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ANALIZA METOD I SYSTEMÓW WSPOMAGAJĄCYCH PODEJMOWANIE DECYZJI DLA ZADAŃ ZWIĄZANYCH Z BEZPIECZEŃSTWEM CYBERNETYCZNYM

Streszczenie: W artykule przeanalizowano istniejące systemy wspomaganie decyzji. Zdefiniowano ich główne cechy charakterystyczne. Przeprowadzono porównanie z opracowanymi przez autora modułami oprogramowania, a także definiuje się ich główne zalety i wady.

Słowa kluczowe: system wspomaganie decyzji, bezpieczeństwo informacji, bezpieczeństwo cybernetyczne, system informacyjny

ANALYSIS OF METHODS AND SYSTEMS SUPPORTING DECISION-MAKING IN THE FIELD OF CYBERSECURITY TASKS

Summary: the article analyzes the existing decision support systems. Their main characteristics were defined. Comparison with the developed author's software modules is carried out, and also their main advantages and disadvantages are defined.

Keywords: decision support system, information security, cybersecurity, information system

1. Introduction

Today, the question of choice is very relevant, and this has not bypassed the cybersecurity industry. This industry, like others, requires reasonable and quality decision-making. However, the number of factors that need to be considered in the decision-making process is much greater. Today, decision support systems (DSS)

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have been widely used in various areas of management, including in the field of cybersecurity. Cyber security challenges are multifaceted and therefore require not only formalized but also informalized methods of decision making. Therefore, the search for an DSS system that allows the processing of information depending on the needs of the decision-maker is an urgent task [1-5].

The purpose of the analysis is to investigate the applicability of existing DSS software systems for non-standard tasks in the field of cybersecurity.

2. The main part

Since information security measures are characterized by a large number of criteria, the choice of one or the other of them is a complex multi-criteria task that depends to a large extent on the preferences of the decision-maker. In multi-criteria objectives, the quality of the solution can be measured by a group of indicators rather than one indicator. In such situations, there is the problem of assessing and comparing the benefits of different decisions based on several criteria. Sometimes a group of experts with specialized knowledge of cyber security is used to improve the quality of decision-making. In such cases, the type of DSS expert system is often used. "Expert Decision Support System" is a system focused on automating the procedures for analyzing problem situations and selecting optimal solutions. It belongs to the class of information systems that combine the advantages of expert systems and decision support systems [6].

There is a large number of DSSs on the market for computer products, but not all of them are suitable for use by a group of persons. We will analyze such systems.

Expert Choise combines group collaboration tools and proven mathematical methods that allow your team to get the best solution to achieve their goals. The expert selection process allows you to measure the possibility of competing goals and alternatives; it synthesizes information, expertise and judgment.

The Super Decision software is based on the analytical network method and the Saati method. Of particular interest are group decisions on societal issues, conflict resolution and optimization of resource allocation for private and public organizations [7-9].

The commercial software product "Decision Lens" for decision support organizations, has the following methodological features: - Theoretical bases of the system - methods of analysis of hierarchies and analytical networks; - availability of web-interface; - possibility of group work [10].

DSS "ELECTRE III - IV" is used when a decision-maker can assign an "internal scale" to pseudo-criteria. ELECTRE IV allows you to create multiple (nested) updates when it is not possible to assign a scale to each pseudo-criterion. Instead of the decision-maker, he should assume that none of the criteria is dominant or insignificant.

"ELECTRE TRI" is a tool that helps to solve a multi-criteria problem and is designed to solve sorting problems. Starting with a final set of actions, which are evaluated based on quantitative and qualitative criteria and a set of predefined categories of recommendations (e.g. very good, good, ... bad, very bad), ELECTRE TRI provides users with two different methods for assigning each category action.

The assignment of any action is based on comparing the action and the reference actions using the above-mentioned ratio [11-13].

The possibilities of the Emperor 3.1 program make it possible to solve the problems of rating, choice of alternatives, allocation of resources, forecasting, planning, taking into account preferences, modeling of situations. The "Emperor" decision support system is based on the method of Hierarchy Analysis.

The Expert system is based on the method of Hierarchy Analytic (HAI) T. Saati. Features of the system: support of both numerical values and subjective verbal preferences of the user. Ability to analyze data for consistency and reliability, eliminating inconsistencies. Convenient graphical interface, tools for problem formalization, analysis of results. Detailed printed reports. Presence of a library of typical hierarchies for solving problems of forecasting and management in various spheres of activity. Presence of a library of solutions for typical tasks in the field of finance, economics, personnel management, enterprise, etc [14-15].

The OPTIUM Decision Support System is based on the Hierarchy Analysis (HAI) method. In the program the possibility of setting up the user interface is implemented. Each user can create comfortable workplaces in this program. The help system contains a description of all application tools.

System "Choice" 5.3 is a simple and convenient tool that will help to structure the problem, to build a set of alternatives, to highlight the factors that characterize them, to set the importance of these factors, to assess the alternatives for each of the factors, to find inaccuracies and contradictions in the judgments of the decision maker / expert, to rank the alternatives, to analyze the solution and justify the results. It can be used in solving the following typical tasks: assessment of quality of organizational, design and engineering solutions; determination of investment policy in various areas; tasks of placement (choice of location of harmful and hazardous industries, service points); allocation of resources; carrying out analysis of the problem by the method of "cost-benefit"; strategic planning; design and selection of equipment and goods.

