such semantic networks are called sc-elements (sc-nodes and sc-connectors, which, in turn, depending on their orientation, can be sc-arcs or sc-edges). The universality and unification of the SC code makes it possible to describe on its basis any type of knowledge and any methods for solving problems, which, in turn, greatly simplifies their integration both within one system and within a group of such systems.

The basis of the knowledge base developed using the OSTIS Technology is a hierarchical system of semantic models of subject areas and ontologies, among which stands out the universal Core of semantic models of knowledge bases and the methodology for developing semantic models of knowledge bases, ensuring semantic compatibility of the developed knowledge bases [10]. The basis of the OSTIS -system problem solver is a set of agents that interact exclusively through the specification of the information processes they perform in semantic memory (sc-agents). All of these principles together make it possible to ensure semantic compatibility and simplify the integration of both various components of computer systems and such systems themselves. Within the framework of the OSTIS Technology, several universal options for visualizing SC code structures are proposed. Within the framework of this work, examples will be used in SCg-code - a graphical version of visualization of SC-code constructions and SCn-code — a structured hypertext version of visualization of SC-code constructions.

IV. Practical implementation of IIRS based on OSTIS Technology (using the example of a unit for post-treatment of wastewater from dairies — biological ponds)

In biological ponds for post-treatment, contaminants are removed by aerobic microorganisms, which enter them with purified liquid from secondary settling tanks (after aeration tanks and/or biological filters), and also develop directly in the ponds themselves. Higher aquatic vegetation (algae) plays an important role. The rate of the biochemical process of extraction and oxidation of organic pollutants in ponds with natural aeration is limited by the low rates of atmospheric reaeration and mass transfer processes. In ponds with artificial aeration, as a result of supplying the required amount of air with intensive mixing of the liquid, the speed of the biochemical process is 5–7 times greater.

The feasibility of their use at dairy processing enterprises is largely due to the fact that many harmful organic substances are not completely oxidized at biological wastewater treatment facilities; they remain stable in water for a long time and can have a toxic effect on living organisms. In addition, intensive technologies have significant disadvantages: high energy costs for aeration and problems associated with the processing and disposal of large amounts of excess sludge formed, its swelling and foaming.

The characteristics of the life cycles of biological ponds fully include: nonlinearity, nonstationarity, multifactoriality, multiprocessivity, constant changes in the structure of internal relationships, the presence of significant hidden mutual influences between technological parameters. Accordingly, it is justified to apply OSTIS Technology to the creation of a knowledge base of their processes with further synthesis of an intelligent information and reference system.

The formation of the IIRS knowledge base was based on the national regulatory document - BS 4.04.02-2019 “Building standards of the Republic of Belarus Sewerage. External networks and structures.” Let’s consider a fragment of the ontology that describes the concept of “biological pond” and the parameters specified on it in the SCn code [10].

biological pond
⇒ *explanation*:*
[Used for purification and post-treatment of municipal, domestic, industrial and surface wastewater containing organic substances.]
⇒ *subdividing*:*
• *biopond with artificial aeration*
• *biopond with natural aeration*
⇒ *parameters*:*
• *waste water flow*
∈ *measurable parameter*
⇒ *designation*:*
[Qw]
⇒ *measurement unit*:*

1 m3/day

waste water

:= explanation:*

[surface, domestic and industrial waters discharged into sewers]

⇒ parameters*:

- *TBOD*

∈ *biochemical indicator*

- *average monthly temperature in winter*
- *average monthly temperature in summer*

TBOD

:= [total biological oxygen demand]

⇒ *explanation*:*

[reflects the amount of oxygen required for the biochemical oxidation of organic wastewater contaminants in 20 days]

∈ *measurable parameter*

⇒ *designation*:*

[L]

⇒ *measurement unit*:*

$1mg/l$

Consider for an example of using the developed ontology to describe a specific technological task. A biological pond with a flow rate of Qw = 5640 m^3/day was taken as a technological prototype. Biochemical indicators of the processed WW: biological oxygen demand (TBOD) Len = 18 mg/l; The technological task is to provide a TBOD of treated wastewater Lex = 5 mg/l. At the same time, the average monthly temperature of PW for the summer period is Tw = 22 °C; average monthly temperature for the winter period Tw = 15 °C. The indicated parameters correspond to the use of a biological pond after a fairly well-functioning biological and physicochemical wastewater treatment of a large milk processing plant. Figures IV–IV show an example of a problem condition and related parameters, formalized in the SCgcode [10].

