

Modelling of Informational Counteraction Between Objects In Economy



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ABSTRACT--- *The article explores several aspects of the possible existence of informational actions and counteractions in the field of economy. The analysis of similar processes has been made utilizing structure-functional and structure-dynamic modelling. The basic models that allow revealing the essence of the phenomena under analysis are the systems of differential equations that are congruent with the constructions, which have used in the traditional dynamic system. The combination of contextual and subsidiary DFD-diagrams, developed following the technology SADT, allows understanding the functional logic of performed actions. The experimental part of the research had based on the use of imitation platform Analogic and the real statistic data that testified to the dynamic marketing behaviour of a range of business entities. These entities promoted their products in the market using information-communication technologies. The scholars of the study integrated structure-functional and structure-dynamic patterns of informational actions and counteractions in the field of the economy that have successfully tested. The results of modelling possess a high level of compatibility with the empirical data. It provides adequate prediction and assessment of the possibility of implementing various scenarios of events, and, consequently, in economy management.*

Keywords: *Economy Management, Informational Action and Counteraction, Imitation Modeling, Dynamic System, Use of SADT Technology for Structure-Functional Modeling of Economic Processes.*

I. INTRODUCTION

Modelling is the basic complex systems application in the economy.

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Also conceivable methods related to the appearance of data affects (II) and information counteractions (IC), permits predicting the behaviour of subjects and objects of methods in a significant information environment. Besides, it contributes to a conceivable estimate of the potential negative or positive outcomes of the implementation of such results.

Under the aggressive data setting, It will understand the presence of components that not only do not add to the formation of some result due to the exchange of information and its processing (passive counteraction) but also purposefully acting to provide some alternative.

In the present technological society, aggressive age in the economic field most successfully is actualised using the sources of data and telecommunication technologies. Considerably often the views regarding goods or service are produced through the application of attentively mapped data impacts on specific consumers societies who are participants of several societies channels, subscribers of several mailings, users of Internet blogs. At the same time, due to the circulation of the sum of data, a confident, positive thought to the advertisement of goods in that way can be created, as well as negative (anti-advertising, hypothetically advertising and speaking). Besides, in the scientific literature are also presented several Internet tacts to nullify negative messages influences, called the messages countermeasures.

The preceding grant to state that the modelling, forecasting and assessment of data influences on social crowds, to realize aggressive strain in the economy and the organization of a relevant messages counteraction is real management assignments.

II. DEGREE OF PROBLEM DEVELOPMENT

The researchers proposed and tested several types of models of messages impacts on various social groups that allowed investigating the manners of the so-called messages "infection", depending on the influence level of several external and internal determinants: topological, regressive, probabilistic and others [1-5]. Some researchers, in their contribution, argue that the most effective, from practical utilisation, are simulation techniques of modelling knowledge influence on societies of intelligence carriers (both hybrid and natural). It ensures adequate forecasting and assessment of the possibility of implementing various scenarios for the development of events, and, consequently, management in the field of the economy [5-7].

In due time, the researcher of this paper also synthesized similar type models. These models have applied in several industries (digital economy, computer networks, education, and telecommunications) [6, 7]. A simulation in the above studies had based on a set of interrelated models of system dynamics that reflected the functioning of ramified, nonlinear dynamic structures [8].

The opinion of authors' views, effectiveness in achieving the goal, in this case, is decisive by the thoroughness of the structural-dynamic and structural-functional review of the totality of economic and information processes. It is crucial to authenticate the appearance and essence of the interrelations between single components and subsystems adequately, the unstable and stable state of the objects, the nature and guidelines of data manners, the functions and application has been performed, as well as to assess the necessary resources and identify constraints that may exist. The solution to such problems can be very successful if using the technology of SADT (structural-functional modelling) and identical software products.

III. THE OBJECTIVE OF THE RESEARCH AND ITS METHODOLOGY

The fundamental objective of this study is to investigate the processes of information counteraction (information action- IA and information counteraction - IC) in the field of economy and synthesis of a set of models of information operations implemented by the opposing sides.

It formulates several definitions that are directly correlated to the material, the goal of this scientific study, as well as the methodology that defines it. Network knowledge base action is a set of associated, objective base actions of information feature, brought out in multiple structural advanced data systems and computer tracks, through the implementation of "subject-object" and "object-object" touches and task-oriented assignments. In fact, to block, begin, refresh, and develop data mechanism in the technological, social spheres, technical and economic.

System dynamics has emerged in the result of progressions in the examination and configuration of complex management systems, computer modelling and computational methods. Its basic principles have developed by J. Forrester [8]. Besides, structural-functional modelling (SADT - structured analysis and design technique) is a composite of rules, methods and procedures, synthesis of functional models of various systems.

