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Information technology of integrated management of threats and opportunities in IT projects

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ABSTRACT

Nowadays, information technology plays a significant role in increasing the efficiency of any company by focusing its attention on market trends, reducing and increasing competition for maximum profit. Based on the results of the analysis of scientific works, the author concluded that the existing information technologies in project risk management can be partially applied to manage the risks of IT projects, taking into account threats and opportunities. Therefore, this study is dedicated to solving the scientific and practical problem of developing information technology for risk management in such projects, which would consider the impact of threats and opportunities. The developed structure of the information base of the integrated management of threats and opportunities in the IT project will make it possible to implement risk management models and methods to ensure the accumulation of statistical and expert information on the management of threats and opportunities. The structure of the information technology of integrated management of threats and opportunities in the IT project, as well as the scheme of its implementation, have been developed, which in turn will enable the project manager and his team to implement the relevant models and methods developed by the author in order to ensure the successful and timely implementation of the project to meet the needs of project stakeholders. The given algorithm for filling the information technology of integrated management of threats and opportunities in the IT project will allow managing risks taking into account threats and opportunities in accordance with the developed models and methods of integrated management of threats and opportunities in the IT project, which differs from modern approaches to risk management in project management methodology and programs and will reduce negative impacts and take into account positive impacts in such project. Thus, the obtained results make it possible to increase the effectiveness of risk management in IT projects, taking into account the impact of threats and opportunities on them.

Keywords: Information technology; IT project; integrated management; risk management; risks; threats; opportunities; structure; database

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INTRODUCTION

Today, information technology plays an important role in improving the efficiency of any company by focusing on market trends, reducing and increasing competition to maximize profits [1]. Modern management information systems are aimed at increasing the capabilities and ways of managing the system and improving the company's management processes, which at each stage of management is strengthened by the introduction of software in modern market conditions, are the circumstances of the successful functioning of the company in the current environment.

In the world and in Ukraine, the project management methodology is being successfully implemented, which considers any idea, function, or end result of an enterprise that is already an

Ukraine, after the transformation of the economy independent project [2]. In the current conditions of new methods and mechanisms of economic relations are being developed. Therefore, it is necessary to create special approaches to enterprise project management for its further profit from its activities. Information technologies help to solve the problem of increasing complexity of the developed approaches, increasing requirements for the timing and quality of work, which necessitate effective project management [1, 3]. The peculiarity of Information Technology (IT) projects is characterized by a large number of threats and opportunities and the use of technology, so projects of this kind are a good area for developing an information technology approach with integrated threat management.

The company's sustainable development is based on the skills, experience, and management

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approaches, and the implementation of projects and process of transition to a new stage of development. In the application of sustainable development, a project looks like an idea, perception, promising the state, or items needed for its implementation and realization. The main features of the project are novelty, conceptuality, uniqueness, adaptability, quantifiability, time limitations, and others.

In the context of the current dynamics of project management, we can conclude that the role of information technology is increasing, and it is they who can increase management efficiency and reduce the proportion of project incompleteness. Information technology factors, such as adaptation to change, resource management, team management, communication, and constraints, have a significant impact on the project.

ANALYSIS OF LITERARY DATA

With the introduction of information technology, companies are able to successfully manage projects, establish communication between project participants, find and quickly respond to deviations, report on all stages of the project, and be able to quickly exercise control [1, 3]. Information technology is a combination of procedures that implement the functions of collecting, accumulating, storing, processing, and transmitting data based on the use of a selected set of technical means with the participation of management personnel [1, 3].

Paper [4] developed an information technology that allows the construction of complex energy facilities according to the least risky topology of the project network schedule, the schedule of which will be minimal in terms of the risk of increasing the project execution time and scope. The results of this study will be useful in the process of developing information technology for risk management in IT projects.

In paper [5], the author developed the structure of the information base and information technology for integrated project deviation management, which allows simultaneous management of risks, changes, problems, conflicts, stresses, and crises. The presented information technology for integrated project deviation management differs from modern approaches to deviation management in project and program management methodology, and its implementation leads to a reduction in negative deviations in the project. This study can become the

basis for the development of information technology for risk management in IT projects, taking into account threats and opportunities.

