V. I. CHIMSHIR

BASIC VALUE OF COMPLEX SYSTEMS

The nature of the basic value is investigated in the following article. Particular attention is paid to the value's development in the initial stages of the system's emergence. As a result of the research it was revealed that the basic value, as an indicator, allows to inspect the state of the system at various stages of its life cycle. The author analyzes the approaches to process research of the basic value formation of the scientists in technical and economic fields. Studies have shown that considering given problem through the prism of target management one can get organizational forms that have large production potential. At the same time the obtained forms have the property of combining technical and social systems being in a stable state. The basic value of such complex systems is to be based on its internal needs. The basic value of the socio-technical system was based on a certain state function the increment of which in any process performed by the system in a closed environment is equal to the sum of the effects on the system through resources leading it to the transition from the initial state to the final one. Determining the basic value a number of difficulties were also noted one of which is an increase of the error of the parameters defining the location of the system when it is at the stability limit. The basic value is investigated as the primary component of the new socio-technical system as well as the nature of the transition processes of the system in accordance to the use of internal and external resources. It is determined that internal and external resources determine the potential of the system and the possible dynamics of its development. One of the methods for measuring the basic value of the system is defined, in which the isolated system changes its state through resource exchange. One of the conclusions shows that the basic value does not depend on the choice of the previous state but depends on the resources that tranport it into this state.

Keywords: Core Value, Sociotechnical System, System's Condition, Transient Processes.

В. І. ЧИМШИР

БАЗОВА ЦІННІСТЬ СКЛАДНИХ СИСТЕМ

Досліджено природу базової цінності. Особливу увагу приділено розвитку цінності на початкових етапах зародження системи. В результаті дослідження було виявлено, що базова цінність, як показник дозволяє інспектувати стан системи на різних етапах її життєвого циклу. Проведено аналіз підходів дослідження процесів формування цінності вченими технічної і економічної спрямованості. Дослідження показали, що, розглядаючи поставлену проблему через призму цільового управління можна отримати організаційні форми, які мають великий виробничий потенціал. При цьому, отримані форми мають властивість об'єднання технічних і соціальних систем, які знаходяться в стійкому стані. Базова цінність таких складних систем формуватися на основі внутрішньої її потреби. В основу визначення базової цінності соціотехнічної системи була покладена функція стану, приріст якої в будь-якому процесі, за умовою здійснення системою цих процесів в замкнутому середовищі, дорівнює сумі впливів на систему за допомогою ресурсів, які ведуть її до переходу з початкового стану в кінцеве. Відзначено ряд труднощів визначення базової цінності, одна з яких це: підвищення похибки параметрів, які визначають місце розташування системи при її знаходженні на кордоні стійкості. Досліджено базову цінність як первинну складову нової соціотехнічної системи, а також характер перехідних процесів системи відповідно до використання внутрішніх і зовнішніх ресурсів. Визначено, що внутрішні і зовнішні ресурси визначають потенціал системи і можливу динаміку її розвитку. Визначено один із способів вимірювання базової цінності системи, при якому в ізольованій системі здійснюється зміна її стану за допомогою ресурсного обміну. Один з висновків показує, що базова цінність не залежить від вибору попереднього стану, а залежить від ресурсів, які переводять її в цей стан.

Ключові слова: базова цінність, соціотехнічна система, стан системи, перехідні процеси.

