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LIFE CYCLE: FORMATION, STRUCTURE, MANAGEMENT[5]

The article aims to define the management mechanism of complex, open dynamic systems with human participation. The following parts of the system life-cycle were identified and unified in the theoretical scope: general and specific compositional elements of repeating changes, marginal index boundaries, the dynamics of the compositional elements of the life-cycle, the key points of the change in the character of the index dynamics. In the practical scope, two common trends of socio-economical system life-cycle management are considered. The first trend is the regulation of the comprising element ratio, which provides the increase in the duration of the maximally effective performance of a functioning system. The second trend is the regulation of the reproduction time of a new system. The systems life cycle aspects are investigated in almost all sciences and studied within many disciplines in the field of higher education. Therefore, deepening the mastery of scientific and methodological foundations of the life cycle of a complex open dynamic system is useful for any subject in everyday and practical activities. A human being – in the formation of own human capital. Families – when it is formed, the birth of children, the distribution of income and expenses. Companies – for efficient business activities. As well as local communities, local self-government bodies, public authorities and global entities within their profile activities. The results of the research provide the possibility of the development of applicable mechanisms for effectiveness and stability enhancement of managerial and entrepreneurial operation in business projects.
Keywords: life cycle; cyclicality; system; structure; management; human being
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1. Introduction

The "life cycle" term has become widespread in scientific and popular sources. For instance, as of 31.08.2019 the Google Chrome provided 1090000000 for the English term "Life-cycle", 120000000 for "Life-cycle", and 126000000 for "Life-cycle". At the same time, Google Academy for the term "Life-cycle" – 4670000, for "Life-cycle" 3810000, for "Life-cycle" – 660 000 references.

This category is used in almost all sciences in the 21st century and applies to a wide field of research. In higher education, the life cycle aspects (directly or indirectly as a factor of time) are also studied across many disciplines and are familiar to qualified university graduates who apply them into further professional activities, subjects, objects, and more. Therefore, the life cycle formation, its structure identification and the development of management measures, are very important issues that are of scientific interest in the past and are relevant now in the theory and practice of social development.

Understanding the scientific and methodological foundations of the life cycle is useful for any entity in own household and practical activities. A human being – In the formation of own human capital (health support, training and advanced training, organization of social and work careers, doing business). Families – when it is formed, the birth of children, the distribution of income and expenses. Companies – for efficient business activities (designing new and developing existing businesses, types of activities, goods). As well as local communities, local self-government bodies, public authorities and global entities within their profile activities.

2. Analysis of Recent Publications Studies

The idea of the recurrence and reversibility of society has set its origins in ancient Chinese and ancient philosophy. The thesis of programmed cyclicality is confirmed by the Christian religion, which states that the world and mankind are created, will develop for some time and cease to exist. These issues gradually began to be addressed by scholars in: theories of the cycle in the history of Vico (cited in Helfat, Peteraf, 2003); theories of life cycles of cultural organisms by Spengler (1923) (cited in Spengler, 2017); concepts of the cycle of local civilizations (which came to light in 1947 and reprinted in 1987) Toynbee (1987); the theory of "challenges" and "answers", social and cultural cycles of the main types change of cultures in P. Sorokin's dynamic model; the cyclical concept of "ethnogenesis" by Gumilev (1993); cycles of American history Schlesinger (1986), etc.

Thus, from the beginning of the 19th century (from the first economic crisis of 1825), the theories of economic cycles appear in scientific thought – the concepts of different directions, currents and schools of political economy regarding the cyclicality of production and the mechanism of cyclical instability, which determined the causes of cyclical patterns: V.-C. Jevons (accounting for solar activity cycles that cause fluctuations in agricultural productivity and cyclicality of industrial production); G. Moore (determined the rhythm influence of the Venus movement); J.-B. Say (argued that the supply generates its own demand and that crises in the whole economy are impossible; as they can only occur in certain regions or in

