

*The object of research is the risk appetite of an IT project. It is important for the implementation of an IT project to determine the critical values of indicators important for the activity, which predetermines the need to define and manage risk appetite. Risk appetite management in the implementation of an IT project directly affects its successful implementation and requires theoretical and methodological foundations for its consideration in the project management system. By establishing risk appetite, the project manager determines how much risk s/he is willing to take in order to achieve the key goals of the project. The definitions of "risk appetite", "risk tolerance", "risk appetite" in the implementation of IT projects have been clarified. It is determined that risk appetite should be considered as an integral set of IT project risk, which affects the achievement of the set goals: completion of the project in time, volume and budget that have been agreed. Risk tolerance defines acceptable limits for individual operational risks of the project. This will allow project participants to understand the limits of their authority and responsibility in risk management. A survey of project managers was conducted on their understanding of risk appetite and its use in project management. As a result, the most significant risks and the most used indicators and methods for establishing the risk appetite of IT projects were identified. This made it possible to generalize the experience of establishing and using risk appetite in IT projects. Also, based on the results of the study, an integrated risk appetite management system for the implementation of an IT project is proposed. This will allow balancing the permissible risk limits and the desired goals of its implementation during the implementation of the IT project. At the same time, an important place is occupied by taking into account the interests of stakeholders and their vision of the results, taking into account the risks. The findings reported here could make it possible to systematize risk management of IT projects and determine it as part of a single integrated project management process*

**Keywords:** *IT project, risk, project risk, risk appetite, risk tolerance, risk profile, risk capacity, risk appetite indicators, stakeholders*

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# FORMATION OF THE SYSTEM OF INTEGRATED RISK APPETITE MANAGEMENT DURING IT PROJECT IMPLEMENTATION

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## 1. Introduction

Each company tries to build its activities in such a way as to ensure the best result with minimal risks. Risk management always means the ratio of risks and rewards for them. At the same time, it is important to understand what risks an organization can agree to when achieving its strategic goals. Each person interested in doing business has his/her own attitude to risk, which may differ from others. As a rule, risk appetite can manifest itself in the form of limits, restrictions, permissible limits for achieving certain target benchmarks, and other qualitative and quantitative managerial influences. In addition, the assessment of a specific identifiable risk does not answer the question of whether this risk is acceptable to the organization. This requires the management of the enterprise to make certain statements that will spell out the level of acceptability of this risk. Violation of the threshold values of indicators important for the activity signals the possibility of implementing an unfavorable scenario of the course of events. This means that for each enterprise there is a task not only to identify and assess risks but also to determine its acceptable limits. Compliance with these limits can guarantee the achievement of the desired results of activities. In addition, the rationale for influencing risks is also very closely related to risk appetite. The directions of risk reduction and mitigation are directly related to the extent to

which they will ensure compliance with certain established requirements. Therefore, it is very important to ensure that the risk appetite statement is communicated by senior management to each employee involved in the activity.

The technological revolution is changing consumers' perceptions of the possibilities of satisfying their needs. There are new rules of doing business, under which one steadily needs to adapt in order to maintain one's competitive advantages and continue to fight for one's place in the market and one's consumer. The scientific and technological revolution, which began in the late nineteenth and early twentieth centuries, continues to this day, but has acquired radically new features and significantly accelerated the pace of implementation of achievements in all aspects of human life. Information technology has already become an integral part of life. It is impossible to imagine the world without the latest generation of smartphones, ultra thin laptops that can work for hours without recharging, systems such as "smart home" and "personal assistant", cars with autonomous control, and much more. However, the implementation of each project in the field of information technology is at high risk as it depends on many factors that are quite latent. The level of these risks varies from case to case as it depends directly on the goals pursued by the organization and on the risks it accepts to achieve these goals.

Therefore, research on the construction of an integrated risk appetite management system for IT projects is relevant.

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## 2. Literature review and problem statement

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In [1], the issue of preventive risk management as a scientific and methodological complex of measures for the management of an enterprise (company, organization) as a whole was considered. The authors' attention was focused on the development and implementation of coordinated preventive actions aimed at preventing and minimizing damage from risk exposure, maximizing equity, and ensuring the profitability of its activities. However, it is impossible to consider preventive risk management without taking into account the acceptable limit of this management and what steps management is ready to take to achieve the desired targets. All this suggests that the solution of an important issue of determining acceptable risk limits to justify risk management directions has been ignored.

