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THE ENTROPY OF TRANSITION AND CRISIS

Abstract: *It is known that the entropic process naturally erodes any social system, but there are unlimited ways for this process to be slowed down or even stopped for long periods of time, which would be in the benefit of the society and its members. The intention of this paper is to precisely identify these opportunities and increase the awareness of decision makers to form and lead the reconstruction program of scientifically rigorous socio-economic reforms, appropriate for the removal of the entropy factors.*

Keywords*: Entropy, transition, crisis, information theory, systems theory, cybernetics, social entropy.*
JEL Classification: E66, D81

1. Introduction

If we dwell on this issue we feel compelled to justify. We do that primarily with the intention of pointing out some ways to avoid and decrease the negative effects induced by unprofessional solving of social affairs, and secondly, to commission other specialists in the field of management, who may engage more actively in solving this problem.

This paper extends Boiangiu *et al.* (2009) adding a stochastic approach and revised interpretations of phenomena in order to present the same issues that are not only of local interest but also of global interest in today's society.

2. The concept of entropy

This concept was revealed to various fields, including the social one, after the apparition of three fundamental areas of science: systems theory, cybernetics and information theory.

2.1 Systems Theory

Biologist Ludwig von Bertalanffy (1968) made a turning point in addressing any concept, any phenomenological analysis, as opposed to early practice to study a phenomenon only in terms of existence and its evolution; a new approach to the subject treated as a set of elements (material or ideal), that are interconnected, composing an organized system.

The approach in a systematic manner opened the path towards understanding the causes that led to the phenomenon and towards pointing out the effects as results of existent interconnections inside the considered system and the systems with the constitutive subsystems and with the supra-systems among which it is inherently a part of.

The work of Ludwig von Bertalanffy (1968) helps us complete the view of the mathematician Georg Cantor (author of sets theory Cantor (1874)). He stated that there were only three sizes of infinity: integer and fractional numbers infinity (the set of rational numbers), the infinity of points on a line, surface or cube and infinity of imaginable geometric lines with a fourth size –the size of all conceivable systems.

2.2 Cybernetics

The science dealing with the study of ways of behavior of all imaginable systems which are dynamically structured, controlled or regulated through communicative information, associated to Norbert Wiener, opens new horizons in the practice of research, having many and varied applications in all fields of technology, in economics, biology, medicine and other fields.

In 1948, Norbert Wiener (1948) elaborated the work "Cybernetics". The merit of Odobleja (1938, 1939, 1978), who actually set up the foundation of this discipline starting from 1938, should also be remembered.

2.3 Information Theory

Shannon (1948) opens the way to the mathematical understanding of communication systems and implicitly insures the scientific support for designing and building the information transmitting devices, without which any activity in any domain today cannot be conceived.

The purpose of this paper is the following: we will insist on the information theory, as being the understanding of the entropy concept and, as a consequence, the establishment of understanding of the paramount role it has in the evolution of any type of events that occur in the transition and crisis period.

Not struggling to define the notion of information, as it is, like the notion of set, that is primary, we will highlight its roles in promoting any kind of policies - fiscal, commercial, investment, educational, production, etc. – which, in their entirety, compose what are commonly defined as social processes.

Typically, any information removes an indetermination, as it is, in the meaning of the word, information only if it removes indeterminacy. To better understand this, let us consider a random experiment and we observe that, in relation to it, we acquire information only when we do not know its outcome prior to the experiment, and as such, the information obtained by the conducted experiment leads, in this case, to the elimination of indeterminacy.

Therefore we say that information replaces an indetermination. Hence for information and indetermination we use the same measure.

From this we deduce that if indeterminacy is high then the information needed for its cancellation must also be high. In fact, **information equals a removed indeterminacy.**

Let's consider an experiment A with the events $a1, a2, ..., an$. If $p1, p2, ..., pn$ stand for the probability for the events to actually occur, then we can write the distribution: $\begin{pmatrix} a_1, a_2, ..., a_n \\ p_1, p_2, ..., p_n \end{pmatrix}$.

Since the indeterminacy of the experiment depends crucially on the probability of events that characterize the result of the experiment, we seek a measure of the degree of indeterminacy of this experiment, based on the probabilities $p1, p2, ..., pn$ of occurrence of the results $a1, a2, ..., an$.