individual markets of goods); T. Malthus (noted that the demand tends to keep up with supply); D. Ricardo (explained the crises being of injustice in the distribution of wealth); S. Sismondi (noted the mismatch between production and consumption); K. Marx (noted the reasons for the average 7-11 years of economic cycles in the contradiction between social nature of capitalist production and private-capitalist appropriation of its results, and the material basis of cyclicality – the massive renewal of fixed capital); E. Tugan-Baranovsky (saw the causes of crises in the disparities between movement of savings and investment in industries producing means of production and in particular the accumulation of fixed capital); G. Kassel (noted the contextual nature of the material culture progress); A. Aftalion (explained the duration cyclical nature of the construction and commissioning period of fixed assets, specifics of interaction between accumulation of fixed capital and production of consumer goods); J. Schumpeter (linked the cycle of capitalist production with the uneven nature of scientific and technological progress (STP) and peculiarities of development of fixed capital); I. Fisher (saw the cause of cycles and crises in disrupting the relationship between demand for money and its supply); M. Kondratiev (noted the qualitative changes of basic generations of engineering and technology, vehicles, large structures, etc.); J. Keynes (noted the psychology role of consumption and income); R. Harrod, P. Samuelson and E. Hansen (explained economic cycles by process of interaction between national income movement, consumption and accumulation of capital, in particular, the effects of changes in effective demand, which depends primarily on dynamics of consumption and investment); Friedman (1977) – saw the main reason for the production cyclicality in instability of the money supply caused by state intervention in the economy.

Among the scientists who have most thoroughly investigated aspects of the systems' life cycle, it is necessary to note the following authors.

At the beginning of the 19th century, William Herschel suggested that there is a relationship between sunspot cycles and weather, which affects the price of the crop and, ultimately, the economy as a whole (cited in Schwager, 1995). Since that time, many scientists have dealt with cyclical issues in the economy, and a large number of scientific papers have been devoted to this problem. For instance, in the twenties of the 20th century, Kondratyev determined that in the long-term dynamics of some economic indicators, there is a certain cyclical nature, when the growth phases of corresponding indicators are replaced by phases of their relative decline with a characteristic period of fluctuations of about 50 years.

Greyner (2002) in the seventieth of the 20th century, was one of the first founders of the life cycle model and development of the organization. It notes that the organization in its development goes through five evolutionary stages, which succeed each other as a result of specific crises (crisis of leadership, crisis of autonomy, crisis of control, crisis of prohibitions, new crisis), leading to revolutionary transformations.

Developing the ideas of Greyner (2002), Adizes (2003) presented the cyclical development of the organization in ten successive stages: nursing, infancy, 'come on', youth, prosperity, stability, aristocracy, early bureaucratization, bureaucratization and death.

Daft, Murphy and Willmott (2010) identify four enlarged stages of enterprise development (entrepreneurship, teamwork, formalization, development of group work).

Miller and Friesen (1984) proposed a model, where five stages of organization of development are distinguished: birth, development, maturity, flowering, decline.

Shnejder, Kacman and Topchishvili (2002) drew up the "Methodology for Feasibility Studios", as well as the "Quantum-Economic Analysis", which is mainly based on the use of the relationship between the life cycle of the product, enterprise and market.

Thorough collective publications are published on this issue. For example, in 2018, Springer published a collective monograph (Hauschild, Rosenbaum, Olsen, 2018), which highlights the historical, theoretical and applied aspects of the LCA methodology and its wide range of applications. Also, the Springer Berlin Heidelberg publishing house since 1996 publishes the scientific journal The International Journal of Life Cycle Assessment (online) (n.d.), which by target publication publishes the results of modern studies of sustainable cyclic laws in environmental, economic, environmental engineering, biotechnology, environmental chemistry. Targeted publications of scientists reveal the aspects of modelling and metrics in life cycle sustainability assessment (Wood, Hertwich, 2012).

Life-cycle aspects and leading international organizations are also being studied. For instance, in 2005, UNEP published Life Cycle Approaches (2005), which looked at theoretical and practical solutions to global development issues and individual challenges, considering cyclical patterns of social development at this stage of human technological development.

3. Unresolved Issues That Are Part of the Overall Problem

The complexity of this area of fundamental and applied research lies in the magnitude and multidimensionality of the problem and it can be argued that the science is developed, gradually harmonized and introduced into the scientific circulation and educational process only by a few aspects of life. The vast majority of research is concerned with describing only specific entities, first of all, product, company, market, where the formalized clear components of change and their correlation are distinguished (Shnejder, Kacman, Topchishvili, 2002). However, there is no unified classification of cyclic laws of multi-level systems, the number of constituent elements and their names in the sources differ and are given according to the context by managerial levels and situational characteristics (Afonin, Bandurka, Martynov, 2008; Farr, 2011; Sokolov, Devezas, Rumyantseva, 2017). This fact necessitates the continuation of scientific research in the conceptualization of methodological aspects of the life cycle of complex open dynamic systems.

The paper purpose is to identify and unification the system components of the life cycle for the sake of rational formation, structuring and management.