The SADT model represents the degree of operating methods of sub-system and systems, that is, the actions worked by them and the connections between these movements. For this objective, a particular system is synthesized, which is a visible form, showing these movements in the form of an analogous ranking. Assist for SADT has emerged from a regular graphical device to software that action based on knowledge of more general concepts of modelling. These tools can explain the semantics of the interlinked web of SADT picture and different designs, and to connect such an aggregation of knowledge and procedure with different technologies.

The researchers offer to provide solution of the management difficulties in the sphere of the market by applying a group of data affects and counter-actions, and a

unified strategy is to use two programs -system-dynamic and structural-functional modelling. Moreover, the outcomes of the application first component will discover the structure and content of the collection of activities within the framework of the second one.

IV. WE ARE MODELLING OF INFORMATION INFLUENCE AND REACTION; ON THE SPHERE OF THE ECONOMIC SYSTEM.

The high order of complexity of the simulated transform, the dynamics of the corresponding guideline, elements and structure predispose not only the existence of a large number of modelling purpose and the architecture of inter-dependent among them, but including the requirement to form a hierarchy order of models that explain objects, relationship, processes, performance and resources results. The connect between the above models, and their order of hierarchy is showed using a set of graphs.

For the designs system dynamics. The subsequent structural determinants are an essential feature. Levels have managed objects showed by variables whose values resemble the integral feature of the movement of the actual progress under attention; rate is the speed of actual progress originating from certain degree and entering into others, which determine the reciprocal changes in them; judgment roles are operational dependencies breathing in the system, as well as constants and auxiliary values. Phase variables (system levels) have shown by applying systems of differential equations [5].

It assumes that the problems as mentioned earlier of information actions modelling in the market are coinciding with the tasks of providing information security in computer networks. A synthesis of such models has previously implemented by several scientific teams in the United States, China, Korea and other countries, but they require a conceptual and methodological filtration [1-4].

The primary node of the picture showing the hierarchy order of data models – is the fundamental economic system-dynamic model of SY (S is the number of objects of data influence, and Y is their number of positively responding to it). Besides SYR, SLY and SLYR models have developed. It contains other states (R is the number of objects that neglect the forced behaviour, L is their number in the latent step). As well as models that indicate the dynamics of the size of a objects group influence (the presence of the symbol "O" in the abbreviation), and overlooking objects after some time, behaviour forced to them and turning them to the primary set of prone II (the symbol "S" in the abbreviation). Explanation of the above picture has given in the publication [5].

It represents the primary system-dynamic model in the form of the following equations system (1). In turn, the development of the system-dynamic model of IC has connected with the IA models for objects groups. It has assumed that two alternative ideas have simultaneously disseminated in the information environment.

$$\left\{ \begin{aligned} \frac{dS}{dt} &= OS(t) + YS(t) - SL(t) \\ \frac{dY}{dt} &= SL(t) - LY(t) \\ \frac{dR}{dt} &= LY(t) - YR(t) - YS(t) \\ OS(t) &= o \cdot S(t) \\ SL(t) &= b \cdot S(t) + \frac{a \cdot T \cdot S(t) \cdot Y(t)}{S(t) + Y(t) + L(t) + R(t)} \\ YR(t) &= c \cdot Y(t) \\ LY(t) &= \frac{L(t)}{f} \\ YS(t) &= g \cdot Y(t) \\ a &= p \cdot k_0 \cdot n \\ b &= M \cdot k_1 \cdot k_2 \end{aligned} \right.$$

(1)

S and L are the numbers of objects affected by IA in the latent stage. Y and R number of aims that accepted the idea of the IA. Also, those that refused to accept it. OS is the number of objects of the type S. YS tempo of a shift in the number of aims that accepted the idea of IA. SL, LY, YR are tempos of change of the number of objects that are attacked by IA. Including types L and R accordingly. o, g, c and b speed of increase in the number of objects of IA. "Forgetting" the idea, immunization and acceptance of the idea of IA in the cause of influence. f latent period. Speed of recognition of the idea of IA in "object-object" contact. p is the possibility of communication. About the algorithm that has forced in the process of IA. k₀ – the possibility of recognition of the idea if IA during a single-case contact of the objects. n – relation of the number of communications of the object that made a decision in the cause of realization of IA to the general number of contacts; M – index of «mass character» of IA; k₁ – correlation of the number of objects under the impact of a single-case IA to their general quantity; k₂ – the probability of success of IA.