Papers [6, 7] developed an information technology for integrated risk management of research projects under conditions of uncertainty and the transition to a circular economy, which, under conditions of uncertainty, allows the research project manager and his team to implement the methodology of integrated risk management of research projects under conditions of uncertainty and the transition to a circular economy developed by the author to ensure the successful and timely implementation of a research project to meet the needs of its stakeholders. The results of this study will form the basis for the development of information technology for managing threats and opportunities in IT projects.

In paper [8], the author created a computer system for analyzing project indicators, consisting of subsystems for assessing the impact of environmental factors and simulating internal risks. This study will be useful in developing information technology for risk management in IT projects, taking into account the impact of threats and opportunities.

Paper [9] developed an information technology of a risk-based approach that provides solutions to the problems of managing risks, resources, finances, timing, and quality of projects and programs for the development of risk-resistant technology. The results of this study can be the basis for the development of information technology for managing risks, including threats and opportunities, in IT projects.

The author in paper [10] presents analytical models of errors in the main indicators of projects, product models for choosing methods for calculating the main indicators of projects for the creation of new technology, as well as applied information technology for decision support regarding the process of project analysis of this creation, which ensures increased efficiency and validity of the choice of project analysis methods. This research will form the basis for the development of models and methods for managing threats and opportunities in IT projects, which will become the basis for information technology for risk management in IT projects.

Paper [11] further developed the information model of interaction between stakeholders of organizational projects in the field of aircraft

maintenance by reducing the impact of the risks of each stakeholder, taking into account the factors of behavioral economics. The results of this study will be useful in the process of developing information technology for risk management in IT projects, taking into account the impact of threats and opportunities.

In paper [12], the author created an information model of a medical project in terms of project quality programs for the organization's development reflects management within the framework of the value-based approach, which allows solving a number of tasks, such as: selecting those changes in the healthcare project that will improve the quality of healthcare services; initiate those projects that will ensure the necessary changes in the quality of healthcare services; develop such action plans in the initiated projects that will ensure the necessary modernization of the overall quality system of healthcare services. This study will be useful in forming information links in the process of developing information technology for risk management in IT projects, taking into account the impact of threats and opportunities.

Thus, it can be concluded that existing information technologies in project risk management can be partially applied to IT project risk management, taking into account threats and opportunities. Therefore, the author proposes to develop an information technology for risk management in IT projects that would take into account the impact of threats and opportunities.

THE PURPOSE OF THE ARTICLE

The aim of the work is to develop an information technology for integrated threat and opportunity management in IT projects, which will help to improve the efficiency of risk management in these projects.

To achieve this goal, it is necessary to complete the following objectives:

1. Develop the structure of the information base for integrated threat and opportunity management in an IT project.
2. Develop an information technology for integrated threat and opportunity management in an IT project.
3. To develop an algorithm for filling the information technology of integrated threat and opportunity management in an IT project, which will include the necessary actions on a set of models.

DEVELOPMENT OF THE STRUCTURE OF THE INFORMATION BASE FOR INTEGRATED MANAGEMENT

In the course of the research conducted by the author in previous works, models and methods for integrated management of threats and opportunities in IT projects have been developed. The purpose of these models and methods is to ensure integrated risk management in IT projects, taking into account the impact of threats and opportunities [13, 14, 15, 16, 17, 18, 19].

In addition, the author analyzed information technologies that can be used to manage risks in IT projects, but the author determined that they do not allow for integrated risk management, taking into account threats and opportunities.

The information technology of integrated threat and opportunity management in the IT project will be built on the basis of the developed structure of the relevant information base (Fig. 1), which includes:

0 - reference base for integrated threat and opportunity management in an IT project;

1 - information base of threats and opportunities in an IT project;

2 - information base for assessing threats and opportunities in an IT project;

3 - information base for managing threats and opportunities in an IT project.

Reference database files for integrated threat and opportunity management in an IT project:

D1 – register of IT projects;

D2 – table of threats to an IT project;

D3 – table of IT project capabilities;

D4 – strategies for responding to uncertainty;

D5 – threat response strategies;

D6 – strategies for responding to opportunities;

D7 – prevention methods for integrated threat and opportunity management in an IT project.

