ECONOMIC CONTROL MECHANISM OVER COMFORT AND SECURITY OF URBAN SETTLEMENTS' TERRITORIES

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The article studies the current problems of the urban planning. Moreover, it deals with the reasons of deterioration of comfort and security within modern cities' territories. It offers a management mechanism of processes, key characteristics of the investment - constructive complex of regions based on entropic mathematical models.

The development of modern cities gives rise to an enormous number of such problems as: atmospheric air and water pollution, repacking and pollution of soil, high noise level, huge and constant traffic jams, greenery deterioration, poor reliability of pipelines and networks, etc. Professional ecologists are constantly thinking over a way to protect modern cities from an environmental and urban catastrophe, to save a comfort living environment. Generally, urbanists mark out two basic destructive factors of urban settlements development: traffic overflow and overpopulation. Some of them also point out to the most important town-building problem that consists in the fact that people do not know exactly what a modern building is. There isn't any unanimous opinion concerning this issue. Big city problems are growing as a snow ball, and sometimes reach a disastrous scale. It's worth mentioning that the situation is deteriorating, notwithstanding the efforts of authorities and professional communities in the sphere of town planning systems security.

So it turns out that the modern scientific and technological race leads to the deterioration of the situation. A small amount of the present-day specialists - builders and managers realizes the historical origin of their occupation. Let's have a good look at so-called "Roman Villas" and accompanying facilities situated all over Europe and North America. A good number of them was built about 2000 years ago and serves as a testimony of the fact that the human civilization even in the extreme antiquity possessed the knowledge not gainable for modern urbanists. Several roads, built 2000 years ago, have been well preserved until nowadays. Apart from the roads in large numbers, they built war camps, fortresses, light houses, cities with well-developed infra-structure (central sewerage and heating), considerable fortification constructions and public places including bath houses in terms comparable with modern. The absolute masterpiece of that time is the Port of Carthaginian. It was able to receive 220 large war ships. More then two hundred docks were situated on the perimeter of the war harbor with an island made in the centre. It's not an easy thing to build such facilities even now and nearly 3000 years ago without electricity, gas, special equipment and machines, computers, engineers, qualified builders, necessary building materials and financial technologies it was almost impossible. Anyway, it was done. Ancient knowledge is obviously far ahead the present day's one, and it's impossible to bring such projects into life. An unconsoling conclusion should be made - the majority of methods of research activities, management, designing and building used nowadays lead to deadlock and are not able to provide security from natural, technical and social disasters, to bring down acceptable level activity of harmful factors, to save people from nerve strain and preserve natural resources. Unfortunately, we have to state the fact that enormous recourses are spent on single ambitious projects such as the artificial islands YAS in the UAE with a huge investment budget, aimed to astonish rich tourists, average people and nouveau riches- F1 fans.

Obviously, change of the approach to designing and forming the artificial human environment can release from enormous resources, solving meanwhile accumulated contradictions. People responsible for the development of town planning politics have to realize that if they continue to broaden cities or reconstruct them us-

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ing old methods, they will not manage to come out of numerous crises. It's necessary to get rid of dangerous technocratic traditions and learn all over again. It's clear that it's not possible to improve the situation in a second. In our opinion, at the first stage of transformation it is necessary to set specific ground rules to control the anthropogenic risks level and also threats from objects reaction to supernormal environmental effects.

As it has been stated above, builders' violations still draw our special attention. Today we can trace poor quality of project documentation, numerous violations at all the stages of investment building projects (further IBP) and ineradicable desire to save on everything while erecting and running lead to lowering constructive and other characteristics, influencing on the safety and security of buildings. Taking into consideration this fact, the management process of urban settlement territories development need to be carried out according to a scheme, where all the destructive factors mentioned above are considered. Moreover, it is necessary to take into account entropy and negentropy that flow in the examined models of systems. Establishment of total control over executor at different stages of IBP is an utopia and lead to dissipation of a good number of resources, which could have been used more effectively by the society. That is why final activities of structural security of buildings and constructions must have integral character while costs of their collection and processing must be minimal. Nowadays, the number of such methods is extremely low, but the greatest effect is reached only with application of relative activities of normative risk level excess.

It's a well known fact that to guarantee effective management diversity (entropy) level of the managing system should not be lower than the same level of the managed system. This principle, called Ashby's Law in the management theory is also fair for necessary entropy, but for effective management negentropy it is also needed. From the point of view of infodynamics, Ashby's Law is a particular case of a more general law of manageability of systems: "every system may be managed only to such an extent at which the sum of primary negentropy and the one brought by the managing system compensate its highest possible entropy and a system becomes managed in full only when total negentropy is equal to the highest possible entropy".

According to this law the degree (coefficient) of manageability of a system may be evaluated with the formula:

$$K_y = \frac{G_0 + G_{in}}{S_{\max}}, \qquad (1)$$

where G_0 - primary negentropy in a system; G_{in} - negentropy brought by the managing system; $S_{\max}$ - maximal entropy of the managed system.

Using formula (1) we can plot the degree of manageability of urban system calculation as

$$K_y(t) = \frac{\sum_{i_1}^{N_1}\left(G_f(t)\right)_{i_1} + \sum_{i_2}^{N_2}\left(G_f(t)\right)_{i_2}}{\sum_{i_1}^{N_1}\left(S_{max}(t)\right)_{i_1} + \sum_{i_2}^{N_2}\left(S_{max}(t)\right)_{i_2}}, \qquad (2)$$

where G_f - actual negentropy; N_1 - total number of objects planned to be built and those under construction on the considered territory; t - time

It is possible to set normal value for K_y by substitution of $(G_f)_{i1}=(G_{lim})_{i1}$, $(G_f)_{i2}=(G_n)_{i2}$, while $(S_{\max})_{i1}$ is a subject to recalculation in case if restoration or repairing works were carried out on operated objects that caused changes in structural design of a building or a construction (G_{lim} - overload minimum capacity of entropy).

