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MULTI-STAGED ORGANIZATION AND TECHNICAL DEVELOPMENT OF MANUFACTURING SYSTEMS ON AUTOMOBILE TRANSPORT

There had been consideredd the principles of organization and technical development of manufacturing systems of automobile transport as the complex multi-staged system. It had been staged that the main method for research of manufacturing systems is simulation.

Key words: *organizational and technical development, manufacturing system, complex system, multi-staged, factor of efficiency, simulation model.*

Initial preconditions and research task setting

Contemporary state of scientific and technical progress, efficient development of manufacturing forces, necessity in facilitating the manufacturing require the development of long term development strategies in autotransport enterprises. This is especially important in conditions of market economy when the correct choice of long term strategy of the enterprise directly influences its further existence [1]. Transport enterprises being manufacturing systems, are on the low stage of hierarchy. In view of this transport enterprises has to be considered as the complex multi-staged manufacturing system.

Manufacturing system is a purposeful, ordered cooperation of structurized and organizational relationships, material, power, information resources, which develop successfully. It ensures the stable, reliable manufacturing of specific goods and services within the environment which changes constantly. Specific peculiarity of manufacturing system is the availability of large amount interacting with each other of elements of subsystems, connected into the system to meet the only target. The greater the number of elements, subsystems, connections between them and statesin which they may be, the more complex the system is. Mathematical dependance between the number of elements of such systems and the maximum number of possible relations between them is expressed as follows [2]:

$$V = n \cdot (n-1), \tag{1}$$

where n – number of elements in manufacturing system.

Maximum number of possible states of such systems is expressed by the dependence:

$$H = 2^{n\cdot(n-1)}. \tag{2}$$

All manufacturing systems are formally similar. This similarity is based upon the following attributes of the system: organization, management, technology, social and psychological relationships, legal regulations, ecological requirements etc. Manufacturing systems differ with each other in scale as well as in types of goods manufactured and consumed, energetic and information resources.

The main objective of prognostication of organization and technical development of manufacturing system – development of the system of scientifically grounded realizing of ways and directions of development, which are based on the lows of market economy. So the main objective of this work is the research of common principles of functioning of complex multistage system and revealing the main research methods in these systems.

Principal Part

The research of process of development of manufacturing systems and tendencies, which characterize their factors allow to specify stages which are relatively autonomous. In some cases the multi stage of the processes is obvious for example, considering them from the point of view of staged development of schedule factors, interrelations between the system of different levels

(enterprise, unity, branch, etc). In other cases it is of more complicated character. Since the manufacturing systems belong to the complex systems, the research of processes of their development requires to consider the common principles of complex systems.

Lets consider the common model of functioning of complex systems which allows to follow the multi-staging in processes, relating to the organizational and technical development of manufacturing systems.

Lets consider the common model of functioning of complex system which functions on the interval $[t_0, t_0 + T]$ may be represented as in fig1[3]:

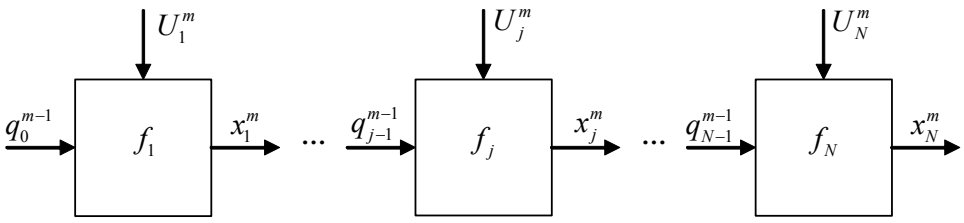

Fig. 1. Schema of common model of complex system functioning.

Where U_j^m controlling influence on subsystem, x_j^m output of the j-th subsystem in the moment m; q – inputs on the subsystem considering the feedback, which act from the moment of time τ_{m-1}; f – functioning in the subsystem.