Information base files for integrated threat and opportunity management in an IT project:

F1 is the RIO-RIT-REO-RET analysis model in an IT project;

F2 – targeted models of integrated threat and opportunity management in an IT project;

F3 – intelligent model for integrated threat and opportunity management in an IT project;

F4 – input data for calculating a mathematical model of integrated threat and opportunity management in an IT project.

Files of the information base for assessing

threats and opportunities in an IT project:

F5 – information about the IT project;

F6 – preliminary register of threats and opportunities for an IT project;

F7 – the results of the RIO-RIT-REO-RET analysis of the IT project, including the formation of the final register of threats and opportunities;

F8 – results of a qualitative assessment of threats and opportunities of the IT project;

F9 – results of classifying risky events of an IT project;

F10 – results of determining the quantitative indicators of the impact of risky events of the IT project;

F11 – results of determining the synergistic impact of threats and opportunities in an IT project;

F12 – graph of IT project risks, taking into account threats and opportunities;

Files of the information base for managing threats and opportunities in an IT project:

F13 – a set of alternative strategies for responding to the impact of uncertainty, threats and opportunities in an IT project;

F14 – results of calculating the probability of successful use of risks, taking into account threats and opportunities in an IT project;

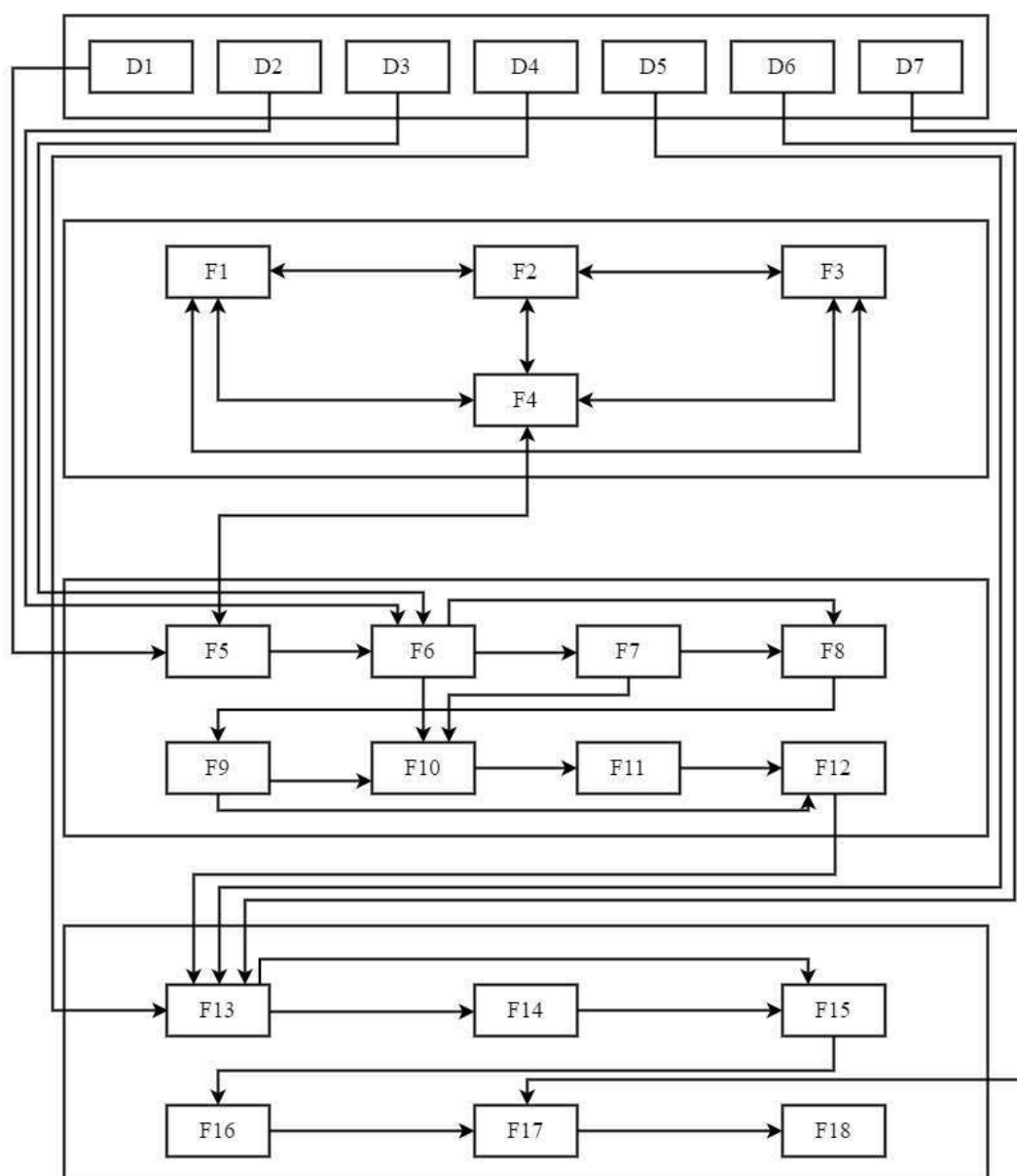


Fig. 1. Structure of the information base for integrated threat and opportunity management in IT projects

Source: compiled by the authors

F15 – results of quantitative analysis of the cost of strategies for responding to the impact of uncertainty, threats and opportunities in an IT project;

F16 – actual parameters of threats and capabilities of the IT project after applying response strategies;

F17 – prevention methods for uncertainty, threats, and opportunities in an IT project;

F18 – target function of managing threats and opportunities in an IT project after applying prevention methods.