In [2], existing methods of establishing and analyzing risk appetite are considered, while risk appetite and risk appetite are considered as identical concepts. These methods were systematized not taking into account the specifics of establishing a risk appetite for specific targets of the company's activities. In accordance with this, the issues of forming a mechanism for managing risk appetite in the organization's activities remained unresolved.

In [3], risk appetite is defined as the aggregate generalized value of all types of risks of the company's activities and separately for each type of risk. In the cited study, the concepts of "risk-appetite" and "risk tolerance" are combined and considered as identical. However, this is not true. All this suggests that consideration of their differences and methods of determination requires detailed analysis and clarification.

In [4], special attention is paid to the study, generalization, and systematization of knowledge about economic risk. Risk is considered as an economic category that reflects the characteristic features of the perception by interested subjects of economic relations of the existing uncertainty and conflict. One cannot but agree with the author's opinion that it is crucial to take into account the interests of stakeholders in determining risk. However, it is necessary to clarify how stakeholders realize their pragmatic intentions in enterprise management, which is manifested in the definition of risk appetite.

In [5], the risk appetite (propensity to take risks) of the bank is considered as the overall (aggregated) level and types of risks that the bank is ready to take on to achieve its strategic goals. This definition of risk appetite meets international standards of risk management but is not exhaustive for understanding this integrated and subjective concept. All this indicates the need to further determine how the achievement of strategic goals is established, monitored, and controlled, taking into account risk appetite.

Work [6] notes that a properly interpreted concept of risk appetite plays an important role in enterprise risk management. It is shown that risk appetite is associated with other stages and components of the risk management system. But issues related to the integration of the concept of risk appetite into the overall company management system remained uncertain.

In [7], the issues of determining the level of risk of individual segments of the loan portfolio at the microeconomic level, which are due to the influence of macroeconomic factors, are considered. The solution to the company's risk management issues is considered to a greater extent risk assessment. However, using individual risk factors to determine the credit risk of the bank, it would be advisable to

determine their allowable limits, which will show the bank's exposure to each risk parameter when achieving the goal.

In [8], the influence of risk appetite on entrepreneurial activity and the impact of entrepreneurial activity on profitability are considered. It is shown that the link between entrepreneurial activity and profitability is not strengthened if risk is used as a moderator. However, the question of how risk exposure can be taken into account in determining entrepreneurial activity and profitability and how this can find its place in the overall risk management system of the enterprise remained unaddressed.

Work [9] states that IT risk management should be integrated into the overall company management program. It is shown that when making managerial decisions at all levels of management, it is necessary to carry out risk assessment and analysis. However, when determining the overall strategy of enterprise development and integration of risk management into it, it is not enough to limit oneself to risk assessment, not taking into account its permissible limits. All this indicates the need for further development of the formation of the concept of risk appetite and its use in the company management system.

In [10], the peculiarities of the development of the digital economy in Ukraine are considered and the main risks associated with this process are outlined. It is shown that understanding and structuring risks for enterprises of the IT sector is a necessary process when building a management system. However, in addition to identifying risks, it is necessary to understand the system of their management and the risks with which the company is ready to work. This requires determining the exposure to individual risks of IT projects.

In [11], the aspects of establishing limits and restrictions for financial risks, which form the basis of financial security of the enterprise, are considered. However, the mechanism for establishing and justifying these restrictions has not been defined.

In [12], a set of triggers for risk monitoring was developed. The proposed set of triggers is considered as the basis for decision-making by management to ensure the sustainability of the business in accordance with the defined development goals. In the cited study, it is proposed to use exclusively expert assessment methods to establish risk exposure. However, it is important not only to determine the method of establishing risk appetite, but also to determine who, when, how often will do it. All this suggests that the aspect of managing certain risk triggers needs further development.

In [13], a taxonomic method is used to determine the integral indicator of riskiness and profitability of the bank. It is shown that the strategy of balancing risks and profits is not sufficiently used in the Ukrainian banking sector. But the ratio of risks to profits of the bank is not considered as a risk appetite, although in fact it reflects it. All this suggests that there is a need to introduce a risk appetite management system in the overall company management system.

In [14], the issues of integration of methods and procedures of project management into the enterprise management system were considered. However, using the process approach in the project management methodology, the author did not pay attention to the questions of how this integration can be carried out and what stages or components should be reflected here.