To make a decision on stopping the process of building it is necessary to possess time series of K_y time series. Its deviation from the normal region shows approximation of industrial-territorial development crisis.

The essence of economic control process of buildings, constructions and territory security is in establishing and changing object and territory quotes (generation limits) of negentropy- based on knowledge of its normative, real (tracking) and maximum permissible value, which at the same time serve as a reference point for enterprises- participants of IBP while deciding on buying or selling their quotes - at the condition of local deficit or excess of G correspondingly.

High liquidity of G and limitedness of its amount in space and time create necessary and

sufficient conditions for competitive struggle development and forming of peculiar security "market" - a system of higher level in the hierarchy of market relationship in building, setting new ground rules of their formation in the conditions of growing demands to social and economic security.

At practical implementation of the offered economic control mechanism of comfort and security different variants of primary distribution of quotes are possible - from compulsory (free or charged) to absolutely free form.

The most important task of economic control of building and constructions security is determination the value of G^{EM} - maximum volume of territorial G quote. At its definition this task stands in just the other way round to the definition of maximum permissible concentration of the critical from the point of view of ecology of a component in the water or atmosphere. It is possible to solve it with the help of addition of negentropies of a complex of independent system rule. That is, territorial negentropy quote value that can be calculated according to the formula, which models the process of generation (transformation) G during construction and running:

$$G^{EM} = \sum_i \left(G_{pln}^{EM} \right)_i + \quad + \quad + \sum_k \left(G_{expl}^{EM} \right)_k , \qquad (3)$$

where $\left(G_{pln}^{EM} \right)_i = 2(G_n)_i - (G_{lim})_{i-}$ i planned quote to object - building; $\left(G_{bld}^{EM} \right)_j = 2(G_n)_j - (G_{lim})_j - (G_f)_j - k$ - quote of put into operation object conditioned by the normative life time and corresponding value of operating costs.

Set by the formula (3) negentropy quotes are the guideline for an owner while making decision on buying or selling negentropy at its deficit or correspondingly excess. On having calculated really used part of DG quote, and having predicted the minimum (considering coming constructing and operating) need in negantropy $G_{min,}$ we can estimate the available reserve G_{rez}=DG-G_{min} and make a conclusion about the degree of entropy satiation (degradation stage) of urban or rural settlements territory.

Proceeding from the above said two important rules can be extracted:

1. Until the statement abs($Balance_{mk}$) J G_{rez} Щ sign($Balance_{mk}$) = -1 is true we may say that the examined territory is not out of entropy satiation limit.

2. Until inequalities G_f-$G_{n/lim}$ i 0 are true for new/operated objects, we can say that they are out entropy satiation limit.

Rules 1 and 2 are the only ones possible. However, their practical use is to a considerable extent justified by the fact that they model "reserve space" from economically proved norm to hypothetical utmost situation, when all the objects are at the critical stage of their operation and it is necessary to carry out repairing-restoration works urgently, to reach acceptable level of security.

It is necessary to point out, that because of essential uncertainty of industrial- territorial development a regular, at least annual correction of emissive plans with regard for real changes of density and other building characteristics is needed. Naturally, there comes out the question of possible building limits for a territory? In other words, what is the maximum value of sum i, j

K in formula (3). As we can see from urban practice, norm range of density are often exaggerated and sometimes builders with "silent agreement" of land department ignore the SNiP requirements. Especially, it deals with territories with high cost of 1 м^2 from the area. Apart from that, a lot of standards are based on out-of-date architectural achievements, town planning and building sciences. Considering the complexity of the situation, it is impossible to make a decision without presented negentropy criteria.

Only with the help of G^{EM} the urban system can stay within the steady area. Insufficient (absence of control over $P(C)$ and G_f monitoring) or excessive (fines, sanctions and encouragement according to G_f value) management can bring system out from this area to unstable state. In case of insufficient management system enters the area of positive feedback leading to full destruction of the system. Bringing in the system excessive management influences will suppress the necessary initiative.

In the examined control mechanism the presence of any economic sanctions (fines, tax increase) or encouragements for improper or vice versa, high quality of constructing or operating of objects on the territory, is not supposed. The G^{EM} value itself is the limit, and on having reached it any *constructing activity* theoretically has to stop. However, companies, taking obligations of essential negentropy growth, may be encouraged in this way or another by the state or local authorities. Anyway, taken obligations may be resold.

It is necessary to point out, excessive local negentropy concentration is an undesirable phenomenon. Unfortunately, progressive development is not a common characteristic of all systems. It is linked with G increase, but at the same time is accompanied by S increase of the environment. Concentration effect is unavoidable because of infodynamics law activity and in our case may be conditioned by the activity of various factors and some of them may look as a positive phenomenon. For example, competition may be dishonest and deals in the negentropy market may be speculative and may be performed under the pressure of persons having other interests including criminal. To lower the probability of such events, $P(C)$ is the most important and of no small importance-sufficient function of territories, buildings and construction security, because there is an optimal batching of managing influences.

Meshkova T.E., Gabrin K.E. Emission and quota system of negentropy as mechanisms of effective control over building objects at al stages of investment cycle.

Liyv E.H. Infodynamics. Generalized entropy and negentropy, Tallin, 1998.

Melchakov A.P. Calculating and evaluation of emergency risk and safe resource of building objects. (Theory, methods and engineering appendixes): Tutorial. Chelyabinsk, 2006.

Prangishvilli I.V. Entropy and system regularities. Complex systems management systems. M., 2003.

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