В. И. ЧИМШИР

БАЗОВАЯ ЦЕННОСТЬ СЛОЖНЫХ СИСТЕМ

Исследована природа базовой ценности. Особое внимание уделено развитию ценности на начальных этапах зарождения системы. В результате исследования было выявлено, что базовая ценность, как показатель позволяет инспектировать состояние системы на различных этапах ее жизненного цикла. Проведен анализ подходов исследования процессов формирования ценности учеными технической и экономической направленности. Исследования показали, что, рассматривая поставленную проблему через призму целевого управления можно получить организационные формы, обладающие большим производственным потенциалом. При этом, полученные формы обладают свойством объединения технических и социальных систем, находящиеся в устойчивом состоянии. Базовая ценность таких сложных систем формироваться на основе внутренней ее потребности. В основу определения базовой ценности социотехнической системы была положена некая функция состояния, приращение которой в любом процессе, совершаемом системой в замкнутой среде, равно сумме воздействий на систему посредствам ресурсов, ведущие ее к переходу из начального состояния в конечное. Отмечен ряд трудностей определения базовой ценности, одна из которых это: повышение погрешности параметров, определяющих местоположение системы при ее нахождении на границе устойчивости. Исследована базовая ценность как первичная составляющая новой социотехнической системы, а также характер переходных процессов системы в соответствии с использованием внутренних и внешних ресурсов. Определено, что внутренние и внешние ресурсы определяют потенциал системы и возможную динамику ее развития. Определен один из способов измерения базовой ценности системы, при котором в изолированной системе осуществляется изменение ее состояния посредством ресурсного обмена. Один из выводов показывает, что базовая ценность не зависит от выбора предыдущего состояния, а зависит от ресурсов, переводящих ее в это состояние.

Ключевые слова: базовая ценность, социотехническая система, состояние системы, переходные процессы.

Introduction. The Value Category gains newer positions as a unique instrument to determine significance of various systems for social groups in modern environment of social relations. In a number of cases, lack of terminological base, mathematical apparatus, and definitions prevent to apply a value as an instrument more widely.

The value represents a particular interest at initial stages of a system's generation. The value is placed into the basis of created system as a cornerstone and enables to

14

Вісник Національного технічного університету «ХПІ».
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assess the system's condition at various stages of its lifecycle.

The value's nature in a number of its appearances remains an unstudied phenomenon, demanding for wide-scale research.

At the moment of a system's genesis the value represents a sum of values of elements involved it its formation. Upon appearance of certain links describing a system with inherent properties the value may be referred to not as a summarized value of its elements, but as a value resulting from a certain synergetic effect of cooperation between system components with each other and with environment.

A system's cost component may be applied as an equivalent category in certain cases to gain a clearer understanding of reasoning associated with core value as a research subject.

For instance, once the matter concerns generation of a certain sociotechnical system encompassing n technical components and m social objects, the value of such system at a specified level of perception may be represented, at the first approximation as a total value of n technical systems and total contribution of m social objects required for the system's functioning.

It should be noted, that waiving away the value's cost equivalent is practically impossible. Practically, the value may be applied as an instrument describing the system's condition and its significance for social groups only with available appropriate mathematical apparatus enabling to transform the value into actual amount of monetary assets by means of cost equivalent.

Publications review. Recently, the value became a particularly active object of study not only by psychologists, but also by a wider circle of scientists in technology and economics. This fact is well grounded. As humanity achieved a sufficient level of progress accompanied with sufficient level of material welfare, decision making aspect arose to a principally newer level.As a rule, two opposing ways of an object's value formations may be observed. In the first case, a social group compares a multiple number of parameters, features and factors and elaborates a value of an object in the course of making a decision. Such a process takes a lot of time and is boring and accompanied with great difficulties. In another case, a social group correlates the said object to already available value and adopts an instant decision.However, itshouldbe noted, that, in a number of cases the formulated value has nothing to do with the object under consideration.

In the first case, actual position of a social group is clear and related with increased access level to information. The second case remained, on the one side, seldom until certain time and unstudied, on another side.

The publication [1] actually answers a large number of questions related with a social group behavior in the course of making a decision. Naturally, high degree of urgency and uniqueness brought a Nobel to its author. Really, the author described a number of processes connected with influence of social, cognitive and emotional factors produced on adoption of economic decisions by individuals and heads of institutions. In addition, the publication describes effects of such influence upon such market parameters, as price, profit and resources deployment. All these processes were united under a single term – behavior economics.

It should be noted, that core value is reviewed at the first time from the point of view of sociotechnical system as a subject of research. Therefore, available publications concerning core value should be considered in relations with problem in question.

The author of publication [2] is expressly confident that core value is inherent to an object, since it is based on the object's essence. Basing on his views a conclusion may be drawn that core value bases on internal resources independently from external environment's attitude to the system. Such an approach identifies a process of development, which originates mainly from inside and depends on core value quantity.