Each of these designs can be of two types. The first type reflects the situation when an object that has accepted a negative idea of IA cannot change the behavioural algorithm and go to the set of aims that have allowed a real idea and vice versa. In presence, the only hope blows information and transition of an object that accepted positive or negative information impact on the real set. Models of the second type - modification of models of the first type and indicate the immediate transformation of the target that selected the negative idea of IA into a set that admitted the definite idea of IC and vice versa.

It represents the complicated system-dynamic model in the form of the following system of equations.

$$\dot{q} = f(q, \varepsilon)$$

(2)

Where $\dot{q} = \frac{dq}{dt}$;

t is time; $q = \text{colon}(q_1, q_2, q_3)$
 $f = \text{colon}(f_1, f_2, f_3)$ $\varepsilon = \begin{pmatrix} \varepsilon_{11} & \varepsilon_{12} & \varepsilon_{13} \\ \varepsilon_{21} & \varepsilon_{22} & \varepsilon_{23} \\ \varepsilon_{31} & \varepsilon_{32} & \varepsilon_{33} \end{pmatrix}$ are II

guideline;

q₁ is the total number of aims subject to information effect (and counteraction); q₂ is the number of aims that admitted the service (goods); q₃ - is the number of objects that rejected services (goods); f_i(q, ε) = ε_{i1}q₁ + ε_{i2}q₂ + ε_{i3}q₃. Values ε_{ij} characterize all possible guideline of data influences and counteractions, given in Figures 1 to 4. These include the propagation speeds of competing influences; the speed of decision-making by II aims (order accomplishment or rejection from it); corresponding pulses of refusal and order; the range of the latent period; the possibility of developing a positive (negative) message. Generally speaking, the guidelines can depend on the time determinants, but here It considers them constant. It should also have noted that in the system (1) inherently, there is a value q₄ = q₁ - q₂ - q₃ characterizing the number of II.

A qualitative analysis of the system of differential equations (2) makes it possible to isolate such values of the guideline ε_{ij}, under which its solutions will be minimized in a variable q₃ and, simultaneously, maximized in a variable q₂. So, when performing ε₂₂ · ε₃₁ = ε₂₁ · ε₃₂ (ε₁₂ · ε₃₁ - ε₁₁ · ε₃₂) · ε₂₁ · ε₃₂ / ε₂₂ > 0 and observing the "ideal" case, when q₃ ≡ 0 q₂ ≡ c₁ > 0 q₁ = c₂ · exp(((ε₁₂ · ε₃₁ - ε₁₁ · ε₃₂) · ε₂₁ · ε₃₂ / ε₂₂)t). Undervalues of ε_{ij} the guideline, close to "ideal", q₂(t) → c₂ with t → ∞, that is, solutions of system (1) remain stable concerning small perturbations, at least in part of the variables q₂ (see Figure 1).

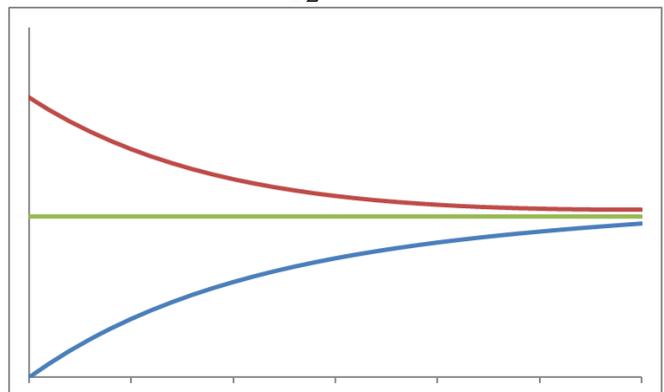


Figure 1. Stable trajectories of the system (2)

For the real application of this type of system-dynamic models, as a rule, a statistical method is used in the distribution of several data affects social channels, as well as questionnaire information in groups of such channels. The manner of simulation is moved out on the stage Analogic or alike [10].

It uses the devices of the CA ER win Manner Modeler for the SADT technology to synthesize structural and functional models for the application of data changes and counteraction processes in the market. To clarify the circumstances; it has estimated that there are two competing product market players, each of which "promotes" its goods and service on the market, bringing out data influences on a specific intellect social group. Simultaneously, an information counteraction to the competitive idea has formed.

The DFD diagram of the Information; Impact on a specific group of objects (one of the groups of a particular social group) as shown in Figure 2.