Denoting by H **the degree of indeterminacy** of the experiment A, we will write that this measure is: $H(A) = H(p_1, p_2, ..., p_n)$.

Claude Shannon found for it, in 1948, the following relation: $H(p_1, p_2, ..., p_n) = -\sum_{k=1}^{n} p_k \log_2 p_k$, which could be written, changing the base of the logarithm:

$$H(p_1, p_2, ..., p_n) = \frac{-1}{\log_{10} 2} \sum_{k=1}^{n} p_k \log_{10} p_k \,.$$

As this formula is identical in its meaning to the relation from thermodynamics deducted by Rudolf Julius Clausius and Ludwig Boltzmann, named "the entropy of thermodynamic systems", Shannon borrowed its name calling it "the entropy of the experiment" A. With this formula, the degree of indeterminacy of the experiment can be measured.

It is not irrelevant to point out that the usage of the same names is not based solely on the graphic consideration, but if we analyze in depth the content of the concept of thermodynamic entropy we can remark that both areas - thermodynamics and information theory - study the same problem regarding the disorder installed in a system.

Choosing, in the entropy expression, base two for the logarithm, highlighting an experiment which can have two equiprobable results, the naming of the measurement unit became the bit (binary digit). This measuring unit was proposed by Claude Shannon.

In the expression: $H(A) = H(p_1, p_2, ..., p_n)$, it was observed that: $\sum_{k=1}^{n} p_k = 1$.

If various experiments k ($k = 1 \div n$) are independent, the formula becomes: $H_T = \sum_{k=1}^{n} H(k)$ and if the experiments are conjugated: $H_T = \prod_{k=1}^{n} H(k)$.

Shannon's formula: $H(A) = -\sum_{k=1}^{n} p_k \log_2 p_k$ has a statistical meaning, named informational entropy.

We observe that if $p_k = 1$ and $\log_2 p_k = \log_2 1 = 0$ then $H(A) = 0$.

This shows there is no uncertainty in the probability field A.

If $p_1 = p_2 = ... = p_n = p$ then the informational entropy is maximum and we can consider the expression: $H(A) = H \leq Hmax = -\log_2 p$, because:

$$H(A) = -\sum_{k=1}^{n} p_k \log_2 p_k = -(p \log_2 p)n$$

But $n \cdot p = 1$ resulting that: $H(A) = H = -n \cdot p \cdot \log_2 p = -\log_2 p$

During the experiment we obtain a quantity of information: $I = H_{max} - H$, where Hmax stands for the maximum informational entropy, and H for the entropy of the events set A.

When the events are equiprobable, then the quantity of information (I1) can be deducted by the following formula: $I_1 = H_{max1} - H_{max0}$, where:

- $H_{\max 1}$ stands for maximum informational entropy at the time moment 1;
- $H_{\max 0}$ stands for initial maximum informational entropy.

For two time moments 1 and 2 we have: $I_2 = H_1 - H_2$, where H_1 stands for informational entropy at the time moment 1 and H_2 stands for informational entropy at the time moment 2.

As a result, informational entropy H can be expressed by the quantity of information I, $H = Hmax - I$, which highlights the fact that the informational entropy can be defined as maximum entropy diminished by the quantity of information transmitted through a communication channel.

Analyzing previous equations, we can write: $I_1 = H_{max1} - H_{max0}$ => $H_{max1} = H_{max0} + I_1$, showing that the maximal entropy increases with the quantity of information I_1 from a system and implicitly the complexity of the system.

From the expression $I_2 = H_1 - H_2$ it results that $H_2 = H_1 - I_2$.

As a conclusion, the informational entropy decreases with the increase of information offered by the experiment.

The information provided so far shows that the increase of entropy can be stopped by increasing the quantity of information in the analyzed social system, which leads to the increase of the degree of social organization.

If we consider an entire social system or its subsystems, like the: financial subsystem, industrial subsystem, judicial subsystem and so on, then the degree of organization can be measured with the relation: $\frac{I}{H_{max}}$, with values in the interval $[0;1]$. To highlight this, we see from the relation: $H = H_{max} - I$ that: $I = H_{max} - H$, which divided by $H_{\max}$ gives: $\frac{I}{H_{max}} = \frac{H_{max} - H}{H_{max}} = 1 - \frac{H}{H_{max}}$.