The developed structure of the information base of integrated threat and opportunity management in an IT project will make it possible to implement models and methods of risk management in an IT project in order to ensure the accumulation of statistical and expert information on threat and opportunity management.

DEVELOPMENT OF INFORMATION TECHNOLOGY FOR INTEGRATED MANAGEMENT

Based on the developed models and methods of integrated management of threats and opportunities in IT projects, as well as the corresponding structure of the information base, shown in Fig. 1, it is possible to develop an appropriate information technology [14, 15], [16, 17], [19].

In the process of developing information technology, scientific works will be used, including the following: [4, 5], [6, 20], [21].

The structure of information technology for integrated threat and opportunity management in an IT project is shown in Fig. 2 and consists of the

following elements.

1. A technology for filling the uncertainty information base with threats and opportunities in an IT project, which is implemented by monitoring the actual parameters of the IT project from the project documentation in the process of regular monitoring of its implementation.

The developed models are used: the RIO-RIT-REO-RET model of analysis in an IT project; targeted models of integrated threat and opportunity management in an IT project; an intelligent model of integrated threat and opportunity management in an IT project; a mathematical model of integrated threat and opportunity management in an IT project.

2. Technology for filling the information base for assessing threats and opportunities in an IT project, which is implemented using the developed models and methods of integrated management of threats and opportunities in an IT project, in particular:

- identification of uncertainties, taking into account threats and opportunities, and classification of risky events, which is realized through RIO-RIT-REO-RET analysis;

- determination of qualitative and quantitative assessment of risk events of an IT project using expert methods and targeted models of threats and opportunities management of an IT project proposed by the author;

- determining the synergistic impact of risky events in an IT project using a mathematical model of managing threats and opportunities in an IT project and a method of integrated threat and opportunity management in an IT project.