Thus, the issue of consistency and complexity in the management of risk appetite remains poorly understood, requires further development, which determines the relevance of the current work.

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### 3. The aim and objectives of the study

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The aim of our study is to form an integrated risk appetite management system in the activities of IT projects. This will make it possible to manage risks, taking into account their acceptable limits, which must be agreed upon by all stakeholders at the beginning of the project.

To accomplish the aim, the following tasks have been set:

- to determine the essence of the concepts of “propensity to take risks”, “risk appetite”, “risk tolerance”, to identify the differences between them and consider the peculiarities of their use in IT project management;
- to conduct an expert survey of leading project management specialists to determine their understanding of the most significant risks in the implementation of IT projects, the most priority indicators of risk appetite formation, the most used methods of establishing risk appetite;
- to justify the components of the integrated risk appetite management system of the IT project with the definition of the relationships between them and to form an integrated risk appetite management system at the level of an IT project.

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### 4. The study materials and methods

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The object of research is risk appetite. The subject of the study is theoretical and practical provisions of risk appetite management of IT projects.

The main hypothesis of the study assumes that in order to integrate the concept of risk appetite management into an IT project, it is necessary to define a risk appetite framework indicating its components, policies, processes, managerial influences, which will allow for its rational monitoring and control.

Hypothetical assumption 1: to manage the risk appetite of an IT project, the main components will be risks associated with project timing, budget compliance, as well as functional and non-functional requirements of stakeholders to the project.

Hypothetical assumption 2: risk appetite is an integral indicator that the project manager or stakeholders must agree and be willing to accept for the successful implementation of the project. This should be reflected in the integration of the concept of risk appetite into the overall risk management system of an IT project. This should concern the definition of the strategy and business goals of the project, practices, and methods of forming the process and policy of risk management.

Empirical analysis and method of theoretical generalization of scientific literature were employed to determine the essence of risk appetite, propensity to take risks, and risk tolerance.

A comparative analysis of international standards on risk management was conducted to determine the differences between risk appetite and risk tolerance.

A systematic approach was used to systematize the factors that affect risk appetite and with which it can be assessed.

The expert survey method was used to prioritize risk groups, risk appetite determination indicators, and methods for establishing risk appetite in software development projects. The expert survey was conducted in IT companies represented in Ukraine and abroad (Intellias, EPAM, SoftServe, and Ciklum) in May–July 2022. The expert survey included 64 respondents directly involved in project manage-

ment. The process of developing the questionnaire involved the definition of the necessary information for research and proof of the hypotheses posed; survey method; structure and content of questions; forms and location of the questionnaire.

During the expert survey, a questionnaire with multivariate questions was used, in which the respondent was offered a set of possible answers and s/he should choose one or more of them. The expert survey was conducted online using the Google Form, which was sent to all respondents. To analyze the results of the expert survey, Microsoft Excel software (USA) was used.

Graphic methods were used to illustrate theoretical and practical materials.

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### 5. Results of the study on the construction of an integrated risk appetite management system for an IT project

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#### 5.1. “Propensity to take risks”, “risk appetite”, “risk tolerance”: essence, differences, features of use in IT project management

Industry 4.0 is the leading trend of the “Fourth Industrial Revolution”, the rapid development of which we have a unique opportunity to observe in every area of economic activity. For the first time the term “Industry 4.0” was used in 2011 at the industrial exhibition in Hannover, where the German government set the task of expanding the use of information technology in production. A highly professional team consisting of representatives of government and business worked in this direction to create a program for the modernization of industrial enterprises of the country. This once again proves that the synergistic efforts of the government and business have positive results.

Industry 4.0 is a digital transformation of production and related industries, as well as processes of creating value for consumers. The characteristic features of Industry 4.0 are fully automated production where all processes are managed in real time and taking into account changing external conditions. The basis of Industry 4.0 are technologies, the results of which are expected to radically change; we highlight the main ones:

- Internet of Things (IoT) and Industrial or Industrial Internet of Things (IIoT);
- Digital Ecosystem;
- Big Data Analytics or simply Big Data;
- complex information systems open for use by customers and partners.

The boom in digital transformation, which has become a kind of mainstream recently, has led to a transformation of approaches and views on enterprise management and the reorientation of the latter to a project-oriented approach to management. The word “digitalization” has become almost integral in the professional activities of project managers involved in the implementation of projects aimed at optimizing business processes.