Therefore, the degree of organization can be measured through the formula:

$$1 - \frac{H}{H_{max}} = R$$

R stands for the average redundancy for the symbol of a message.

Analyzing this relation, it leads us to the following conclusions:

- The degree of organization increases as the quantity of information stored in the system increases;
- The degree of organization decreases as the maximum entropy rises.

3. Social entropy

Sileţchi *et al.* (1978) showed that social phenomena take place in irreversible time in a society which is an opened cybernetic system, because it takes resources from the exterior and offers back products and services. As the time is irreversible, the social phenomena have also an irreversible character.

Therefore, irreversibility is a principle of social development.

This principle has its origins in the fact that social development inflicts a gradual exhaustion of human or material resources. The recovery of these resources is uncertain or sometimes impossible.

In time and space, the connection between the natural environment and the society development permanently changes, as the direction of this development is oriented from the past to the future.

In the human society's evolution there has always existed a resource transfer between the environment and society, which, if made wrongly, could lead to the permanent degradation of the environment and human society. Therefore, a theoretic approach from a different perspective was necessary, regarding the possibilities to maintain the order in nature.

Nicholas Roegen (1979) stated that "*in nature, the order tends to become disorder*" which means that, as he states, in theory "*the entropy should be redefined as a reflection for the degree of disorganization*".

The irreversibility of social processes caused by the continuous transfer of resources from the environment, for ensuring social development, leads to its degradation, in the case of unscientific exploitation. Then, the following relation takes place:

$$S = k \int \frac{dX}{X} = k \ \ln X + C,$$

- S – social entropy
- X – social development
- C – the constant of integration

The parameter k can be obtained from the relation:

$$k = \frac{dR}{dX},$$

- dR - variation of natural resources;
- dX - variation of social development.

It is known that disruptive phenomena of social development cannot easily be avoided. They amplify informational entropy and implicitly uncertainty, thus increasing the social entropy, which can only be brought back through the development of natural and human resources.

The rates of this development have different states (i) with probability p_i. This probability can be considered as social probability.

Keeping the meaning of k from the precedent equation, social entropy can also be expressed as: $S = k \sum_{i=1}^{n} p_i \log_2 p_i$., a convenient relation for comparing the social entropy with the informational entropy: $H = -\sum_{i=1}^{n} p_i \log_2 p_i$; resulting in $S = -k\ H$, an expression which makes the connection between the two types of entropy (social and informational).

In order to protect the order in nature against degradation, there must be equilibrium between social development and nature. This equilibrium would be possible if the need of natural resources that leads to social development leads also to the degree of instruction and education in people and in turn to the increase of natural resources.

Knowing that natural resources are limited and sometimes not regenerable, the attention of political decision factors must be drawn towards the scientifically foundation of development programs in a country but also toward a global consensus for the restriction or elimination of discrepancy between the rate of progress between countries.

The variation of social entropy can decrease by reducing the variable ratio of the natural resources quantity and social development.

We know that the entropic degradation is an irrevocable process; however, the evolution in social domain shows us how we can understand the time laws.

If we consider Y as the rates of social development, depending of the (t), then the variation of social entropy, $dS(t)$ is equal to: $dS(t) = k\ Y(t)$, where: $Y(t)$ the rate of social development depending of time.

In this formula, the time t is an order factor, a factor of irreversible transformation and orientation of social development.

The rates of development, depending on time, $Y(t)$ vary between extreme values, as a result: $Ymin(t) \leq Y(t) \leq Ymax(t)$, leading to the conclusion that, in order to decrease entropy, the difference between the extreme values: $|Ymax(t) - Ymin(t)|$ must decrease in time.

4. Social organization as an open cybernetic system

Starting from the premise that the social organization can be considered an opened cybernetic system, as Popescu (1978) and Dumitrescu (1981) say, we note it with S_{SOC} and realize the following configuration:

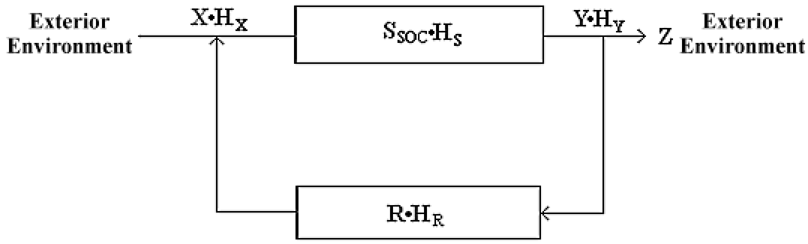

Figure 1. Configuration of a regulated system communicating with the environment.