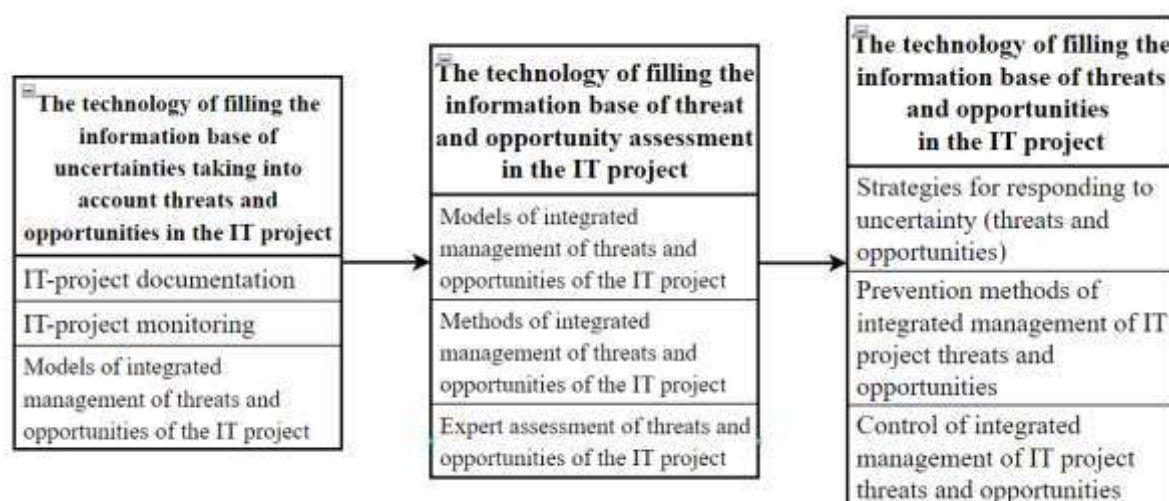


Fig. 2. Structure of information technology for integrated threat and opportunity management in IT projects

Source: compiled by the authors

3. Technology of filling the information base of threat and opportunity management in an IT project, consisting of selection and evaluation of the effectiveness of strategies for responding to uncertainty, threats and opportunities of an IT project, methods of prevention of integrated risk management and opportunities of an IT project and storage of lessons learned.

This technology is realized by means of the developed methods, in particular: strategies for responding to uncertainty, threats and opportunities, prevention methods of integrated threat management and opportunities in an IT project, a method of intelligent selection of the optimal strategy for managing risk events: threats and opportunities.

The information technology scheme of integrated threat and opportunity management in an

IT project is shown in Fig. 3.

Thus, the structure of the information technology for integrated threat and opportunity management in an IT project, as well as the scheme for its implementation, have been developed, which in turn will allow the IT project manager and his team to implement the relevant models and methods developed by the author to ensure the successful and timely implementation of the IT project to meet the needs of its stakeholders.

ALGORITHM FOR FILLING INFORMATION TECHNOLOGY OF INTEGRATED MANAGEMENT

According to Fig. 1 and Fig. 2, an information technology for integrated threat and opportunity management in IT projects was developed.

