СЕКЦІЯ 2.
ПРИКЛАДНІ ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ, ТЕХНОЛОГІЇ ІНТЕРНЕТУ РЕЧЕЙ, ІНФОРМАЦІЙНА БЕЗПЕКА

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THE APPROACH TO ASSESSING THE SECURITY RISKS OF THE MUNICIPALITY WITHIN THE CONCEPT OF SMART CITY

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A smart city is based on the intellectual exchange of information that takes place between a large number of its various subsystems. The exchange of information is based on a smart operational management model designed for sustainable urban development. It all works well and develops in safe conditions, or local emergencies. Instead, the municipality needs to be prepared and understand the city's capabilities in dangerous situations. Then there is the problem of city management with minimization of risks and resources [1].

The concept of safe Smart City includes not only equipping households and critical urban infrastructure with surveillance cameras, remote control sensors, but also the organization of safe traffic, the most convenient and safe organization of urban space, information security. A risk situation in Smart City management is a set of interrelated or independent factors (actions, circumstances, events or phenomena) that force a decision-maker (DM) to make a decision in conditions of uncertainty, limited knowledge, unclear and incomplete data, causing risk. For our study, risk management includes the management of the municipality in an emergency and catastrophe.

In Smart City, there is an infinite number of connected devices that generate a large amount of data, as well as the associated risks and opportunities. Data and information are central to our digital society. The huge amount of data and the created types of data create new problems, and as a consequence of the knowledge that can be obtained from this data [2].

We formulate the statement of the evaluation problem as follows. Suppose we have the subsystems of the municipality $C_1, C_2, \ldots, C_n$ within the concept of Smart

City. Based on them, it is necessary to assess the risk for the quality of decision-making on the creation and management of preventive measures depending on the regime (staff, emergency, disaster) and propose solutions for the necessary funding to ensure acceptable risk [3-4].

The emergency mode in Smart City is a freelance model of operation, in which the indicators of the quality of the municipal system or the indicators of the external environment lie outside the intervals of the regular mode within such limits that the tendency is observed to the next catastrophe mode.

The catastrophe mode in Smart City is a freelance model of operation, in which the municipal system goes from a working state to such an inoperable, catastrophic state that the transition to a working state is fundamentally impossible. Suppose we have a set of indicators (criteria) according to which we will evaluate the subsystems of the municipality of *K*. We offer evaluation of indicators in a hybrid way, based on the expert experience of the managers of the municipal subsystem and the intellectual analysis of data obtained within the "Smart City Data Sources".

Each indicator of the municipal subsystem is evaluated by a linguistic variable by a regional expert or manager in the field or subsystem of the municipality. We present such a term set of linguistic variables as the level of the situation in the subsystem of the municipality to create preventive measures described by criterion K. The term set we propose the following $T = \{L;\ \ BA;\ \ A;\ \ AA;\ \ H\}$, where: L - «low level"; BA - "below average"; A - "average level"; AA - "above average"; H - "high level" [3].

On the other hand, for each indicator, we get a quantitative estimate, within the "Smart City Data Sources". Depending on the type of data, their structure, frequency of receipt, the subjectivity of receipt, and other characteristics, the membership function is investigated and built separately for each criterion. This will allow to compare the obtained estimates, by translating into a normalized scale, to reveal the vagueness and uncertainty of the obtained data, which will improve the quality of decision-making made using the intellectual analysis of such data. As a result, for each criterion we obtain a quantitative estimate of the situation q from the interval [0; 1], to make decisions on the creation and management of preventive measures [4].

Thus, we can formally present a fuzzy model, risk assessment for the quality of decision-making on the creation and management of preventive measures regarding the regimes of situations, as follows:

$$A(C;\ T; q; M;\ S) \rightarrow R(\mu(R); L; F). \qquad (1)$$

The input data of the model are C - subsystems of the municipality; T - expert level of situations for the creation of preventive measures, which is assessed on the basis of sets of criteria of the subsystems of the municipality; q - quantitative assessment of the situation obtained with the help of components within the "Smart City Data Sources"; M - taking into account the reasoning of the municipal leadership on the scenario of the unfolding of events; S - modes of situations (regular, emergency, disaster).

At the end of the evaluation model, we have: μ(R) - risk assessment for the quality of decision-making by the municipality, on the creation and management of preventive measures (separately, both for the subsystems of the municipality and for

the whole city); L - linguistic interpretation of the level of risk for the quality of decision-making on the creation and management of preventive measures; F - the projected amount of the required number of resources in relation to the risk.

The model is able to assess the level of risk and draw, by a fuzzy inference, a conclusion about the acceptability of risk. The model reveals the vagueness of input estimates, increases the degree of validity of further management decisions on the creation and management of preventive measures.

1. Malyar M., Polishchuk A., Polishchuk V., Sharkadi M. Model of operation management systems risk assessment. Computer science and information technologies CSIT: IEEE XV international scientific and technical conference, (Zbarazh Castle, 23-26 September 2020). Ukraine, 2020. P. 190-193. DOI: 10.1109/CSIT49958.2020.9321930

2. Polishchuk V., Kelemen M., Kelemen jr. M. Methodology for determining the level of process control in complex systems taking into account risk-oriented factors from safe time to pandemics. CEUR-WS. 2021. Vol. 2864. P. 419-433. http://ceur-ws.org/Vol-2864/paper37.pdf

3. Поліщук В.В., Маляр М.М. Моделювання оцінки рівня ризику функціонування соціо-економічних систем. Науковий вісник Ужгородського університету, серія «Математика і інформатика». 2020. Вип. 1 (36). С. 92-104. DOI: 10.24144/2616-7700.2020.1(36).92-104

4. Polishchuk V., Polishchuk A., Jevčák J., Choma L., Kelemen jr. M. Criteria for the information model for assessing the risks of unmanned aerial vehicle flights in environmental research on mountain terrain. SGEM 2020: XXth international multidisciplinary scientific GeoConference, (Varna, 16-25 August 2020). Bulgaria, 2020, 20. 2.1. P. 97-102. DOI: 10.5593/sgem2020/2.1/s07.013

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ПРОЕКТУВАННЯ ТА РЕАЛІЗАЦІЯ СИСТЕМИ З ПРОГНОЗУВАННЯ ПОГОДИ

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Вступ. За останні 50 років комп’ютерний світ докорінно змінив наш світ. Комп’ютерні технології допомогли людству створити багато нових технологій, які кожного дня покращують або спрощують життя людей. Один із видів таких технологій є методи прогнозування погоди, які дає людям можливість оцінити приблизну вірогідність погоди на наступний день. Дана тематика також дає можливість провести дослідження, в результаті якого можна буде створити додаток з прогнозування погоди, враховуючи, новітні методи побудов систем такого роду [2].