The indicated models stand for:

- X – inputs (material resources, financial, human and so on);
- Y – outputs (products, services for the population, social protection system);
- Z – established objectives (here: economic reform, administrative, judicial, institutional);
- H_X – system inputs entropy;
- H_Y – system outputs entropy;
- H_S – system entropy;
- H_R – regulatory system entropy;
- S_{SOC} – analyzed system (without social order variations);
- R – the regulator system .

In order to sustain the following statements, we will show you the main causes responsible for the apparition of the four kinds of entropy.

Causes leading to apparition and increasing of the entropy of the inputs in the system (H_X **):**

- Faulty supply with material resources;
- Temporary or extended lack of funds for suppliers payment;
- Faulty supply with energy or fuel;
- Difficulties in ensuring transport for important material resources. The problem appeared because of various disturbing factors as: strikes, ships

sequestration, unusual meteorological phenomena;

- Lack of reserve stocks due to high costs, or due to lack of storages;
- Absence of legal framework.

Causes regarding H_S:

- The inability of ensuring human resources when needed;
- Faulty equipment of production units;
- Inefficient involving in tasks fulfillment of employees;
- Faulty professional conversion;
- Gaps in labor law;
- Migration of the qualified personal in other countries in searching for financial and professional fulfillment;
- Absence or lack of equipment;
- Neglecting, sometimes **in an** inadmissible **way**, of **the** research units;
- The faulty or incomplete reform of educational system.

Causes responsible with the apparition and evolving of H_Y:

- poor quality of products and services;
- insufficient involving of factors that were called in order to help economical units become more profitable;
- unfair competition of partners from inside or outside the country;
- acceptance of commissions in order to facilitate some imports that slow the export or even compromise it;
- insufficient research of exchange markets or marketplaces;
- costs that discourage imports or exports;
- the existence of growing smuggling activities that destroy the internal commerce.

All these considerations had in sight the presentation of an open cybernetic system (S_{SOC}) where the possible entropy of objectives was not kept in mind. If we also consider this aspect, then:

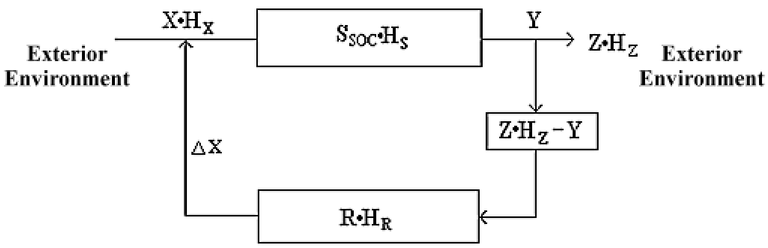

Figure 2. The system with entropy of its own objectives

where:

- H_Z – the entropy of its own objectives
- ΔX – the variation of system input models

Regarding the fact that units are actually matrices, we can write the following matrix equations system:

$$\begin{cases} Y = [Ssoc \cdot Hs] \cdot [X \cdot Hx + \Delta X] \\ \Delta X = [R \cdot HR] \cdot [Z \cdot Hz - Y] \end{cases}$$

resulting:

$$Y = \frac{S_{SOC} \ [X \ \ H_X + R \ \ H_R \ \ Z \ \ H_Z]}{I + S_{SOC} \ \ H_s \ \ Z \ \ R},$$

where I stands for unity matrix.

The final relation analysis highlights the possibility of maximizing the results Y of the considered social system.