The development of any new products or systems using information technology is based on a project approach to management, and therefore necessarily requires measures to manage the risks of these projects. According to the latest edition of PMBOK (7th edition), risk is an uncertain event or condition that, if it occurs, can have a positive or negative impact on one or more goals.

The success of any project directly depends on how effectively risk management is carried out within a particular

project. It is proposed to consider the project risk management as a set of measures and methods aimed at identifying, analyzing, and assessing risks that may directly or indirectly affect the successful implementation of the project.

In order to achieve their goals and implement the project in accordance with the goal, project managers must take risks and be ready to accept some of them. A number of questions arise: how to identify risk, how to determine the magnitude of this risk, what risk the manager is ready to take for the successful implementation of the project. In order to summarize the answers to all these questions, the concept of “risk appetite” was introduced in the business environment to describe “the levels and types of risks, the possible consequences of accepting or withholding which the organization considers acceptable for itself” [15]. In the Ukrainian business environment, project managers use the terms “risk appetite” and “propensity to take risks”, which are essentially identical and have the same lexical meaning. According to the Resolution of the National Bank of Ukraine “On Approval of the Regulation on the Organization of the Risk Management System in Ukrainian Banks and Banking Groups” dated 11.06.2018 No. 64, the concepts of “risk appetite” and “propensity to take risks” are represented as identical. They mean “the aggregate value for all types of risks and separately for each of the risks determined in advance and within the permissible level of risk, for which the bank decided on the expediency/necessity of maintaining them in order to achieve its strategic goals and fulfill the business plan.”

At the same time, it should be noted that propensity to take risks is the amount of risk that an organization is ready to take in pursuit of strategic goals. Thus, it should determine the level of risk at which appropriate action is necessary to reduce it to an acceptable level. Risk appetite at the organizational level is the degree of risk or potential adverse impact of an event that an organization is willing to accept/maintain to achieve its mission, vision, and business goals.

The procedure for determining propensity to take risks is called a “limit system”, which analyzes the overall exposure to various risks and defines “risk limits”. This means that a maximum threshold can be determined for each risk. Management is responsible for developing and formulating the company’s risk appetite. However, this does not mean that risk management should be handled solely by the company’s management because the company’s success in achieving its strategic goals directly depends on risk-oriented approach to management.

Determining a company’s propensity to take risks begins with an understanding of the company’s strategic goals and objectives, stakeholder perspectives, risk culture, and experience in managing these risks. Based on this, management continues the process of risk perception by developing:

- risk profile: management’s assessment of the company’s main risks, internal controls, and capabilities to manage these risks. The risk profile may include, but is not limited to, strategic, market, financial, operational, organisational, legal, and regulatory risks;

- risk capacity: the actual amount of risk that the company may bear; this requires an assessment of the amount of risk that the company can accept based on financial, operational, and reputational impact;

- qualitative risk assessment: classification and priority of the company’s main individual risks relative to each other. Categorization and prioritization take into account risks, rewards, and activities to mitigate these risks;

- quantitative risk analysis: using a rating scale to ensure a greater degree of accuracy and measurability of risks. Rating scales can include simple estimates, benchmarking, and complex probabilistic models. Although not all risks are quantifiable, this analysis can be used to set limits for making strategic decisions about certain business activities [16].

Propensity to take risks can be determined using the comprehensive results of the processes discussed above, combined with an assessment of the relationships of key risks, to determine what risk is acceptable to achieve strategic objectives. Risk appetite should be clear enough to guide company behavior and strategic decision-making, and pragmatic enough to facilitate understanding and use across all parts of the company. As a rule, it is developed at the level of top management and is accompanied by a more detailed definition of specific strategic goals of business activities [17]. When developing risk appetite, management must also consider the company’s levels of risk tolerance or acceptable levels of volatility to achieve strategic goals. Tolerance levels are usually determined for specific risks and can vary depending on the importance of strategic goals for the company and the relative cost-benefits of achieving them.

Each level of organization needs clear guidance on the limits of risk they can take. Risk appetite should be expressed in the same terms that are used to assess risk. An organization’s risk appetite is not necessarily a static quantity, as the Board of Directors may vary the amount of risk it is willing to accept depending on the circumstances at the moment and its strategic objectives.