4. Methodology and Methods

The research uses the author's methodology, which:

- examines the multi-level cyclical patterns, identifies problematic and discussion issues and identifies systemic features of cyclicality;
- investigates peculiarities of complex open dynamic multi-level systems, an element of which a human being appears;
- applies systematic approach, methods of analysis, synthesis, analogies, observation, comparison, abstraction, grouping, generalization, modelling;
- uses principles of scientificity, objectivity, rationality, economy, balance, sustainability, purposefulness, complexity, planarity, information security, creativity, priority, multivariate, efficiency, structured, harmonized, manageable, secure, dynamic, collectivity;
- system life cycle structure is conceptualized and visualized;
- the directions of system life cycle management are considered by regulating the ratio of system components and the creation time of the new system.

5. Analysis and Results

In the scientific literature, the study of scientific and methodological aspects of "Life cycle" occurs mainly within the framework of a systematic approach, when based on the existing cyclical regularities, the temporal aspects of system development are considered.

The origins of understanding cyclic regularities have developed in ancient times and become an archetype constructed as a result of observing the properties of the material world. For instance, in the natural dimension, it is the change of season: winter, spring, summer, autumn, etc., caused by the rotation of the Earth around the Sun; these are daily changes: night, morning, day, evening, etc., caused by the rotation of the Earth around its axis; is the transition of substances from one state to another: liquid, solid, vapour, plasma, etc. under the influence of changes in temperature. In the biological dimension for animals and plants, it is the set of development phases of a living organism, which gives birth to a new generation while passing them. In living beings, the life cycle is regarded as ontogeny – a set of successive changes from the organism's moment of birth to the end of life. For humans, ontogeny involves the phases of: fertilization, embryonic, post-embryonic, and adult organisms. The ontogeny of plants distinguishes growth, development and ageing. The stages of the social cycle are revolution, involution, co-evolution and evolution. The economy considers economic cycles as the movement of production from one crisis to the next according to the phase of the economic cycle, the main of which are: crisis, depression, recovery, exaltation; or, according to other approaches, determine peak, bottom, bust or recession.

The systems' formation idea dates back to antiquity, in the mid-1920s, the term "system" became one of the key philosophical and methodological and scientific concepts, and in the late 1960s – early 1970s, began to use the term "systematic approach" in the philosophical

and systems literature, which concluded the object research expediency as systems (Blauberg, Judin, Sadovskij, 2001).

In a general sense, a system is a collection of individual elements that are in a relationship and bond with each other, forming a new integrity and quality. According to the basic principles of system theory, any object, phenomenon, or process can be considered as a system if: there are two or more system elements; each element has inherent qualities only; there are links between the elements by which they interact; the elements are organized according to a certain structure; functioning in time and space; there is a possibility of dimension; there are boundaries and the environment, etc. (Thomson, 1998).

Systems are formed artificially by embedded retention constants (e.g., gravity, motion, charges, masses, orbits, temperatures of the matter transition, structures of substances, fixed relations, etc.) and memory. The system's main characteristics define: endurance, stability, soundness, tolerance, resistance, elasticity. For its operation, the system performs a set of interrelated functions, the main ones are: collection, storage and reproduction of information; maintaining the structure of the system components; maintaining the order of processes and resources in time and carrying out their transformation; removal of substances, energy and information from the environment; system activity waste removal into the external environment; system protection; adjusting the performance of individual sub-systems; adjusting for deviation of flow parameters from optimal values (Mel'nyk et al., 2005).

The life-cycle of systems is methodologically explained by axiomatics, regularities and laws. Axiomatics: covers all spheres of human life from the standpoint of consciousness, understanding, outlook, feelings, activity; defines categories, events, phenomena; is a statement. Patterns are stable, common and repetitive relationships between phenomena, processes, categories, objects, entities, functions, methods, principles, decisions, status, etc. Patterns are observed, identified, considered and used to rationalize human life. Laws are objectively existing, constant, proven, logical and necessary interrelations among objects, phenomena or processes, arising from their internal nature, essence, reflect cause and effect relationships and characterize the course of events.

Exploring the life cycle allows distinguishing natural, biological, technical, economic, social and management systems in overall. The most sophisticated systems are the human element that forms combined system connections. Consider such complex open dynamic combined systems in more detail.