Causes regarding H_R:

- Liability of organizational structures, a consequence of their treatment in the perspective of satisfying some algorithms meant to respond only to some group interests;
- Legislative uncertainties especially caused by return on laws previously approved that never had the time to confirm or infirm their justness;
- Partisan attitudes, with political connotation, that induces to the people the feeling of uncertainty which directly provoke breaking the rules of state law.
- Major deficiency of communication found very often in the highest levels of decision factors as in information transmitting and processing system;
- Selection of the managers by political criteria;
- The limitation of managers attributions, diminishing their personality as the efficiency of their work;
- Faulty security of technical and economical documentation, inspiring from other units work;
- Poor control of tasks fulfillment.

Causes leading to the apparition of objectives entropy (H_Z):

- Setting the system's objectives without scientific substantiation based on the analysis of political phenomena;
- Bad correlation of data resulted from marketing studies and the data obtained by analysis of political phenomena evolution;
- Superficial study of development, the main way to observe the evolution vector of social and economic phenomena belonging to the considered social system.

The objectives entropy will diminish the achievements Y of the system, which the decision factors must account for in order to decrease total entropy of the social system.

Opposing the practice of decision factors from the totalitarian social system, that limit the autonomy of the manager, in transition period, when the conditions of increasing the social entropy are very favorable, the following aspects must be considered:

- For a system to be flexible and easily adaptable to concrete conditions of the period, it must have some degrees of freedom;

- A system that cannot lead itself can’t be left unguided.

From the facts stated, we conclude that our concern must be to find the ways, the methods and the resources needed for the development that can assure the depreciation of disturbing rate that lead to entropy and disorder in the social development process.

One method is to stop the variation of development rhythms, which may be realized by rational organization of social processes and by evolving the act of decision.

Keeping our attention over these facts, we conclude as follows:

- Transition from order to disorder is accompanied by increasing the social entropy, which is manifested by decreasing of social organization, whilst moving from disorder to order leads to decreasing of social entropy and improvement of social organization.
- The variation of social entropy is higher when the rhythms of social development are also high.
- Variation of social entropy increases with the ratio of the quantity of material and energetic resources to social development.

Nowadays, we witness a great effort of ecologist associations to warn us about the depletion of natural resources and degradation of natural environment. They suggest that human efforts must be led in finding substitutes for some exhausted or insufficient resources.

In the same time we must highlight that social development must adapt to some social and human rules and objectives scientifically grounded.

5. Informational energy

In his works, Onicescu (1956, 1963a, 1963b, 1966, 1969) studied the repartition of an event:

$$A = \begin{pmatrix} a_1, a_2, \ldots, a_n \\ p_1, p_2, \ldots, p_n \end{pmatrix},$$

He found a different relation than Shannon’s for the measurement of uncertainty, written as follows: $\varepsilon(p_1, p_2, \ldots, p_n) = \sum_{k=1}^{n} p_k^{\ 2}$, which he named: “informational energy”. From this relation it is clear that the author considers as information the probability, but not also its logarithm.

While the entropy decreases with the increasing of the system’s state of organization, the informational energy (ε) is increasing with the system’s state of organization from the value $\frac{1}{n}$ (when $p_1 = p_2 = \ldots = p_n$), a proper value for a completely disorganized system, to the value 1 (when $pk = 1$), a proper value of a fully organized system. The used unit of information measuring, $\varepsilon\left(\frac{1}{2},\frac{1}{2}\right)=\frac{1}{2}$ is named Onon.

As the informational energy is minimal when the value $\frac{1}{n}$ is considered, a new indicator of informational energy (ε') has been adopted, an indicator that allows the comparing of the degree of organization between systems that have different dimensions. The expression of this new indicator will be:

$$\varepsilon' = \frac{\sum_{k=1}^{n} p_k^2 - \frac{1}{n}}{1-\frac{1}{n}} = \frac{\varepsilon - \frac{1}{n}}{1-\frac{1}{n}},$$

The values set for this new function is [0;1], noting that the extremity "0" of this set corresponds to a state of maximum disorganization of the system, while the value 1 corresponds to the fully organized system.

The concept of informational energy that characterizes the degree of organization of a system is also the basis of a new mathematical discipline, named "informational statistics".

6. Transition, but with social progress

From the beginning of the human existence, changes have always occurred during transition from a social system to another. These changes have their origins in the man's will to have a better existence. Dobrotă *et al.* (1995), Boiangiu *et al.* (2009) stated that any economic or financial crisis changes more or less the social system and finally leads to its reorganization.