Risk appetite is not a magic number and is not always quantifiable. In most cases, it depends on the business objectives and what risks need to be taken to achieve specific goals. At the organizational level, an acceptable level of consequences from the onset of risk can be determined in terms of both the impact, if the risk arises, and the frequency of this impact.

The integrity of the magnitude of risk appetite is primarily due to the need to assess and analyze the total amount of risk appetite that the company is ready to take at a particular point in time to achieve specific goals. In essence, risk appetite is critical to the success of an organization. The formulation of the company’s risk appetite gives board members and top management important information about the breadth of its powers, responsibilities, and points of control.

In addition, risk management and innovation are inextricably linked. Every organization must recognize that taking risks to innovation and development is essential to doing business. In case of risk avoidance or risk evasion, the company immediately becomes vulnerable to losing positions in relation to competitors. The task of management is to find the right level of risk necessary to support innovation and growth throughout the organization. With this knowledge, an organization can determine which strategies to adopt and what goals to pursue.

Equally important is the fact that risk appetite must be flexible enough to adapt to changing conditions, helping the company remain relevant in a particular business environment. Initial judgments about “risk appetite” often focused solely on financial and operational measures. However, when applying risk appetite, organizations need to consider enterprise risk management through the prism of goals that correspond to expected results. This view can be formulated in judging how the company is going to make decisions about risk management [18].

The key attributes [19] of successful use of the concept of “risk appetite” are:

- risk appetite statement – a written formulation of risk appetite;
- risk appetite limits – the level of risk fixed in the risk profile, in case of violation of which immediate escalation and corrective action are required. Propensity to take risks limitations relate to the inclusion of individual risk in the strategic context and perspective of the company. They turn strategic goals into specific leadership and control of risks in the business environment of the enterprise;
- risk appetite trigger is a level close enough to the limit of risk appetite that requires corrective actions from management;
- risk appetite framework is a set of policies, processes, skills, and systems necessary for employees to communicate in the process of using risk in their activities.

Work [20] notes that “propensity to take risks can also be described as the risk capacity or the maximum amount of residual risk that a company will take after the introduction of controls and other appropriate measures.” Among other things, in [20], the factors influencing risk appetite are considered, namely:

- culture of the organization;
- the industry or domain area in which the enterprise operates;
- the presence of competitors and the state of the competitive environment;
- type of enterprise initiatives;
- the current state of affairs in the industry and the financial viability of the company.

Defining the company’s risk appetite, it is worth highlighting the concept of risk tolerance because these categories are quite interrelated and can influence each other.

Risk tolerance depends on the very diverse factors that determine risk appetite. However, the level of risk tolerance

adopted by an organization can vary on a case-by-case basis: factors that include the nature of the project, the time frame of the project, and the experience of the employees involved. Risk tolerance can change over time, such as how industry standards, regulations, and accepted practices change. Graphically, the difference between the propensity to risk and risk tolerance is shown in Fig. 1.

It is important to understand the differences between two seemingly similar terms describing the measure of risk. Detailed analysis of interpretations from different organizations is given in Table 1.

Analyzing the above interpretations, we consider it expedient to expand them, taking into account the trends and conditions of the current business environment.

We believe that it is necessary to consider risk appetite as an integral indicator of the level of risk that a company is ready to accept in order to achieve its strategic goals. Within the limits of risk appetite, the company does not take any measures to minimize them. In other words, this is the level of risk with which the organization seeks to work. This is determined by the organizational mission and strategic goals.

### Risk appetite vs. risk tolerance

If risk appetite represents the official speed limit of 70, risk tolerance is how much faster you can go before likely getting a ticket.



Fig. 1. Risk appetite vs. risk tolerance [21]