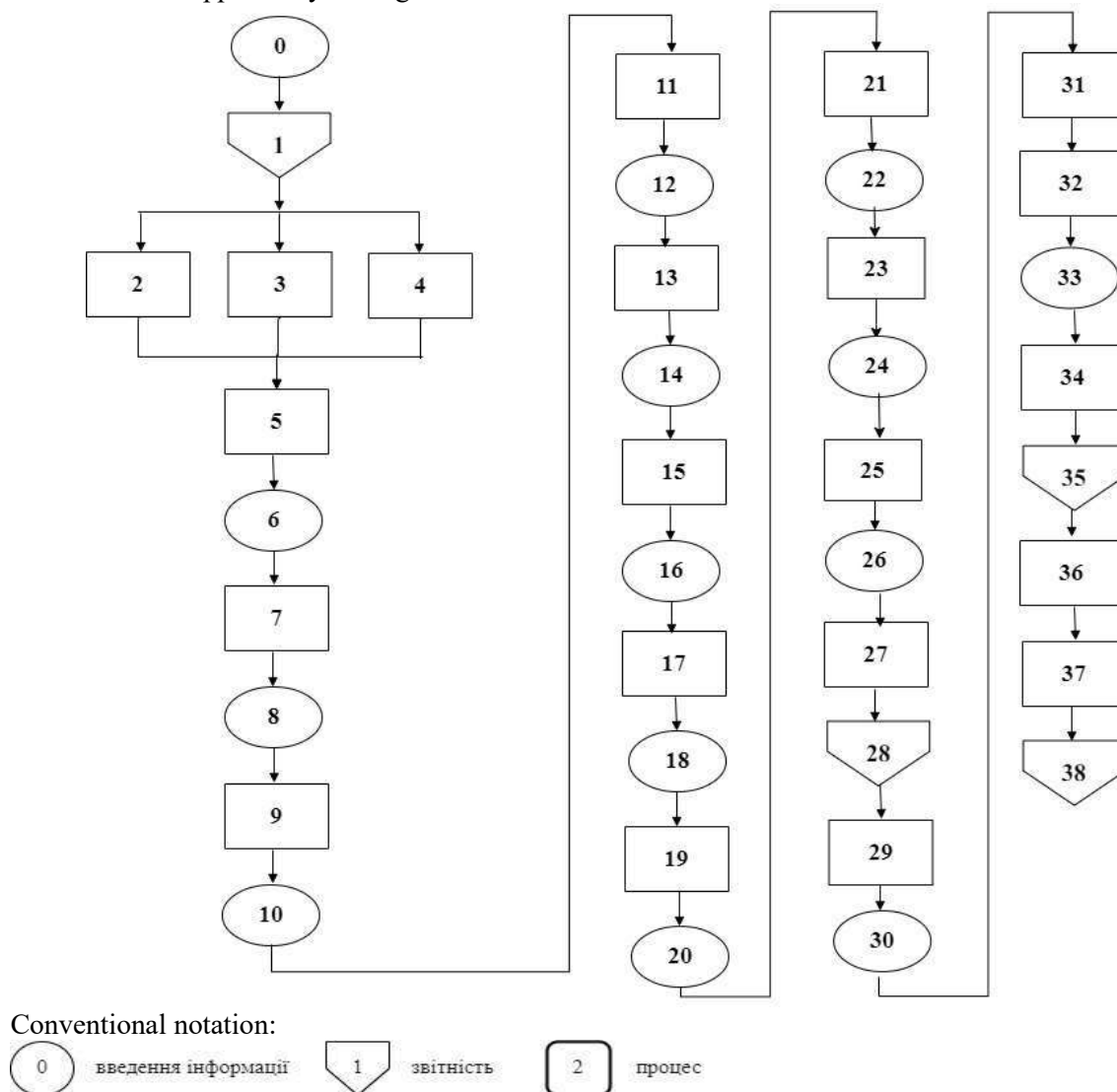


Fig. 3. Scheme of information technology for integrated management of threats and opportunities of an IT project

Source: compiled by the authors

Taking into account the research proposed by scientists in their works [4, 5], [6, 20], [22, 23], [24], the author proposes the following algorithm for filling the information technology of integrated threat and opportunity management in an IT project:

0 – Formation of a reference base for integrated threat and opportunity management in an IT project – filling files with data [13, 14], [15, 16], [17, 18], [19]:

D1 – register of IT projects [14];

D2 – table of threats to an IT project [14];

D3 – table of IT project capabilities [14];

D4 – strategies for responding to uncertainty [19];

D5 – threat response strategies [19];

D6 – strategies for responding to opportunities [19];

D7 – prevention methods for integrated threat and opportunity management in an IT project [19].

1. As a result of regular monitoring of the IT project, weekly reports on the progress of the IT project are received, which contain planned and actual indicators of the IT project (volume, time and cost), as well as calculated deviations.

2. According to the data provided in the weekly reports, the RIO-RIT-REO-RET analysis model is built in the IT project [14].

3. According to the data provided in the weekly reports, targeted models of integrated threat and opportunity management in the IT project are built [15].

4. Based on the data provided in the weekly reports, an intelligent model of integrated threat and opportunity management in an IT project is built [17, 18].

5. In accordance with paragraphs 2-4, a mathematical model of integrated threat and opportunity management in an IT project is developed [16].

6. Based on the data obtained in paragraphs 2-5, fill in the information base of integrated threat and opportunity management in the IT project, in particular: files F1-F4.

7. In accordance with the data provided in the information base of integrated management of threats and opportunities in the IT project (file D1), a preliminary register of IT projects is built [14].