The changes had different durations, either short or long, with higher or lower costs and sacrifices, with happy or unhappy completions, which we have always named transition or crisis periods.

Teamwork, with common efforts and interests, always led to remarkable results that amazed the world, making the crisis or transition period easier, with lower costs and sacrifices.

7. Trend and tendency in the transition or crisis process

In the interest of lowering these entropies, which may take place only by eliminating the causes that produce them, first a theoretical analysis of how social evolution takes place is required.

In the analysis of social phenomena, when attempting a forecasting of their evolution, we are using a very large number of techniques and methods, which have certain specificity according to the application domain.

Ascending social development, characterized by dynamism and growing complexity, requires an increasing interest in improving the methodology regarding the social perspective, "exploring" the future, a systemic approach to social dynamics. This approach requires the analysis of the social indicators. As this analysis is based on the need to develop social prognosis, it is necessary to define two basic notions, which are precious tools in this process, namely: the trend and the tendency.

The trend represents the fundamental direction of the evolution of the studied variable (social forecast) which was resulted for a statistics series after the removal of accidental, seasonal and conjuncture oscillations of the considered series. It can be expressed in qualitative indicators.

As the trend is actually a mathematical function, $f : R \to R$, many models are available for its expression, specific to the evolution mode of the studied phenomenon. For exemplification, we write: $y'(t) = \frac{df(t)}{dt}$, the first derivative of function f. If an economic process is evolving in constant time t, which is rare, the situation usually expresses low entropy systems, thus well organized.

If the analyzed process runs with a constant speed, results: $y'(t) = a$. In this case the trend is given by the solution of this equation: $y(t) = a \; t + b$, a relation met in mechanics.

If the growth rate of the studied phenomenon is constant, then the trend is given by the solution of the following equation: $y(t) = k \; e^{\alpha t}$, where $\alpha = \frac{y'(t)}{y(t)}$, the evolution speed of the analyzed process is proportional in every moment t with the reached level.

7.1 Other models used in the forecast studies:

Prais model which leads to: $y(t) = \bar{y} \; e^{\frac{-\alpha}{t+\beta}}$; α and β are constant of the model, and $\bar{y}$ stands for the value of the function y(t) corresponding to the maximum level of phenomenon evolution (saturation level).

Bertalanffy's model which leads to the solution of a differential equation expressed by the relation: $y(t) = \bar{y} \; \left[1 - \beta \; e^{-\alpha t}\right]^{\gamma}$, where $\gamma = \frac{k}{\alpha \; \beta}$ and k is a constant depending by the growth rate of evolution.

If in the analyzed system there are highlighted growing processes whose speed varies inversely with time, for the study of trend the solution of the following equation can be used: $Y(t) = A \; \ln(\beta \; t + \gamma)$

For cases leading to involution phenomena the expression used is: $y(t) = \frac{k}{\alpha \; t + b}$, whose graphic is a hyperbola.

Aside from these, other models, like the polynomial,

$y(t) = a_0 t^n + a_1 t^{n-1} + ... + a_n$, or the logistical: $y(t) = \frac{\bar{y}}{1 + b \cdot e^{-\gamma t}}$ models can be used.

Trend and tendency, as concepts, are associated to a number of economic and social indicators. These indicators must fulfill the following requirements:

- A strong theoretical base which gives them the ability to explain the quantitative and qualitative mutations on the time scale, from the past, through the present to the future;
- To realize a systemic approach over the phenomenon, without removing it from the context and to analyze it independently of any influence of other elements of the considerate social system;
- To facilitate a mathematical modeling of the social system dynamics;

The social indicators will be developed as follows:

- to the level of global society as a super system;
- to the level of particular social systems (industrial, demographic, educational etc.), human groups (community, institution, family) – as a subsystem;
- to the level of dual relations between an individual and the social environment.

As the studied social system is also an opened cybernetic system, in order to optimize the relations between these social indicators, it is necessary to have in mind the following aspects:

- Retrospective analysis (to be able to highlight previous tendencies in the evolution of social indicators and the relation between them);
- Prospective research (to establish a relation between the past and the present);
- Identification of negative and positive phenomena in the evolution of social indicators;
- Forecasting the future evolution of social phenomena.