Table 1

Comparative analysis of the differences between risk appetite and risk tolerance

Source	Interpretation of risk appetite	Interpretation of risk tolerance
ISO Guide 73:2009 Risk management: dictionary	The size and type of risk that the organization is willing to take on to maintain its activities. ISO 31000 does not include a definition of risk exposure in the guidance standard	The willingness of an organization or stakeholder to bear risk after processing the risk to achieve its objectives. Risk tolerance may be affected by legal or regulatory requirements
COSO Strengthening Enterprise Risk Management for Strategic Advantage, 2009	A broad description of the desired level of risk that the stakeholder will take in carrying out its mission	Displays acceptable variation in results related to specific performance indicators in accordance with the objectives that the interested party seeks to achieve
BS 31100:2008	The scope and type of risk that the organization is willing to seek, accept or tolerate	The willingness of the organization to bear risk after processing the risks to achieve its goals. Risk tolerance may be limited by legal or regulatory requirements.
KPMG Understanding and articulating risk appetite, 2009	The amount of risk in a broad sense that an organization is willing to take on in pursuit of value	Risk thresholds, or risk tolerances, are typical risk measures used to monitor exposure compared to declared risk exposure
Towers Perrin, What’s One’s Risk Appetite, Emphasis 2009 by J. David Dean and Andrew F. Giffin	The amount of total risk that the organization is willing to accept or maintain based on a risk-reward compromise: <ul style="list-style-type: none"> <li>– displaying risk strategies and stakeholder expectations;</li> <li>– is established and approved by the board of directors through discussion with management</li> </ul>	The amount of risk that the organization is willing to accept in the aggregate (either from time to time within a particular business unit or for a specific risk category): <ul style="list-style-type: none"> <li>– expressed in quantitative indicators that can be controlled;</li> <li>– often expressed by acceptable/unacceptable results or risk levels</li> </ul>
ECIIA and FERMA, Guidance on the 8th EU Company Law Directive, article 42, 2011	The level of risk that the company is willing to assume: high return-high risk; low risk – low profit, or portfolio of various risks. Risk appetite is strategic and is primarily related to the business model	The maximum amount of risk that a company can bear despite control. Risk tolerance is more operational and is primarily related to the goals of the company

Risk tolerance is a more detailed indicator and follows from individual risks. According to ISO 73:2009, risk tolerance is the willingness of an organization or stakeholder to bear risk after processing the risk to achieve its goals. In other words, risk tolerance is a residual risk that remains after the implementation of certain measures in order to minimize the consequences of the onset of risk [22].

**5. 2. Results of the survey on understanding risk appetite in the project risk management system**

To form a risk appetite framework and integrate it into the overall risk management system of an IT project, a survey was conducted among employees of leading IT companies in Ukraine. As of the end of the first quarter of 2022, the number of employees in the Ukrainian IT industry was

more than 77 thousand [23] (according to the report of the IT Association of Ukraine). Respondents were asked to choose the risk groups that they manage in their company on software development projects. The results of the survey are shown in Fig. 2.

Even the blind can see that the most significant risk groups chosen by respondents are personnel risks (81.5 %) and risks associated with deviations from the originally planned budget (70.4 %). This once again proves our hypothesis that budgetary risks are one of three groups that should be taken into account when determining the integral indicator of the level of risk appetite.

The question “Has your company implemented indicators that may indicate its risk appetite” was answered by respondents as follows (Fig. 3).

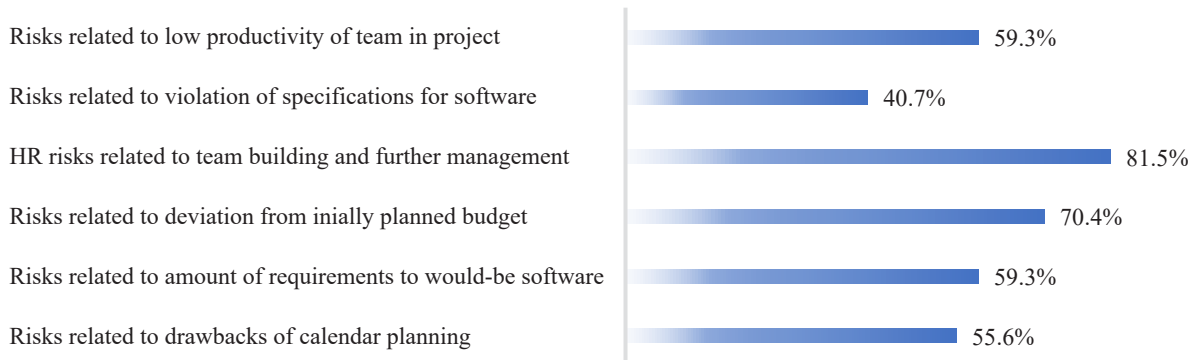


Fig. 2. The main risk groups in software development projects, the proportion of respondents who chose this answer

