economic potential of the market should be shaped by self-organizing companies, which should have implemented such regulatory mechanisms to be able to function without the corporate structure imposed on them. Such companies should also cooperate by using networks of similar companies available

on the market, in order not to allow a single unit imposing total control. Such a model (Fig. 4) was practically verified in 1998 by Dee Hock [10], the Executive Director of Visa International.

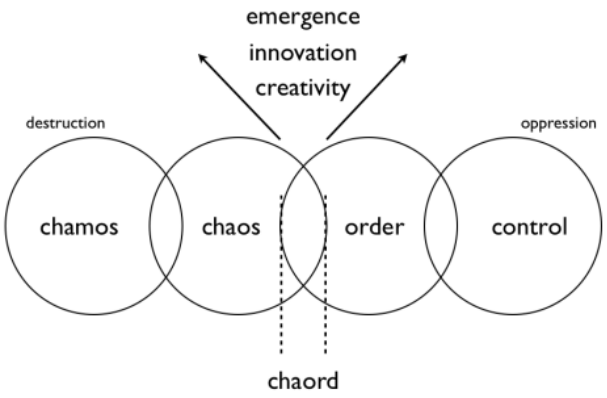

Fig. 4. Organization based on the principles of natural systems
Rys. 4. Organizacja oparta na zasadach systemów naturalnych
Source: https://thenatureofbusiness.org.

The company Visa International is one of the most well-known companies in credit cards for business customers, which are banks. It functions, however, by respecting the principle that management and decisions are in the hands of all employees, and the principle that a company must constantly be ready for adjustments related to changes, but at the same time cannot violate its fundamental values.

Summary

Despite Adam Smith's theory, competition in business sooner or later leads to crisis, as reflected in the behavior of the individual object, which affects the whole economic system, not only in the local, national, but global perspective. This is the biggest barrier to the development of the whole free market economy. Its entities are the companies that make up the space field of relatedness, which is a dynamic nonlinear system. This system is characterized by indeterminacy, uncertainty, and randomness of events. A single object, however, is subject to the laws of nomicity and processes of self-organization, associated with the phenomenon of emergence. To make this possible, we cannot strive for global change, but we have to make bottom-up adjustments and support the process of natural self-organization of the company. This is made possible by striving to minimize the hierarchy of each company working on a large scale as well as the rejection of the model associated with centralized management. Then the creation of a healthy, functioning and flexible body will be able to interact with others on a win/win basis. As evidenced, companies that seek only their own satisfaction and individual success, motivated only by competition pay in the end a high price,

but they also cause the so-called butterfly effect, which says that even one, as it might seem, insignificant object can greatly affect the state of others, and even the entire system. Whether we like it or not, with increasing levels of individualism, we observe a reduction for all members of the community, not only the poor but also the rich worsening of every important indicator measuring aspects of life, from health care, social support, crime, public security, education, to life expectancy. In order to ensure not only the proper market regulations and prevent the global crisis, but additionally the wellness of communities, we should strive constantly to form partnerships at every level and different possible forms of cooperation. There is both selfishness and altruism. The latter, however, is more contagious and spreads rapidly by reference to the human natural tendency of seeking relationships.

Consideration of each economic problem as a logic problem and seeking deterministic solutions relating to the cause and effect laws, has not yet led to develop the verifiable solution model for a specific domain. The probability of such a model creation is very low, because both the market and its components are a multi-dimensional system, which is characterized by incomplete specificity, the lack of sufficient information, and a set of attractors relating to factors. Those, seeking to restore imbalance in an impossible to identify in the process of earlier space prediction, cause chaos. Therefore the only solution is taking care of the balance which lies at the basis of many functioning economic models.

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