8. The results of clause 7 shall be recorded in file F5.

9. For IT projects identified in clause 8 (file

F6), a preliminary register of threats and opportunities of the IT project is formed from the information base of integrated management of threats and opportunities in the IT project (files D2 – D3) [14].

10. The results of clause 9 shall be recorded in file F7.

11. In accordance with the data provided in files F6 and F7 (paragraphs 8 and 10), an expert qualitative assessment of threats and opportunities is being conducted [15].

12. The results obtained in clause 11 shall be recorded in file F8.

13. Based on the data obtained in clause 12, classification of risky events of the IT project is performed.

14. The results obtained in clause 13 shall be entered into file F9 [17, 18], [19].

15. Based on the data provided in file F9, quantitative indicators of the impact of risky events of the IT project are determined in accordance with the target models of integrated threat and opportunity management in the IT project [15].

16. The results of clause 15 shall be entered into the appropriate file of the information base of integrated threat and opportunity management in the IT project – F10.

17. In accordance with the data obtained in clause 16 and the mathematical model of threats and opportunities management in IT projects, the synergistic impact of threats and opportunities in an IT project is determined [16].

18. The results of clause 17 shall be recorded in file F11.

19. Based on the data provided in file F11, as well as by applying the method of integrated management of threats and opportunities in IT projects, a risk graph of the IT project is built taking into account threats and opportunities [19].

20. The results of clause 19 shall be recorded in file F12.

21. Based on the data in File F12 and reference files D5 through D7, the IT project manager forms a set of alternative strategies for responding to the impact of uncertainty, threats, and opportunities in the IT project [17, 18].

22. The results of step 21 shall be recorded in the F13 file.

23. In accordance with the data provided in file F13, as well as taking into account the method of

intelligent selection of the optimal strategy for managing risk events: threats and opportunities, the probability of successful use of risks, taking into account threats and opportunities in the IT project, is calculated [17, 18].

24. The results of step 23 shall be entered into the F14 file.

25. In accordance with the data provided in files F13 and F14, as well as using the method of intelligent selection of the optimal strategy for managing risk events: threats and opportunities, a quantitative analysis of the cost of strategies for responding to the impact of uncertainty, threats and opportunities in an IT project is carried out [17, 18].

26. The results of step 25 shall be entered into the F15 file.

27. Implementation of strategies to respond to uncertainty, threats and opportunities of the IT project, in accordance with the selected strategies [19].

28. Weekly reports are received on the progress of the IT project, as well as on the strategies applied for integrated threat and opportunity management in the IT project.

29. Based on the data obtained in paragraphs 22, 24 and 26, as well as in accordance with the method of intelligent selection of the optimal strategy for managing risk events: threats and opportunities, the actual parameters of threats and opportunities of the IT project after applying response strategies are determined [17, 18].

30. The results of clause 29 shall be recorded in file F16.

31. Controlling the results of reducing the impact of threats and taking into account the impact of opportunities – if the application of the selected strategies did not help reduce the negative consequences in the IT project, proceed to step 2 or step 23 of the information technology for integrated management of threats and opportunities in the IT project, depending on the decision made by the IT project manager.

32. In case of successful implementation of integrated management of threats and opportunities of the IT project, the IT project manager selects prevention methods for uncertainties, threats and opportunities in the IT project from the reference file D7.

33. Information on the implementation of clause 32 shall be entered in the F17 file.

34. Apply the selected prevention methods to the uncertainties, threats, and opportunities of the IT project.

35. Receive weekly reports in the IT project on the work performed and preventive measures implemented for uncertainties, threats and opportunities.

36. The actual parameters of uncertainties, threats and opportunities of the IT project after applying appropriate prevention methods are entered into the F18 file of the information base of integrated management of threats and opportunities in the IT project by forming the target function of threat and opportunity management in the IT project [17, 18, 19].

37. Controlling the impact of uncertainties, threats and opportunities on the IT project based on the data provided in file F18. If the impact is not reduced after applying the prevention methods, it is possible to repeat the selection of prevention methods – go to paragraph 32.

38. In case of successful application of prevention methods, the implementation of information technology is completed and reports on integrated threat and opportunity management in the IT project are generated and printed.