The "human being" system. A human being has a unidirectional biological life cycle: birth (the period from conception to birth – seven to nine months); childhood (the period from the moment of birth to the beginning of the process of conscious social communication and education – up to 5-7 years); youth or adolescence (the period of accumulation and development of the body's vital forces until puberty, acquisition of civil rights, the possibility of self-sufficiency in society – from 5-7 to 14-21 years); maturity (the period of becoming a human being who has already reached the full physiological formation and capacity in society and is involved in active labour and social process, creates own family, gives birth and raises children – from 14-21 to 50-70 years); ageing or old age (period of exclusion from active labour and social process and loss of health, working efficiency and capacity, which ends with a death of a human being – 50-70 years and more); death (social and biological) (Afonin,

Bandurka, Martynov, 2008). Accordingly, human resources have life-cycle stages: birth, formation, development, and exhaustion (Kuznecova, Nosyreva, 2009). Modigliani and Brumberg (1954) developed a life-cycle hypothesis as a model explaining the planning of consumption and conservation of a population over the life cycle to maintain a sustainable standard of living.

Stages of the employee's work career, as a rule, are associated with the working life of a human being, and in the scientific literature, those are traditionally classified as: preparatory (a period associated with the process of becoming a human being, training, adaptation, self-affirmation – up to 25 years); adaptation (the period of becoming an employee, when the development of the profession, skills are formed and fixed – 25-30 years); promotion (career growth and significant employee achievement – 30-45 years); preservation (the period of fixing achievements of an employee and the highest skill results – 45-60 years); final (period of curtailment of labour activity, decrease in efficiency and productivity, preparation for the end of career, completion of professional affairs, transfer of knowledge – 60-65 years); pension (period of non-professional activity of a human being, which may be accompanied by active social activity – 65 years and more). Those stages can also be classified according to other approaches, depending on attitude to work, behavioural characteristics, perception, etc. For instance, such steps could be orientation, anchoring, demonstration of opportunities, monotony, exit, etc. (Zakharova, 2018).

Family system. There are different approaches to looking at the family life cycle. For example, Neubert identifies 5 stages of family-related birth and cohabitation, Satir classifies 10 stages of crisis-related family, Vasilyeva highlights 5 stages related to communication and birth of offspring, Hill notes the presence of 7 stages associated with birth, upbringing and death, Erikson proposes 6 stages of family, formed by relationships and age of marriage (given in Karabanova, Konopleva, Garanina, 2007).

The commodity system. When considering the life cycle of a product, the following stages are usually determined: product introduction, sales growth, maturity stage, market saturation, commodity decline; growth, maturity, decline (Shnejder, Kacman, Topchishvili, 2002). In international trade, the life cycle of a product is viewed in close relation to innovation, markets, national economies, and international competition (Audretsch, Sanders, Zhang, 2017). In the area of commodity policy, Life Cycle Sustainability Assessment (LCSA) is a popular trend, as an interdisciplinary basis for integrating development models, as well as for tracking the environmental impact of production, use and disposal of products (Onat et al., 2017; Rajagopal, Vanderghem, MacLean, 2017).

The enterprise system. Usually, there are distinguished such life cycle stages of an enterprise as birth, childhood, adolescence, early maturity, final maturity, ageing and rebirth; or birth, growth, peak activity, and decline; or the emergence, rise, high point, recession, crisis process; or creation, formation, stabilization, consolidation, problematic, brink of bankruptcy, bankruptcy (Shnejder, Kacman, Topchishvili, 2002; Adizes, 2003), modern studies note that life cycle phases significantly influence the management of an organization (Gurianova, Gurianov, Mechtcheriakova, 2014). Currently, new developments are constantly emerging in the optimization of production and organizational activity of an enterprise due to cyclic regularities (Mikulášková et al., 2020).

The business system. Alexandrov (2018) examines aspects of business-cycle – that is, business, economic, and enterprising cycle that manifests itself at the micro, meso- and macro levels. An important feature of business cycles is that they emerge naturally from the logic of economic development and operate synchronously across industries. Accordingly, the assessment of business cycles phases contributes to a successful forecast of the economic environment and entities (Guvenen, 2016).

The business model system Jabło´nski and Jabło´nski (2016) highlights differences in business models in the context of company life cycles and sustainability criteria. It is noted that the company development can be viewed in terms of a business model that should consider stages of Initiation, Growth, Maturity and Decline.

The city system. Turgel' (2008), exploring theoretical approaches to analysis of urban cyclicality, notes that the life cycle of a city is a sequence of phases' changes of emergence, growth, maturity and decline, which driving force is the development cyclicality of functional specialization, ensuring the interaction of external elements of environment economy.

The region system. Butorina, Pazdnikova, Karpovich (2018) identified cyclical processes in innovation, investment, technological, technical, industrial, social and structural components of regional development of the country's region.