The "MPRIORITY" system is based on the method of Hierarchy Analysis. The system "MPRIORITY" differs from its analogues in its dialogue interface, adapted to the peculiarities of MAI and user perception. The program contains the dialogue means allowing to receive the fullest information on the spent pair comparisons and to eliminate possible inconsistencies in matrixes of pair comparisons. Use of the mechanism of templates present in program system (a template - the ready hierarchy for one of problems of decision-making) allows the user to adapt program system under the field of the activity.

DSS "SRF" helps the decision maker or his representative to determine the weight of the criteria. The SRF software is designed for criteria to be used in the ELECTRE method. This procedure is based on the association of playing cards for each criterion. The interviewee was asked to place these cards in the bundles of blank cards potentially contained in the interval. These operations collect certain information necessary to determine the weights.

"The DM-MAI Decision Support Module is a decision support software designed to address the problem of ranking by preference for alternatives in a predefined category according to their assessments and criteria. For example, it can be used to sort security tools (e.g. "Very good", "Good", "Bad", "Unsuitable"). DM-MAI implements a method of Hierarchy Analysis. This software not only uses a multi-user mode, but also compares the quality of the decision-maker's assessment using two

methods of assessing the competence of experts using the ranking method and the experimental qualimetric method), which improves the quality of decision-making by screening out incompetent persons who participate in the decision-making process. [18]

"Decision Support Software Module" is a convenient tool that helps to solve a multi-criteria task and is designed to solve ranking problems. The point method is based on the point method, which makes it possible to carry out evaluation on the basis of quantitative and qualitative criteria (for example, very good, good, bad, very bad). [19]

The software system "DMS" has two variants of use: single-user and multiuser interfaces, which allows the team of experts to work. It is based on decision making methods: frequency distributions, group averages, cross section tables, paired regression, hierarchy analysis method. The system also provides the possibility of preliminary assessment of the competence of experts [16].

Combine DSS uses in one system a combination of statistical and expert methods of decision-making. This is a unique software product that allows for qualitative and quantitative assessments. The system implements statistical methods: correlation analysis, position radar, multivariate scaling, classification method. If statistical methods are not suitable for solving the problem, then a convenient point method is offered that allows solving non-standard tasks. In the system it is possible to compare the results obtained by different methods to choose the optimal solution [17,20-21].

The table shows the comparison of systems for the use of methods to obtain importance coefficients and the presence/absence of direct dependence on the opinion of experts.

Table 1. DSS comparison according to methods of the importance coefficient determination and dependence on experts

| System name | Methods for benefits determining | Ability to assess the competence of an expert | Quantitative/qualitative methods are used | Knowledge base availability |
|--------------------------------|--|---|---|-----------------------------|
| Expert decision support system | Method of pairwise comparisons | - | Quality | Not exist |
| Expert Choise | Method of pairwise comparisons | - | Quality | Not exist |
| Super Decission | MAM and Saathi's method | - | Quantitative | Not exist |
| Decision Lens | HAI and MAM | - | Quantitative | Not exist |
| Imaginatik Idea Central | Mathematical methods | - | Quality | Not exist |
| ELECTRE IS | Pseudo-criteria are used | - | Quality | Not exist |
| ELECTRE III-IV | Pseudo-criteria are used | - | Quality | Not exist |
| ELECTRE TRI | Can provide different methods depending on the expected result (qualitative or quantitative) | - | Quality Quantitative | Not exist |
| Emperor 3.1 | HAI | - | Quantitative | Not exist |
| DSS«Expert» | HAI | - | Quantitative | Not exist |
| OPTIUM | HAI | - | Quantitative | Not exist |

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|------------------------------------|--|---|----------------------|-----------|
| DSS «Choice» 5.3 | Method of pairwise comparisons | - | Quality | Not exist |
| MPRIORITY | HAI | - | Quantitative | Not exist |
| SRF | Playing cards method | | Quality | Not exist |
| «Decision support module DM-MAI» | HAI | + | Quality | Not exist |
| «Decision support software module» | Point method | + | Quantitative Quality | Not exist |
| Software system «DMS» | frequency distributions, group averages, cross-section tables, pair regression, HAI | + | Quantitative Quality | Not exist |
| Combine DSS | Statistical methods: correlation analysis, positional radar, multidimensional scaling, classification method. Point method | + | Quantitative Quality | Not exist |

3. Conclusion

As can be seen from the analysis, all DSSs are based on expert judgments, which are updated when selecting each new solution. None of the DSSs presented contain a knowledge base. Since the expert judgement on one or the other alternative may change under the influence of external factors, it is advisable to create a knowledge base that contains independent expert judgements on a certain common problem in different circumstances, the system will use this existing knowledge base in its further work and will not be directly dependent on the opinion of experts. A separate problem in the formation of the expert group is the verification of the competence of the LPR, so the opportunity to conduct an assessment, using the capabilities of the SPS, is quite convenient. Formation of a database of opinions of competent experts will help to save time as there is no necessity to form expert group each time at occurrence of a new similar problem.

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