In developing a forecasting model, there are a few stages:

- Time evolution analysis of the studied social process;
- The developing of a mathematical model;
- Formulating predictions using the mathematical model with the gathered statistic data;
- Comparing statistic with predicted data;
- Taking proper corrective measures.

As social systems are dynamic systems depending on time (t), the study can be realized using forecasting simulation models because these models are intended to exploit the future.

Forecasting simulation models allow the evaluation of some endogenous variables depending on existing variables (exogenous).

7.2 Forecast Tree Method

This approach is similar to the method of decision tree used in managerial practice.

For a depth study of social phenomena this approach in not very convincing. Therefore, it uses proper mathematical tools that help in solving equations or differential equation systems.

For example, let us use the simplest differential equation model.

Assuming the variation speed of a variable is proportional to the average rate of stability X^* and to the current average rate $X(t)$, the differential equation is: $\frac{dX(t)}{dt} = a\left[X^* - X(t)\right]$, with the solution: $X(t) = X^* + (X_0 - X^*)e^{-at}$, where: $a(0;1)$ adjustment coefficient and X_0 stands for average base rate.

As $a = \ln\frac{X_0 - X^*}{X_m - X}$, let us consider X_m (previous average rate) equal to 10%, X_0=13% and X^* = 8%. In this case: $a = \ln\frac{13-8}{10-8} = \ln\frac{5}{2} \approx 0{,}91$.

It is required to calculate the forecasting for 5 years.

Replacing the value for a we obtain: $X(5) = 8 + (13-8)e^{-5\cdot 0{,}91} = 8 + 5\frac{1}{e^{4{,}55}} = 8 + 0.05 = 8.05\%$

We can conclude that forecasting simulation makes possible the reproduction of any process that has a known law of evolution.

The stages in applying the forecasting simulation method are:

- The development of **a** social system project;
- The development of the mathematical model of forecasting simulation;
- Insertion of this model in a computer;
- Simulation of some variants regarding the dynamics of the considerate social system;
- Analyzing the compatibility of studied variants with the future objectives of the studied social system;
- Basing on the gained data, the social forecasting is created, keeping under observation whether or not it expresses the characteristics of the real seeking model.

The forecasting studies are developed mostly on global models (applicable on the national economic system or its subsystems).

Global model has two particular models:

- Demand model of development, analyzing the allocation processes of resources based on the forecasted objectives of the system;
- Supply model of development, analyzing the possibility that the forecasted objectives can be fulfilled based on the existing external resources.

The subsystems of global system (human-demographic, economic, technological etc.) demand the existence of some interactive processes of mutual adaptation that create interdependence relations (feedback type relations).

In order to highlight these interdependencies, which have a decisive role in the organizational processes, processes that are capable help obtaining low entropy, the literature shows a number of organization models such as:

- Demographic-economic model that reveals the interdependence between demographic factors and economic;
- Techno-economic model that analyses the connections between technological development and economic growth;
- Techno-ecologic model that provides the ability to establish relationships of cause and effect in the social system considering two parameters: technological development and evolution of environmental factors.

Knowing and applying these models to the study of organization and development of social systems, provides strong premises for removing the causes that make possible the emergence of the five kinds of entropy.

Therefore, we observe that there is a real possibility to avoid the increasing of social entropy, which would have a devastating effect over the social stability. Simply reminding these models without knowing and applying them properly, can only lead to an even bigger instability in the social system, causing its self-destruction.

7.3 Stochastic approach

In social sciences, uncertainty is considered one of the main characteristic of the dynamic system. The dynamic system could be an economic or social system. In order to model uncertainty of transition or crisis process, from the probability theory point of view, the stochastic process theory represents a tractable mathematical tool.

Following the Wiener's (1923) definition of the Brownian motion, Itô (1944) proposed a larger class of stochastic processes: $dX_t = f(X,t)dt + g(X,t)dB_t$, where $f(X,t)$ is the drift of the process and $g(X,t)$ is its diffusion. B_t is the Brownian motion.

In finance, Black-Scholes (1973) used a geometric Brownian motion in order to model the assets price dynamic: $dX_t = \mu X_t dt + \sigma X_t dB_t$, where μ and σ are constants. Using this stochastic differential equation in order to explain the dynamic of the economic variable, the future value of the variable has a log-normal distribution with the mean $X_0 e^{\mu t}$ and the variance $X_0^2 e^{2\mu t}\left(e^{\sigma^2 t} - 1\right)$.