The branch system. According to the ADL/LC model developed by Arthur D. Little (2016) consulting company, the life cycle of an industry includes four stages: birth, growth (or development), maturity, ageing (or decline). Developments by Hauschild, zu Knyphausen-Aufseß and Rahmel (2011), who have found a relationship between cyclical changes in industry indicators and "Customer preferences", "Competitive situation", "Technology" (are thorough in this area of research). Vasylieva and Velychko (2017) consider the questions of the cyclic patterns and the interconnections of industrial cluster development in their research. The results acquired are used in the regional management optimization process on the whole and in controlling function optimization in particular.

The market system. The market, as a set of economic relations between buyer and seller, also has cyclical patterns that significantly affect the frequency of goods sale, profitability and the entities market policy (Coibion, Gorodnichenko, Hong, 2012).

The elite system. It is necessary to note the cyclical dynamics of continuity and of changes in the control sub-systems of the macroeconomic level, observed in the 14^{th}-15^{th} centuries. Arab scholar Ibn Khaldun identified the patterns of change in the ruling dynasties (elites) over four generations within the 80-100-year political and demographic cycle as a result of a decline in their collective solidarity (cited in Korotaev, 2006).

The state system. Cyclical phenomena in countries can be identified by macro indicators. In the twenties of the XXth century, Kondratyev determined that in the long-term dynamics of some economic indicators, there is a certain cyclicality when the phases of growth of the respective indicators come with phases of their relative decline with a characteristic period of fluctuations of about 50 years. Detailing the structure of Kondratyev cycles has led to the advent of a four-phase model, when within one Kondratyev cycle (long wave), there are not two, but four phases – prosperity, recession, depression and recovery (Poletaev and Savel'eva, 1993), and provides an opportunity to exercise long-term forecasting with 40-year

oscillation time periods (Tănăsescu, Bucur, Oprean-Stan, 2016; Wilenius, Kurki, 2017). Moreover, Pavlov et al. (2019) spot the connections between the cyclic patterns in different countries.

The global process system. In global development processes (challenge, problem, trend, threat, risk), cyclicality is also manifested (Sardak et al., 2017). For instance, globalization is the first phase of the formation of a unified system of the world economy, the second phase is defined as the struggle of national capitals, the third is identified by the Cold War, the fourth is the general expansion of the market economy system. Terrorism, also viewed in terms of a systems approach, has cyclical features and components of maturation, propagation, peak, extinction, and cessation (Schoenenberger, Schenker-Wicki, Beck, 2012).

The humanity system. The world population also has signs of cyclical development. This applies to both historical aspects of rising social and economic development and current demographic trends of humanity as a whole and of individual civilizations (Barraquand et al., 2017; Guo, 2017), and from 2030 will go to the beginning of the stabilization phase.

The world system. Different development cycles of the Universe, humanity, civilizations (religious, ancient Indian cycles, Mesoamerican cycles, zodiacal epochs, Pushkin's cycles, Sorokin's social and cultural cycles (Sorokin, 1996), Chmikhov's cosmogeosocial cycles, language cycles etc.) (Grinin, Korotayev, Tausch, 2016).

It should be noted that at the grassroots management levels of the global environment of human life system, the thesis about cyclical development and life cycle stages is considered by a wide range of scientists and is beyond any doubt. At hierarchically higher managerial levels of the global environment of the human life system, the scientists notice only similar patterns of cyclical nature. But despite the great research material, the important question raised by Popper on scientific objectivity of explaining cyclical development of social and economic systems remains unresolved (Popper, 1983).

For example, based on analysis of the papers of the above scientists, we can note the following problematic and discussion issues regarding cyclical development of systems with human participation:

- uncertainty of the driving forces' source of repeated changes;
- fuzzy delineation of systemic (internal) and extra-systemic (external) influence on development;
- lack of a unified description of the nature of development at different managerial levels;
- the use of different descriptive terms for the same constituent elements of repeated changes (period, step, stage, phase, wave, cycle);
- uncertainty in the number of constituent elements of repeated changes;
- lack of a mechanism for identifying the exact time of change of constituent elements of repeated changes;
- a superficial description of the off-system life of subjects (pre-system creation period and post-system elimination period);
- paying more attention to initial and less attention to final components of repetitive change;

- lack of a reliable mechanism for forecasting and predicting dynamics of constituent elements of repeated changes (Sardak, Dzhyndzhoian, Samoilenko, 2016).