The system considered consist of N subsystem j = $\overline{1, N}$. It is possible to consider macroeconomic system with different entering subsystem of different hierarchical level (enterprise, unity, brunch, etc), different technological system, stages of system development and their interrelated directions etc. The understanding of complex system as the multistaged is chiefly determined by its economic content.

Each of the subsystem functions with the objective to achieve definite values of local optimization criteria in each interval of time m. These may be, for instance, manufacturing, technical end economic factors.

Which the realization of unique technical policy in economy, separate subsystem j may be considered as both the manufacturing system of different levels of hierarchy, as well as of one level hierarchy, for example, of inter-branch complexes, branches. And the controlling influence on subsystem U_j^m for any moment of time m – may act in the kind of target orders of organization and technical development of the considered subsystems, considering their specification. If the sub-systems are consider in regard of level of their hierarchy, them the target settings of the enterprise unit, branches, inter-branch complex (manufacturing units, regions, interregional complex) will also be considered. Input-elements, which enter the subsystem, may be considered as its resources, with ensure introduction of measurement with different directions of organizational and technical development, as well as the products of other system, such as raw materials, equipment, types of products, and other, which stipulate for the input – elements of other subsystems. Solving the tasks of increasing intensifying level of economic processes, the multistaging may be considered from the point of view of system with different levels of their development. Target settings may be selected for different subsystem, processing from ensuring the activity of factors of economic growth, enhancing those, with provide common system under consideration, for example the sphere of automobile transport.

The target, directed, for example, on the release of workers, which is the result of increase of level of automation or mechanization of operation, may be considered as the criterial functions for some systems. For the other systems it is necessary to find a target which ensures the output of new line of goods, improving its quality. There are also other variants, for example, maximum renewal

of equipment in the results of enterprise reconstruction, modernization of equipment, introduction of latest technology or reducing cost of goods, improving labor quality, etc.

The questions, related to the improvement of organizational and technical level must be solved with the consideration of objective, that is, of current and perspective target orders for development and functioning of the system. The general target orders may coincide with the local targets of separate subsystem. It is also possible to select the target setting, peculiar to the system under consideration, proceeding from its role in the economy mechanism [3].

Multistaging in the organizational and technical development of the system may be considered from the point of view of sequential introduction of measures of different directions of innovative process, scales of their realizations in separate manufacturing systems. If is known that different direction of innovations are connected with each other. The level of introduction of measures on one direction predetermine the possible level of technical development of the system on other directions.

Very often the efficiency of introduced measures in respect of automation of manufacturing depends on the level mechanization of other operations, raw material supply, with ensures full loading of the line. Manufacturing of new types of goods is stipulated for by the introduction of new technology, new types of raw materials and their quality etc. Development of separate directions of innovational processes differently influences the requirement in raw material resources, the final results of the system functioning. Some of them ensure reduction of cost on manufacturing, other allow to reduce member of workers, improve labor quality etc. That is why the consistency of result of increase of level of systems, which is the result of introduction of measures on different directions of innovation progress is various in its essence.

Multistaging in the development of the system is seen from the point of view of separate processes, for example, technological of parameters and levels of goods quality, consumption of with stipulates for the level of goods quality of separate subsystems (through feed back chain).

Multystaging in organization and technical development of manufacturing system is stipulated for by the objective processes, related to the division of labor, development in the process of extended renewal. It is subordinated to the character of this manufacturing, society target, with determine the target setting of economic development for shot term and long term periods and specification of with stipulates for the strategy of resources usage, character and target of development of subsystems of different levels.

Multistaging of processes is observed within the separate system for example, during the research of the factors which determine the growth of factors of their functioning. On this bases it is possible to build the hierarchical system resources, which determine the level of its final results. In the generalized form such an approach for the system, for example, on the type of diagram on fig 2:

