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1. Features of using a scenario-purposive approach for modeling and controlling the technological complex of milk production

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Introduction: A scenario-purposive approach is effective in the study and management of organizational and economic systems [1, 2]. There are works about its application in technological complexes (TC) of food processing of continuous and continuous-periodic types [3], which show the possibility of obtaining new solutions, including the diagnosis and prognosis in the management of the subsystems at a sugar factory and in beer production.

Resources and methods: To increase the effectiveness of TC of a milk factory, that refers to continuous-periodic type, a scenario-purposive approach has been applied. In contrast to existing methods, the use of this approach makes it possible to show the relationship between the operations, objectives, facilities, resources, and transitions in time.

Based on the analysis of technological and techno-economic variables of TC of milk production, the description of it has been made, namely highlighting the objectives, operations (processes), transitions, and events to create the purposive scenario, which serves as the basis for the withdrawal of the base and table prographs (process-resource-object graphs) and for the realization of a simulation modeling. For the subsystem of milk pasteurization, a purposive scenario has been developed for TC of the milk factory, taking into account all the technological and techno-economic variables, as well as with respect to further definition of situations, creating scenarios of their development and selecting the optimum.

Results: After the conducted system analysis of technological variables and determination of the techno-economic indicators, we highlighted the operations f_i (listed in Table. 1), which make up the pasteurization process, and objectives c_j (listed in Table. 2), which should be achieved as a result of the operations.

The purposive scenario of the work of pasteurization department subsystem of the milk factory TC is determined by the given formula:

$$A = < F, C, T, \alpha, \beta >, \quad (1)$$

where $F = \{f_1, \ldots, f_{10}\}$ is a set of operations; $C = \{c_1, \ldots c_{20}\}$ is a set of objectives; $T = \{t_1, \ldots, t_{11}\}$ is a set of transitions; $\alpha : T \times F \cup F \times T \to \{0,1\}$ is the

incidence function "operations - transitions"; $\beta : F \to 2^C$ is the function of distribution of the objectives (2^C is the set of all the subsets of C).

Based on (1), the purposive scenario was created (Fig. 1), specifying the operations, objectives, transitions and connections between them.

Table 1

The Objectives of Milk Pasteurization Subsystem

Denotations	The content of the objective
c_1	To rate the quality of raw milk
$c_2 - c_{10}$, $c_{13} - c_{20}$	To maintain the required values of process variables of pasteurization department
c_{11}	To conduct the pasteurization of milk at a temperature of 74-76 ° C for 15-20 s
c_{12}	To determine the temperature of pasteurized milk at the outlet of the pasteurizer

Table 2

The Operations of Milk Pasteurization Subsystem

Denotations	The content of the operation
f_1	Evaluation of the quality of milk that comes into production
f_2	Reception of milk
f_8	Pasteurization of milk
f_{12}	Storage of finished products

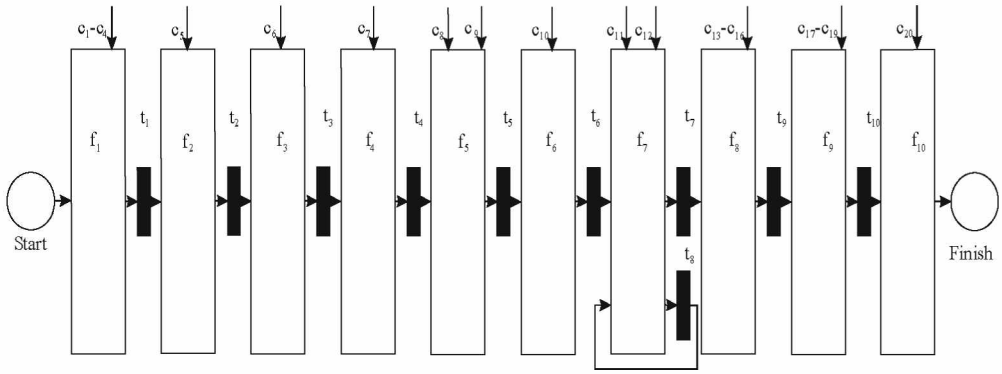

Fig. 1. The purposive scenario of the production line of pasteurized milk

Conclusions: On the example of the pasteurization department, we clearly see the relationship between the objectives, operations, resources, objects, etc. The purposive scenario is used for simulation modeling of the process of object functioning, for forecasting the development of the situations and for making decisions.

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