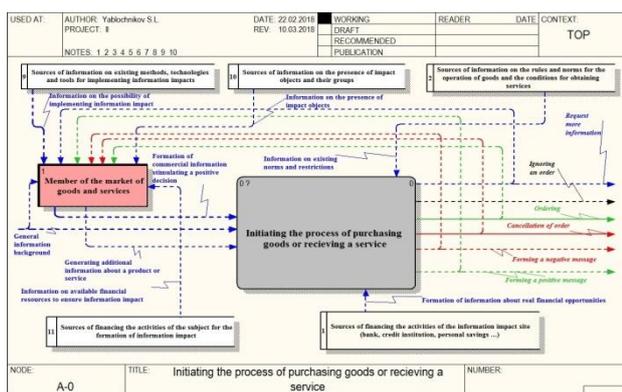


Fig. 2. The picture of the implementation of II on a group of objects

In this figure, a product market member is performed, starting, due to data impact, the manners of obtaining specific products or hosting services. Selecting the object public and the tool of controlling it, he turns to references of data on accessible techniques, technologies and centres of applying II, as well as on the availability of necessary II amenities and their combinations. In doing so, it evaluates its capacities and means to perform these results, obtaining data from appropriate references.

In shift, the very manner of stimulating the movement of market partners, initialized by this problem, can have different results: the formulation of an application and the arrival of products or services; opposition to direction; overlooking the offer. Besides, articles "infected" due to II package themselves suit references of initialization of II for another purpose, growing unless positive or negative communications. II task, the manner of creating a relevant judgment, uses origins of data on the laws and standards for the action and the method of working of these products and services, as well as on open finances and various reimbursement systems for goods and services. Besides, it is reasonable to ask supplementary data from a business existence.

Fig. 3 shows the disintegration of the primary manner (Fig. 2) as an heirss DFD picture. First of all, the data task, which, in a particular style, has designated to the general data experience, should be performed in a particular way to

the purpose of magnetism. They should please him, to go to the decision-making phase, or slightest to perform some investigation. (Evaluating the competing conditions). At this step, It concentrates on three primary manners: the selection of a favourable preparatory decision; denial of a business project and understanding of the complete data without additional procedure (latent stage).

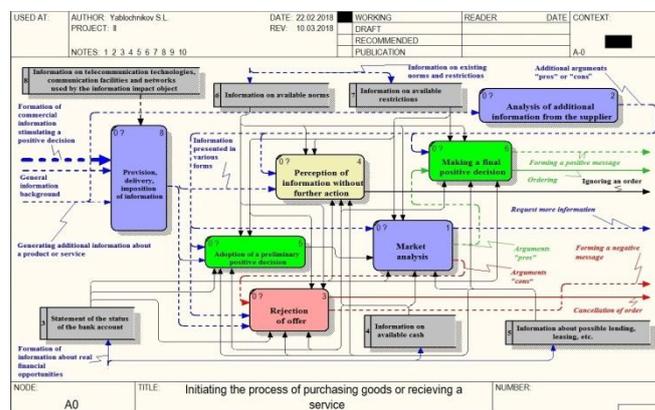


Fig. 3 DFD-diagram of stimulating the purchase of products or services

In the first reference, the task of data effects starts to examine the business thoroughly, while comparing accessible monetary support (cash and non-cash reserves, the probability of lending or additional means of funds for products and services, for example, publicity, rebates, rewards) and a collection of features, data, concerning which he inquiries from the subject building the II. Data concerning prevailing values and limitations, the forms of action and preservation granted by the subjects of the product market, as well as the class of assistance has also carried into account. Had used the last favourable decision, the II article not only can put a request, spending for it but begins circulating convinced data (messages) in social channels, adding to the avalanche-like increase of data influence on another object.

In case of rejection of the business proposal, the II facility cannot only correctly assign such a rejection, but also begin propagating adverse information (negative message) amongst the participants of some associations of social channels about the reaction to the goods and consumer assistance formed by it, thus, basically, carrying out components of data encounter. Overlooking II promotes the shift to the so-called passive stage, however, overtime period, it is probably the change to unless the beginning phase or the selection of one of the types of resolutions (negative or positive).

Figure 4 shows the initial DFD diagram revealing the data encounter between two rival participants in the business for products and services. The processes of evaluation understanding, estimating data by data outcome purposes, in this reference, are significantly larger complicated. Therefore, the number of consequences of the implementation of these manners also turns.