Compilation of articles referred as [3] reflects a different view on core value. To the authors' opinion, competition evolution in business associated with leaving mass marketing for individual marketing leads to transformation from standard value to generation of individual, unique core value by means of mass orientation towards a consumer.

Mr. Jean-Noel Kapferer, well known expert in brands management presented a modern model of strategic brands management as a core value of an organization in his work [5]. The author considers an essence of branding and entire complex of brands management as the most valuable asset of a corporation requiring strategic approach to management.

Schwarz' theory occupies a separate place in the galley of value theories [6]. This theory classifies value into ten essential features thus enabling to identify social groups. The theory is based on the concept that values form a circular structure, which describes a motivation driving a social group. Practical basis of the theory is represented by two essential methods, developed to measure main value indexes. The proposed methods may construe a basis for identification of monetary equivalent of a value.

A great number of works have been dedicated to problems of core value formation within social groups affected by inter-ages relations. The author of "Modern Social Analysis" [8] compilation of works identifies the reason of uneven core value formation. Senior generation has an inherent feature to fall behind the accelerating life speed. Therefore, humans tend to return to values of their youth as they grow elder. As a result, a sensitive misbalance occurs between values inherent to elder generations and altered objectives of a newer age.

Prof. G. V. Atamanchuk points out a fundamentality of so called social value, being actually a core value based on formation of development and existence principles of a social group in his course of lectures in public management theory [9].

Reviewing the stated problem in the light of target management it may be noted that humans are capable to invent organization forms with great productivity potential. As a rule, such forms aggregate technical and

social systems in stable condition. Core value of such complex systems will form, first of all, on their internal needs basis Kliland D., King U. (1974) [10].

Setting to discussions and review, certain results may be noted in work by such authors, as M. V. Dykha, N. P. Tanasiienko, and G. M. Kolisnyk [12]. This group of authors state that core value change dynamics lie in principles of investments and innovations activities activation. Works by the said authors review levels and dynamics of changes in core value of certain business entities in certain states, including Ukraine. They identified core value level of certain Ukrainian entities in comparison with appropriate entities of other states. After appropriate review conclusions were drawn indicating a critical part played by innovations in key factors of core value growth. Thus, the authors proposed a strategy of investments and innovative development of an organization. Along with the above, essential principles are formulated of efficient implementation for investment and innovation strategy and governmental investment and innovation policy to increase core value formation dynamics. Really, a combination of alterations in core value according to applicable innovations strategy and governmental investments policy leads to rapid increase of an organization's core value. These steps, certainly, lead to growing favorable attitude to a particular entity, contributes to its competitiveness and steady social, technical and economic progress.

The book [13] refers to solution of a problem how to structure a complicated situation affecting the core value indicators stability. Identifying criteria and other factors inherent to complicated situation the author comes to a conclusion that they are intangible and non-specific in their majority. Thus, it does not enable to measure interactions between objects in complicated situation applying simple techniques in a number of cases. The method proposed by the author enables to summarize entire data of such objects and interaction environment to obtain priorities. The obtained priority values, in their turn, may be applied to identify core value in the course of new projects development involving the interacting objects, which actually construes one of the most vital challenges for modern public and business entities.

Reviewing research work [14], we find a substantial work reviewing 393 publications issued from 2000 to 2014 in more than 120 reputable magazines. Multi-criteria decision-making method is an essential subject of the said work. We referred to results of this work, since, to our opinion, multi-criteria approach in decision-making is a complex tool to find solutions including both quantitative and quality factors affecting an organization's core value.

The author shows multiple other areas to apply multi-criteria decision making method, including power generation, environment protection and ecology, bioengineering, etc.

The research work [15] is, on the contrary to previously mentioned research more specialized and focused upon sociotechnical systems implementing projects in construction industry. Methods described in the research are oriented to select a number of criteria actually determining core value of a project as a product of activity

of an appropriate developing organization and are chosen from alternative ways to achieve particular aims. In this work the authors has as his aim to determine optimum combination of solutions for project managers in construction companies. The author offers to apply experts' evaluations supplemented with customers' weight factors to implement the proposed approach. Final stage consists in achieving a result applying the alternatives' evaluation methods.