At the same time, it can be stated that all social and economic systems develop within repeated changes and are characterized by the same signs of cyclicality:

- indicators' variations characterizing the state of subjects are noted;
- systemic (from the moment of creation to liquidation) and extra-systemic (pre-systemic creation – "design" and post-system liquidation – "utilization") periods are ascertained;
- subjects are created by actions of other entities (that is, the entities do not arise "unknown from where" but are the result of the actions of other entities – "constructors");
- after the entity's termination, their resources are used by other entities (i.e., the entities do not disappear "unknown", but they get transformed into resources of other entities – "utilizers");
- entities have a unidirectional life cycle from "birth" to "death";
- entities do not necessarily go through the entire life cycle (each point in time may be the last);
- entities' activity sometimes shows similar changes in indicators;
- entities experience upward, peak, and downward fluctuations in indicators;
- slight fluctuations occur in constituent elements;
- nature of fluctuations in the indicators and length of life of the entities are individual.

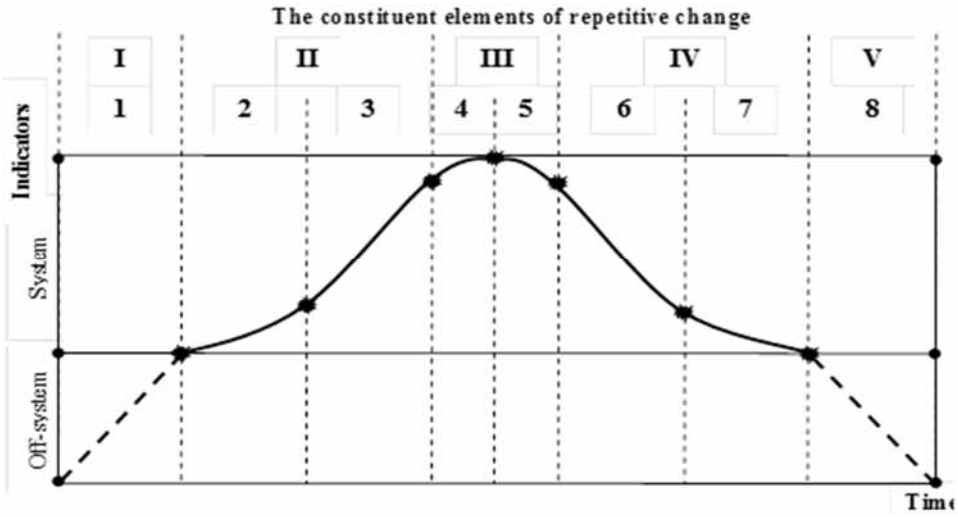
These definite signs allow to point to a simplified structure of the life cycle of a system Figure 1 (where a human being becomes an integral element and forms a combined system connection), by constituent elements of repeated changes (general and specific), which are determined by indicators (natural or relative) and time (hours, days, months, years).

Presented in Figure 1 graph is given as a proportionally balanced curve that describes the off-system (highlighted two common components) and systemic (highlighted three common components) state of a system. Determining the two off-system and three system-wide components of recurring change allows to diagnose, predict and regulate the dynamics of systems development indicators.

In this context, it is necessary to note the important role of finding the key points of change in the nature of the indicators' dynamics. Key points of change in the nature of the indicators' dynamics determine specific components (periods, steps, stages, phases, waves, etc.). For instance, there identified 8 specific constituent elements. However, the number of key points of change in nature of indicators' dynamics and, accordingly, the number of specific life cycle components (as well as their duration and fluctuation limits) may differ from entities and be larger, because in practice, the trend curve is not "smooth", it is subject to constant imbalances ("jerks" and "delays").

Figure 1

Simplified system life cycle structure



– dynamics of system indicators;
– dynamics of out-of-system indicators;
– limit values of indicators;
– components dynamics of the life cycle;
– key points of change in the indicators' dynamics;
I – the first common component – the "pre-system state" (creation of system sub-system forces);
II – the second common component, the "growth" (increase indicators);
III – the third common component, the "stabilization" (alignment of indicators);
IV – the fourth common element, the "reduction" (reduction indicators);
V – the fifth common component element is the "post-system state" (elimination of the consequences of system activity by extra-system forces);
1 – the first concrete component is "creation";
2 – the second specific component is "slow growth";
3 – the third concrete component is "rapid growth";
4 – the fourth specific element is "increasing stabilization";
5 – the fifth concrete component is "shortened stabilization";
6 – the sixth concrete component is "rapid reduction";
7 – the seventh concrete component is "slow reduction";
8 – the eighth concrete component is "liquidation".
Source: compiled by the authors.