The presented algorithm for filling the information technology of integrated threat and opportunity management in an IT project will allow managing risks taking into account threats and opportunities in accordance with the developed models and methods of integrated threat and opportunity management in an IT project, which differs from modern approaches to risk management in project and program management methodology and will reduce negative impacts and take into account positive impacts in an IT project.

CONCLUSION

As a result of the study, the author developed an information technology for integrated management of threats and opportunities in IT projects, in particular:

1. The developed structure of the information base for integrated threat and opportunity management in an IT project will make it possible to implement models and methods of risk management in an IT project in order to ensure the accumulation of statistical and expert information on threat and opportunity management.

2. The structure of the information technology

for integrated management of threats and opportunities in the IT project, as well as the scheme of its implementation, have been developed, which in turn will allow the IT project manager and his team to implement the relevant models and methods developed by the author to ensure the successful and timely implementation of the IT project to meet the needs of its stakeholders.

3. The given algorithm for filling the information technology of integrated threat and opportunity management in an IT project will allow managing risks taking into account threats and

opportunities in accordance with the developed models and methods of integrated threat and opportunity management in an IT project, which differs from modern approaches to risk management in project and program management methodology and will reduce negative impacts and take into account positive impacts in an IT project.

Thus, the results obtained make it possible to increase the efficiency of risk management in IT projects, taking into account the impact of threats and opportunities on them.

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Інформаційна технологія інтегрованого управління загрозами та можливостями в ІТ-проектах

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АНОТАЦІЯ

На сьогоднішній день інформаційні технології відіграють важливу роль у підвищенні ефективності діяльності будь-якої компанії шляхом зосередження своєї уваги на тенденціях розвитку ринку, зниженні та посиленні конкуренції для отримання максимального прибутку. Проаналізовано наукові праці, в яких розглянуто питання розробки підходів, моделей та методів

управління IT-проектами в умовах турбулентності та невизначеності, зокрема ризиків, загроз та можливостей. За результатами аналізу наукових праць автором зроблено висновок про те, що існуючі інформаційні технології в управлінні ризиками проектів частково можуть бути застосовані для управління ризиками IT-проектів з урахуванням загроз та можливостей. Тому це дослідження присвячено вирішенню науково-практичної задачі щодо розробки інформаційної технології управління ризиками в таких проектах, яка б враховувала вплив загроз та можливостей. Розроблена структура інформаційної бази інтегрованого управління загрозами та можливостями в IT-проекті дасть можливість реалізувати моделі та методи управління ризиками в IT-проекті з метою забезпечення накопичення статистичної та експертної інформації щодо управління загрозами та можливостями. Розробка означеної інформаційної технології ґрунтується на розроблених авторами моделях та методах інтегрованого управління загрозами та можливостями в IT-проектах, зокрема концептуальній, таргетній, інтелектуальній та математичній моделях, моделі RIO-RIT-REO-RET-аналізу, а також методах інтегрованого управління загрозами та можливостями та інтелектуального вибору оптимальної стратегії управління ризиковими подіями: загрозами та можливостями. Розроблені структура інформаційної технології інтегрованого управління загрозами та можливостями в IT-проекті, а також схема її реалізації, які у свою чергу дадуть змогу керівнику проекту та його команді реалізувати розроблені автором відповідні моделі та методи з метою забезпечення успішної та своєчасної реалізації IT-проекту для задоволення потреб його стейкхолдерів. Наведений алгоритм наповнення інформаційної технології інтегрованого управління загрозами та можливостями дозволить управляти ризиками з урахуванням загроз та можливостей відповідно до розроблених моделей та методів інтегрованого управління загрозами та можливостями в IT-проекті, яка відрізняється від сучасних підходів до управління ризиками в методології управління проектами та програмами й дозволить зменшити негативні впливи та врахувати позитивні впливи в IT-проекті. Таким чином, отримані результати дозволяють підвищити ефективність управління ризиками в IT-проектах з урахуванням впливу на них загроз та можливостей.

Keywords: інформаційна технологія; IT-проект; інтегроване управління; ризики; загрози; можливості; структура; база даних

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