Referring to research work [16] the problem in question may be reviewed from the theory of games point. According to a hypothesis of rational behavior applicable in the theory of games each of gamers initially possesses a certain core value. It should be noted here that, depending on a number of factors a certain part of a core value may reside in a delayed value area. Each of gamers strives, therefore, to choose a strategy, which enables to maximize his target function to change the core value positively. Should the number of gamers increase, the individual rational strategy gets more complicated and gets into stochastic strategy area. A set of such strategies causing balanced development of gamers' value may be called a "game solution" or a "temporary balance".

Thus, the author concentrates upon considering essential matters of record-keeping, risks evaluation in decision-making in conflicting and uncertain conditions, risks modeling and analysis, risk management basing on statistical solutions and theory of games.

Research purpose and objectives. The purpose of the proposed work lies in an attempt to develop an identification mechanism for a core value at the stage of complex system formation. Such a mechanism should enable to determine a quantity of resources required to optimize the system's development dynamics.

Achieving stated aim requires to find a solution of the problems, as enlisted below:

- Identification of core value nature and its behavior at the initial stages of the system's creation;
- Identification of core value change dynamics depending on usage of internal and external resources.

Core value identification mechanism. Core value definition is only associated with stable conditions of sociotechnical systems. In this view, it is supposed that system's initial and final conditions are identical at the moment of the system's condition fixation. However, processes, which transfer the system from one condition into another, and, consequently, intermediate conditions may be other than stable.

Suppose, a core value of sociotechnical system is represented by a condition function. Increment of such function in any process occurring in the system in enclosed environment is equal to a sum of effects produced upon the system by means of resources causing transition from an initial condition to a final condition.

Possibility to apply such a condition function bases on a provision, that effect produced upon a system in enclosed environment depends only on initial and final conditions of the system and does not depend on a

manner, in which the transition occurs. In other words, once it is possible to imagine a system's condition after wrapping its parameters number to two (K1 and K2), the transition from conditions S1, S2,.., Sn-1, to the Sn condition, if ever possible, will be uniquely determinable (Fig.1).
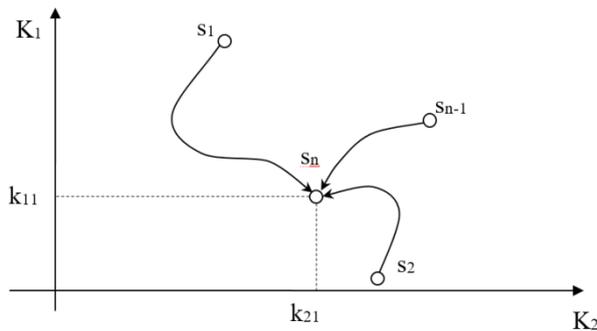

Fig. 1. System's transient conditions

The system's core value may both increase and decrease and effects may be both positive and negative. The proposed statement concerns external and internal resources. As a rule, the system's core value increases if external resources are spent to change its condition. If internal resources are spent on this purpose, the core value decreases, respectively (Fig. 2). Here a certain note should be made. If the matter concerns an enclosed cooperation system, where losses associated with transition processes may be ignored, the case a (Fig. 2) produces a positive dynamics of core value. Appropriately, as regards the case b the value remains unchanged, since here internal transformation of resources occurred into value being an integral component of the core value. Transformation illustrated with Fig. 2 fall into category of Quality Transformations.
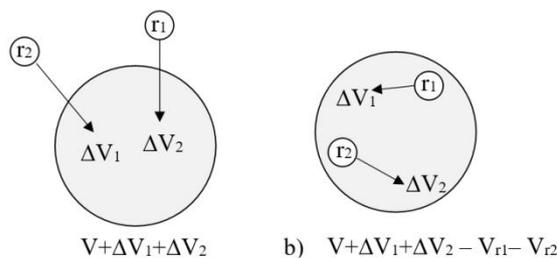

Fig. 2. System's core value change due to quality transformations

It should be noted that calculation of a system's transfer into desired condition is not always possible. In such cases reverse transfer may be reviewed to determine required resources. It means a review of a transition from desired condition into condition experienced by the system at the current moment.