The ratio correctness of repetitive changes components in systemic state of the life cycle of entities of human life in graphical form is indirectly confirmed by the development of Weibull (1961), Gauss (cited in Fisher, 1958; Pogorelov, 1974; Kolmogorov, 1987; Petrov, 2008) in "normal distribution" in technical, natural and biological systems.

This trend is abstracted in comparison with dynamics of biological activity of flora and fauna according to the annual calendar, which is most clearly observed in the middle latitudes of the Earth for seasons:

I – the first constituent element is winter (January, February) time of "sleep" or "rest";

II – the second component is spring (March, April, May) is a time of "growth";

III – the third component is summer (June, July, August) is the time of "highest growth" or "development";

IV – the fourth component is autumn (September, October, November) is the time of "slowing down";

V – the fifth component is winter (December) is the time of "sleep" or "rest".

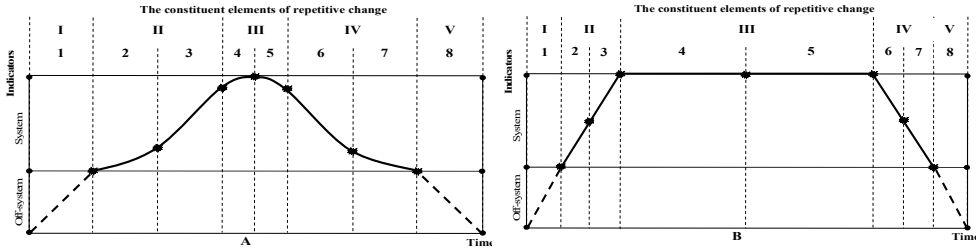
The history of mankind testifies to the continuous effort of humans to consciously manage the life cycle of systems. However, it should be noted that in naturally created systems, the ratio of constituent elements is not subject to significant changes. In artificial systems, there is a wide possibility of management actions. For instance, consider two common areas of system life cycle management.

The first direction is the ratio regulation of the constituent elements of a system. For example, in business activities, entrepreneurs focus their efforts, on the one hand, on minimizing the time of "pre-system state", "growth", "contraction" and "post-system state", and on the other, on maximizing the time of "stabilization". The schematic ratio control of the system components is shown in Figure 2.

Figure 2

Adjusting the ratio of system components

A – conditionally organic ratio *B – adjustable ratio*



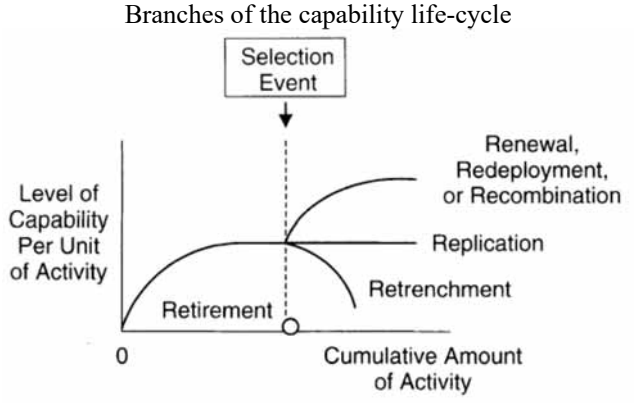
Source: compiled by the authors.

Accordingly, in Figure 2A there is a relatively organic ratio of the system constituent elements for nominal distribution visualization, and Figure 2B depicts an adjustable ratio of system components, which is carried out artificially due to managerial influence. In an economic system, this approach ensures that the duration of the most effective business activity is increased.

The Helfat and Peteraf (2003) research notes, that as a result of "Selection Event" at a certain time, there is a change in system dynamics and there is a realization of three scenarios: growth – "Renewal, Redeployment, or Recombination", stabilization – "Replication" or reduction "retrenchment" (Figure 3).