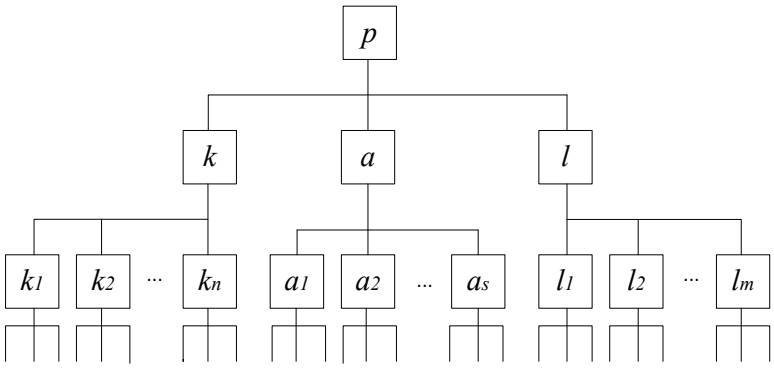

Fig 2. Diagram of hierarchical building of factors of using the manufacturing resources

Where p – factor, which expresses the final result of system functioning; this may be the volume of transportations, increase in labor productivity, income, profitability and other; k – factor of efficiency in using the main funds; a – factor of efficiency in using labor object (spare parts, materials); l – factor of labor efficiency.

Factor a, l characterize the efficiency of resources usage of the system, means and objects of labor, and reflect the efficiency of technology for the system under consideration;

$k_1 ... k_n$ - factors of parameter changing k in respect of factors, influencing their dynamic. The dynamic characteristics of structures, which function in the system of main manufacturing funds may be selected as such factors. It may be the structure of the funds on subsystems in the common system of functioning of main funds of manufacturing system their active and passive parts, average age of automobiles, level of rolling stock, specific gravity of morally aged equipment, renovation of equipment, specific gravity high efficient rolling stock, modernized equipment, special equipment etc;

$a1 ..., a_s$ – factors of changing of losses of labor objects as for the factors, which determining their dynamics. Here it is possible to proceed from changing structure and quality of the used labor objects (for instance, changing portion of new aggregates and spare parts, material etc; changing level of their quality, interchangeability etc).

l1..., lm — factors of changing labor lasses, stipulated for by changing level of workers qualification, number of those employed, changing level of funds availability mechanization etc.

Controlling the factors of fund and material capacity on different structures – factor which stipulate for their level via the choice of corresponding directions of innovation process and introduced measures, allows to control the resulting factors of the system, for example, volume of transportations, revenue, profitability and so on.

The revealing of hierarchical structure of factors is a complicated process. Economic dynamics stipulate for the qualitative new peculiarities of development of manufacturing system, changing the role of separate growth factors, encouraging the new among them. The effect of some factors of development of organization and technical system is obvious, and revealing of quantitative measure of their influence upon the final results of development and system's functioning does not cause difficulties. However the number of factors (qualification level, social and psychological climate and other) are difficult to describe quantitatively. Application of mathematical methods for the solution of organization and technical development of manufacturing system requires reveling parameters which may be evaluated as for the experiment data. The mathematical models, built on this principle, may become basis for decision making, allowing at the same time to receive data on systems response, that is, the organizational and technical development of the manufacturing system.

Mathematical models may be used for both, the evaluation of functioning of organization and technical system as well as for prognostication of their development, which is extremely important under condition of evaluation of strategic management. It is necessary to note that the big dimensional presentation of many classes of mathematical models, as well as availability of non linear connections and stokhastisity of variable values make it very difficult and sometimes even impossible to research such models in the analytical way. That is why, in our opinion, the most acceptable method relating to research of organizational and technical manufacturing system is the simulation method. This method has no restrictions. It may be used for research of organizational and technical manufacturing system of any complexity and structure. Imitational experiments are directed to the improvement of model's adequacy, which reflects the real object or manufacturing process.

In the process of simulation there are many methods for correction and refinement in the model, which make it efficient and reliable.

Conclusion

Manufacturing system is not the aggregate of units, when each its part is governed by the

laws of casual relationships which influence it, but the aggregate of relationships between these elements. During the research of such system and development of products of their organizational and technical development it is necessary to consider their multistaging system is the simulation method, which is based on the principle of analogy, that is the possibility to study the real object through the similar to it and more available object – on its one model. The most accepted research method for organizational and technical manufacturing system is the method for simulation

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