As core value is being assessed a problem arises with precision, or inaccuracy of an obtained index. It is subject to a separate research and depends on parameters system laid in the basis of condition function. Such an approach to precision cannot affect actual contents of the drawn conclusions.

In a number of cases core value quantity is not so important. More attention should be put to value quantity which led to changes in the system's condition.

At the stage of determination of quantities of required resources the core value may be adopted as a zero point and, consequently it may be supposed, that a core value of the system being in this condition is equal to zero. Thus, the core value may be identified unambiguously for any other condition. On this basis a definition may be stated for a core value term.

System's core value in any stable condition may be expressed as a quantity of resources required to transfer the system from initial, or zero, condition into desired condition.

In case of impossibility of such a process in enclosed system, as it was stated above, a so-called reverse process may be applicable. The reverse process means a core value identification via resources quantity taken with opposite sign which are capable to return the system from desired condition into initial, or zero condition.

Besides, if more than one positions are taken for a zero condition of a system, the meaning of core value in a position, other than abovementioned will be the same, whatever distant are the said zero conditions (Fig. 1).

To check this statement, suppose that a sociotechnical system may reside in three random condition, two of which are zero conditions. The system's core value in a condition, other than zero conditions is known as well, as quantity of resources required for transition from two specified zero conditions. Since a system in enclosed environment is always capable to leave one random condition for another, three different cases may be marked (Fig. 3). Arrows show directions of possible transfers from one condition into another,

$$S_1 \rightarrow S_3,$$
$$S_1 \rightarrow S_2 \rightarrow S_3,$$
$$S_2 \rightarrow S_3.$$

Having displayed a system's condition in 2D coordinates K1 and K2 (Fig. 3), with K1 and K2 being the system's condition indexes expressed visa core value. Fig. 3 demonstrates that whatever the initial system's condition might be, its transfer into S3 condition, its condition is parametrically determined by (k13, k23) indexes.
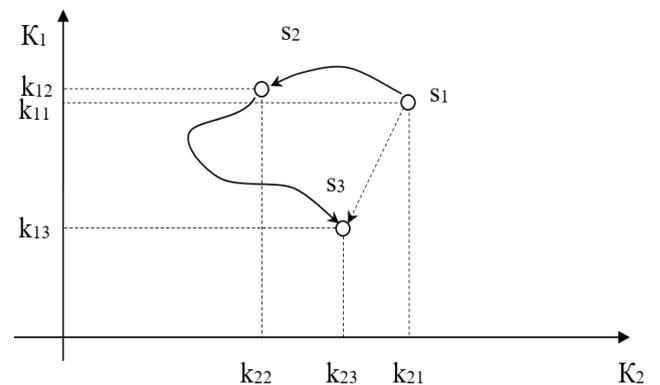

Fig. 3. System's transition from one condition into another.

Results of research. Thus, a conclusion may be drawn, that the core value depends not on preceding condition choice, but on resources required to transfer the

system into this condition. Isolated system are transferred from one condition into another by means of their internal resources.

A number of difficulties associated with core value identification should be marked. The first difficulty displays itself when system is in the stability border condition leading to increase in parameters' errors, identifying the system's location. This difficulty arises with minor transitions between conditions. Under such circumstances, it is rather hard to isolate a system to identify its initial, or zero condition. In such case it may be reasonable to apply a total value which includes three components, such as core value (1), outcoming value (2) and incoming value (3).

Such an approach to core value quantitative determination shows a principle of its measurement. In this case the system should be isolated and resources quantity should be assessed enabling to its transfer either into desirable condition, or backwards. Applying this technique a core value may be defined as a function of parameters describing its condition. As a result, each system's condition may be matched with a definite core value meaning.

Placing a problem of core value identification for all the system's condition, a tool for quantifying core value may be obtained for other systems, as well.

Actually, the instrument under review will represent an isolated system with mathematical model of core value identification.

Applying a scalability feature of sociotechnical systems [11], this model may be also applied for other systems, for which a core value should be determined.

Once theoretical grounds are developed and mathematical model is obtained for measurement of core value, another important problem arises to quote a monetary equivalent of the core value. The environment, technical system in the structure of sociotechnical system, system's scale, territorial location of the system and other inherent features effect the core value monetary equivalent presentation.