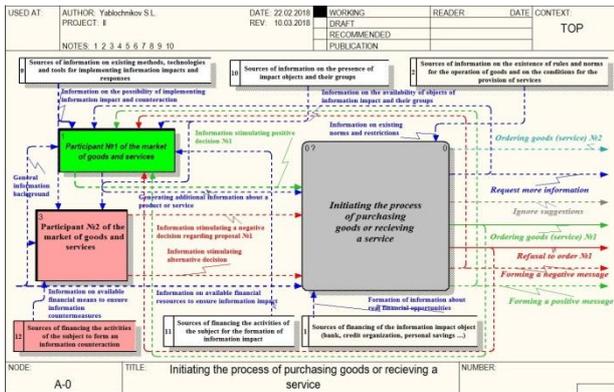


Fig. 4. Information dispute among two business players entities

In this reference, there are two potential situations for performing an influence on objects. The first one presupposes good rival(s) of the subjects; feel only within the utilisation of II with data on the concrete features of the products and services given, as well as on individual proposals, gifts, warranty, rebates, preferential terms and post-warranty assistance. The second relates to the messages of one of the cases (or both), bearing overt or tacit anti-advertising of opponents' proposals.

A subsidiary DFD picture of the implementation of data encounter manners in the business of products and services has shown in Fig. 5.

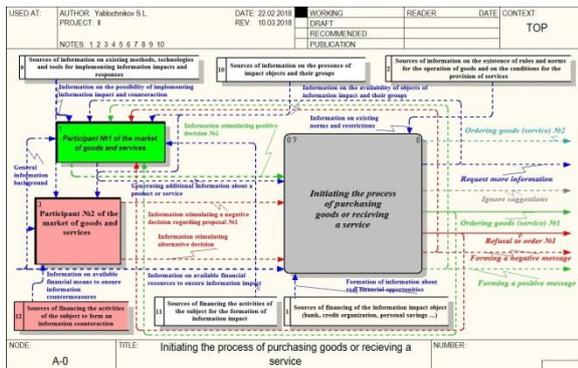


Fig. 5. Implementation of data counteraction manners in the business of products and services

In this reference, the purpose of data impression regards and examines actual data about both given products and services. At the identical time, he is being forced adverse message by one of the subjects of game. All this suits the base for exploring all the reasoning "pros" and "cons", regarding possible references and conditions. Here, for any generalisation of the condition, it is taken that only the second participant of the market uses the factors of data prevention, and the first conducts an "honest" game, notifying the II objects only about the real features of its products (services).

Subjects of the business, building II on task, legally or not quite illegally from few references get a report about the communication facilities, telecommunications technologies, services, computer channels used by the objects of weight. This necessary data, as a control, is actively selected in the globally by Internet, bringing out a contextual investigation,

or by observing the appropriate activity of possible customers of products and services.

V. THE PRACTICAL APPLICABILITY OF THE ADVANCED STRUCTURAL-FUNCTIONAL MODELS

These principles should be used concerning research, work to create some manners regarding improvement from telecommunications products, including assistance in this market and to maintain the structure of each similar demand. Application of simulation on the Analogic principles is performed using statistical data on the possible actions of real economic realities "Nittelekom Ltd" and "Solyaris-service" (Ukraine). The original statistical score was used in experiments to imitate the distribution of IC from seven several users separately, as well as concurrently from several nodes of actual social channels. Depending on the typological feature of social groups, appropriate IA models have compiled. The fitness of models, their correction and optimization (if required), processing of the outcomes of simulation trials have checked. For the practical application of system-dynamic models, statistical data have used on the expansion of IA in social channels, as well as questionnaire data in social gatherings. The obtained conclusions, first of all, made it reasonable to conclude the significance of using the technology of structural-functional modelling as a first step in the development of a hierarchical system of dynamic models in the form of a collection of differential equations (2) that are inter-related and jointly conditioned. The authenticity of statistical conclusions was 0.95. Secondly, the outcomes of modelling allowed optimizing the movement of economic entities in the circle of promotion of products and services in a competing ecosystem.

VI. CONCLUSIONS

The authors formed several tools, including mathematical and structural-functional models that analyze and predict the processes of implementation of impacts and counteractions in an aggressive information environment. First, the forecast of dynamics of several objects that react positively to the impact is essential. It allows synthesizing managerial decisions on the formation of practical tools to neutralize adverse influences on the full set of objects and their gatherings. Restrictions on the implementation of this activity are the real structure of the complex of factors affecting information processes, as well as their dynamics.

To solve such Issues and manage similar manners. It is necessary to implement the system- dynamic and structural-functional modelling. In turn, the software of modern simulation principles permits analyzing in detail various situations, visually understand the outcomes of simulation, and conduct simulation experiments. The centres of structural and functional modelling are valid at the preparatory stages in the identification of objects, their possible states, realized functions and expected results.

The models of information action and counteraction,

synthesized by the authors, can be productively used to form the policy and tactics of data connection, crossing structures in the commercial field with purposes and their gatherings, and to build algorithms to prevent adverse informational influence.

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