Figure 3

Branches of the capability life-cycle

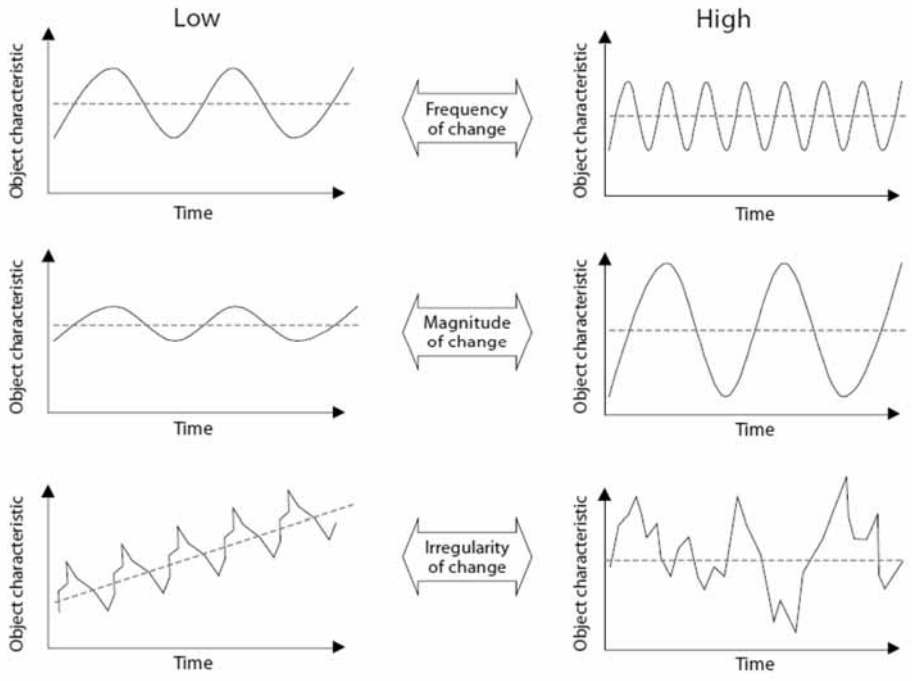


Source: Helfat and Peteraf, 2003.

As a regulation variant of the constituent elements ratio of a system, the visualization given in the research by Hauschild, zu Knyphausen-Aufseß and Rahmel (2011) can be cited. This research notes that changes in system indicators can occur in three directions – "Frequency", "Magnitude", "Irregularity" (Figure 4).

Figure 4

Attributes of industry dynamics



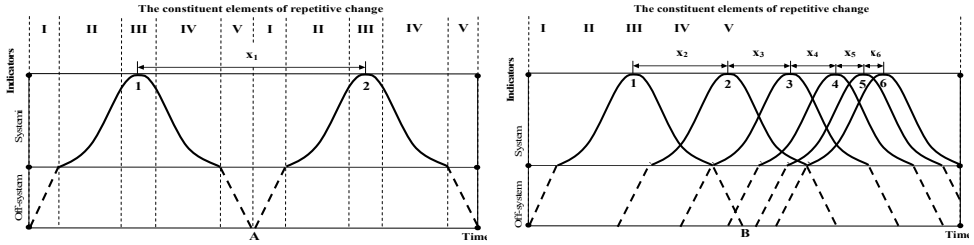
Source: Hauschild, zu Knyphausen-Aufseß and Rahmel, 2011.

The second direction is to regulate the time of the creation of the new system. For instance, in business activities, entrepreneurs focus their efforts on accelerating the releasing new products, new activities, new businesses and more.

Figure 5

Adjusting the time to create a new system

A – conditionally organic ratio *B – adjustable ratio*



Source: compiled by the authors.

Figure 5A shows the time ratio of creation of a new system №.2, after complete passage of all constituent elements of system № 1, when the time between the averaged centres of the "stabilization" element is equal to the value of x_1.

Figure 5B shows adjustable ratio time to create a new system №.2, at the beginning of its "before system state" in the "stabilization" period of system №.1 (respectively, time x_2 is reduced compared to x_1). When designing system №.3 in the period of "growth of system" №.2, time x_3 is reduced compared to time x_2. And so on ($x_1>x_2>x_3>x_4>x_5>x_6$), while accelerating the time of the creation of new systems, it is desirable for entrepreneurs to prolong the time of entrepreneurial activity with its maximum efficiency.

6. Conclusions

The research identified the life cycle components of the system: general ("pre-systemic", "growth", "stabilization", "contraction", "post-systemic") and specific ("creation", "slow growth", "rapid" growth", "increasing stabilization", "reduced stabilization", "rapid contraction", "slow contraction", "elimination") are constituent elements of repetitive change; limit values of indicators; the components' dynamics of the life cycle; key points of change in the nature of performance. This forms a scientific and methodological basis for effective design, creation, management and development of multi-level systems with human participation.

7. Practical Importance

The paper explores and generalizes the approaches of scientists to defining concept of the life cycle of a certain system.

The research suggests that throughout the life cycle of a system at different stages, there are so-called key points that can dramatically affect the life/growth of a system. All this allows to form a scientific and methodological basis for effective design, creation, management and development of multi-level systems with human participation.

The prospect of further research is the development of an applied mechanism for determining parameters of system life cycle components and system life cycle relationships.

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