Thus, a conclusion may be drawn that the optimum way to measure a system's core value is a technique providing system's isolation and system's condition is altered by means of resources' exchange.

However, isolation of the system is not always possible. Furthermore, number of cases doesn't require application of controlled resource exchange to nominate the core value quantity.

For instance, with two cooperating sociotechnical systems even being in a partnership agreement, i. e. without resource exchange a system with lower value starts to derive value from a system with greater value index (V1>V3). Such a process is called a low-lever values exchange process (Fig. 4 a).

In addition, the system may increase its value due to independent processes running in external environment represented for the reviewed system as V2 value. They may be described as favorable events for the system which have not been included into initial plan of its development (Fig. 4. b).
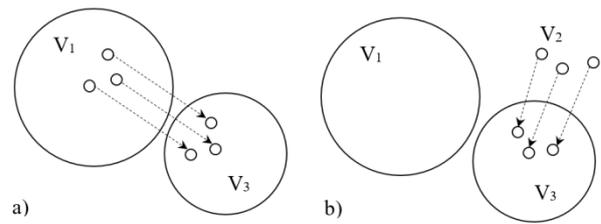

Fig. 4. Process of value accumulation
a) low-level process of values exchange;
б) value increase due to independent processes running in external environment.

Thus, the values exchange system existing between two cooperating systems may be described, as follows. Suppose, a certain sociotechnical system maintains a conditional contact with another system. The systems are segregated from external environment and yet maintain a contact via which a value is transferred. In a reviewed case such a value may be represented by a technology, a unique process, experience, knowledge, etc. Suppose, that a system with lower value index is capable to produce objects into external environment, for instance, due to value obtained from another system. Fig. 5 illustrates a scheme of transfer a value from a system with higher value index via a system with lower value index into external environment.
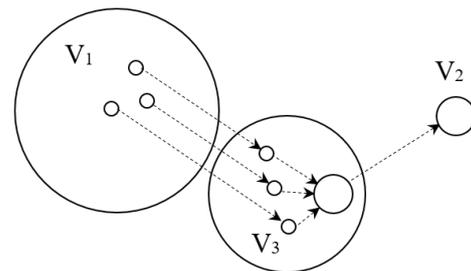

Fig. 5. Value transfer from system with higher value system to external environment via a system with lower value index

Results review. As it is the value index alteration that is of interest, it should be noted that core value alteration may be defined as a quantity of value transferred into external environment, provided that core value of the intermediate system remained unchanged.

Actually, the stated definition provides a mathematical formulation of the value transfer process. It states that a value obtained by a system is spent to alter its core value and to transfer the latter to external environment.

In view of such definition the core value should be judged from changes in a system with which the original system interacts rather than the system possessing the core value.

Conclusions. Research process enabled to identify that value as a condition indication of a complex sociotechnical system found its scientific application rather recently. Yet the urgency of this item increases as the time runs. Challenges the science faces at the initial stage is caused by complicated description of parameters

and processes, which may be applied as a basis for mathematical apparatus. This work makes an attempt to describe a core value as an initial component of a new system, its nature and the system's transient processes nature.

Availability of internal and external resources represents an important factor for the system development. They determine a system's potential and probable dynamics of its development. The work identifies a part played by external and internal resources in changes in the system's core value.

One of probable ways to assess system's core value is identified. This way provides isolation of the system with altering its condition by means of resources' exchange.

Many opinions represented in this work suggest a demand for further researches, which would enable to support drawn conclusions experimentally. Furthermore, the problem of finding a core value for all the system's condition remains unsolved as well. Finding a solution will enable to obtain an instrument for measuring core value for other systems.

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Відомості про авторів / Сведения об авторах / About the Authors

Чимшир Валентин Іванович (**Чимшир Валентин Иванович**, *Chimshir Valentin*) – доктор технічних наук, доцент, Національний університет «Одеська морська академія», директор дунайського інституту Ізмаїл, Україна; ORCID: https://orcid.org/0000-0003-3621-2702; e-mail: chimshir@ukr.net.