Consequently, with a higher probability, a confidence interval can be obtained in order to explain the forecast values of the economic or social variables.

Vasicek (1977) used an Ornstein-Uhlenbeck process with the constant parameters k, X^* and σ: $dX_t = a\left(X^* - X_t\right)dt + \sigma dB_t$.

According to this stochastic process, the variable has a normal distribution with the mean $X^* + \left(X_0 - X^*\right)e^{-at}$ and the variance $\frac{\sigma^2}{2a}\left(1 - e^{-2at}\right)$.

In order to explain the departure from normality of the economic or social variables in transition or crisis periods, some authors, such as Merton (1976), Bakshi *et al.* (1997) proposed the stochastic processes with jumps. The dynamic of the variable is described by the following stochastic process:

$dX_t = \mu X_t dt + \sigma X_t dB_t + X_t^- J_t dY_t$, where Y_t is a Poisson process (Y_t - Y_0 is Poisson distributed with the intensity λ). X_t^- is the value of the variable just before that jump happens. J_t is the amplitude of the jumps. If J is constant, the variable is described by a stochastic process with pure jumps. If J is a random variable, the several choices can be taken into consideration. The most used processes in literature are those when the variable is described by a stochastic process with log-normal or Pareto jumps.

8. Characteristics of the transition or crisis period

So far we have made a series of theoretical considerations regarding the consequences that may occur by neglecting the favorable aspects for increasing the social entropy and the destabilization of the social system.

Now we need to concentrate on the characteristics of the transition period, highlighting the options expressed by a number of specialists regarding the decreasing of its duration and lowering its costs. The achievement of these goals will quickly establish the normality inside the social system and will help in the development of social order.

Referring to the transition period, Popescu et al. (1995) stated that under the scientific, historical, economic, social-politic and psychological aspect, the assertion of the principles and main laws of economic reform in the transition period is a long process, in which the political authority must permanently attend to create a healthy and legal political environment that is necessary in order to properly organize the competitive market, ensuring the population that the taken measures are right and make the people believe in them, highlighting the mutual efforts submitted by any member of the society.

9. Conclusions

All over the world, the main direction of political and economic structures is defined by the efforts made in order to increase the standard of living, which is actually primordial for the entire human society's evolution.

The problem that rises is to identify all the possibilities that can ease the perfect development of economy without involving the alteration of natural environment.

During the Conference from Stockholm in 1972 and the Conference of United Nations from Rio de Janeiro in 1992 the durable development of society was described as a reconciliation between economy and natural environment in a new evolving direction which is to support human progress all over the planet for a very long time.

This was a result of many protests led by ecological organizations about the activity of many companies that, in the urge to increase their profits as fast as possible, exploit natural resources in an irrational mode, knowing that these resources are exhaustible.

Herman Daly said: "there is something fundamentally wrong in treating the Earth as if it were a business in liquidation."

The criteria of efficiency and effectiveness are needed according to the new direction in social development.

Efficiency represents the ratio of effectiveness and cost, similar to yield in physics.

Effectiveness, in the case of social systems, can be seen as the rate of satisfying their constitutive functional demand.

A social system may have the maximum efficiency if it completely satisfies its functional demand.

A difficult problem stands in expressing the system of priorities. This is a problem generated by the characteristics of the relations between functional demands of an organized social system.

To measure the effectiveness of a system:

- first, the functional demands are identified and their priority is established;
- the existent opportunities are specified; then the degree of contribution of each possibility to satisfy one functional demand or another must be quantified.

Social entropy represents a great danger to the development of human society. It is a phenomenon that has to be kept under control, or else it could lead to catastrophic results. Natural resources should be exploited wisely and we should never forget that many of them are non-regenerative. The performance of a stable social system depends entirely on people. This is why it is required to highlight what the attitude of the decision factors regarding to people and to transition should be. Specialists agree that the work satisfaction is a positive factor in reaching high performance in the working area and neglecting this aspect might lead to economic decline. It only depends on us to try to avoid the apparition of such dangerous phenomena and we must continue our research and always find new methods in order to be able to eradicate them.

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