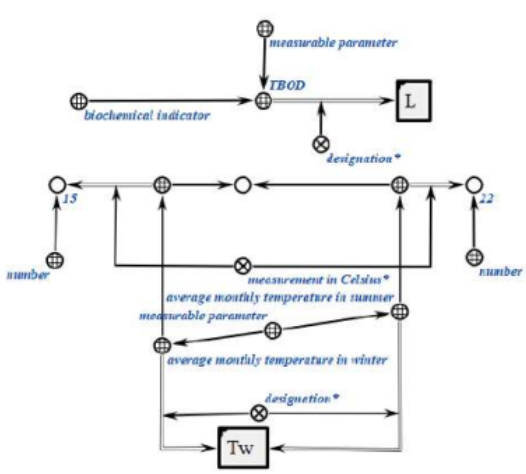

Figure 4. Formulation of the problem conditions (fragment 2)

V. Conclusion The use of OSTIS Technology and the development of the corresponding ISRS in the analysis and formation of new production knowledge in the water use segment of dairy processing enterprises will allow: • increase the efficiency and versatility of decisionmaking, including cases of complex production situations;

• improve administration flexibility, even when expanding technological lines;

• increase the level of qualifications of employees,

since the OSTIS Technology represents a knowledge system in natural language and corresponds to modern ideas about the organization of human longterm memory.

Taken together, the creation of such products based on the OSTIS Technology will form an ontological basis for digital modeling of resource use processes (water, electricity, heat, steam, reagents) in dairies.

Acknowledgment

The authors would like to thank the scientific team of the department of intelligent information technologies of the Belarusian State University of Informatics and Radioelectronics for their assistance in the work and valuable comments.

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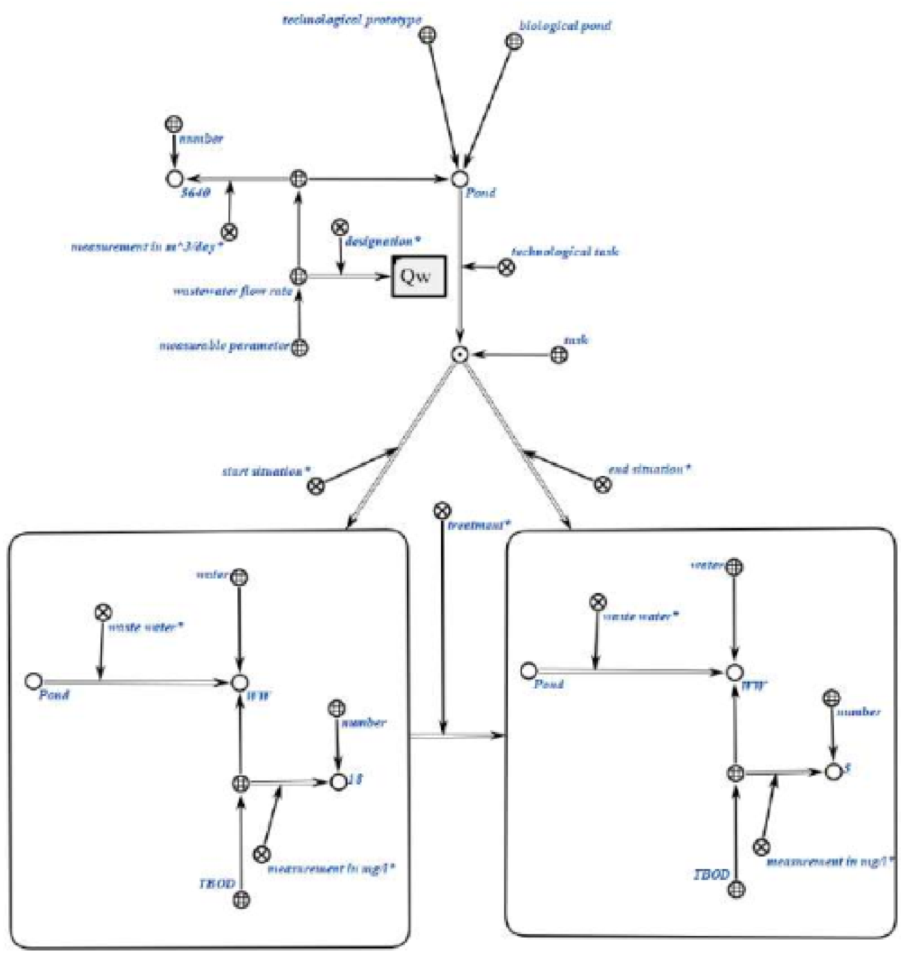

Figure 3. Formulation of the problem conditions (fragment 1)

ПРИКЛАДНЫЕ АСПЕКТЫ ИСПОЛЬЗОВАНИЯ ТЕХНОЛОГИИ OSTIS ПРИ ИНФОРМАЦИОННОМ

ОБЕСПЕЧЕНИИ ЦИФРОВИЗАЦИИ ПРОЦЕССОВ ВОДОПОЛЬЗОВАНИЯ МОЛОКОПЕРЕРАБАТЫВАЮЩИХ ПРЕДПРИЯТИЙ

Штепа В. Н., Муслимов Э. Н. Оценены концептуальные подходы цифровизации производств на основе идеологии e-Manufacturing, которые предложено использовать для моделирования процессов водопользования предприятий по переработке молока, проанализированы организационно-технологические процессы формирования загрязнителей их сточных вод. В методологии IDEF0 выполнено функциональное моделирование водопользования таких производств, что позволило выявить сложность и многонаправленность взаимосвязей параметров и обосновать использование технологии OSTIS для задач формирования интеллектуальной информационно-справочной системы. На примере биологического пруда, как узла очистки сточных вод, реализован элемент предложенного подхода.

Received 13.03.2024