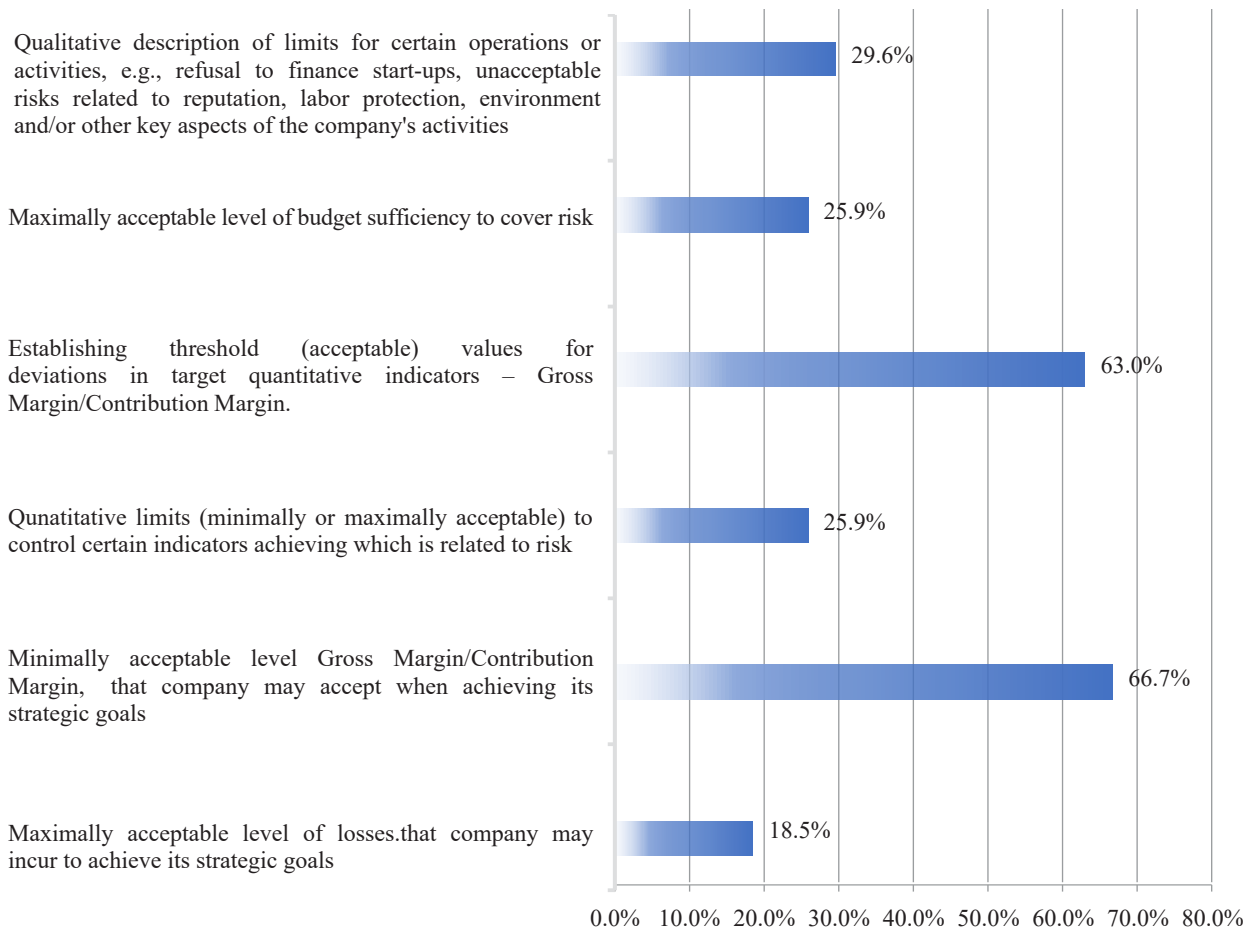


Fig. 3. Indicators for determining the level of risk appetite, the proportion of respondents who chose this answer

The survey showed that the main indicator that is taken into account when determining the level of risk appetite is the minimum allowable level of Gross Margin and Contribution Margin (GM/CM), which a company can agree to when achieving its goals. In other words, this is a possible deviation from the established targets. It should be noted that companies have set limits on propensity to take risks – GM/CM limit values below the level of which projects will be unprofitable.

The respondents' answers regarding the areas of establishing risk appetite in the company were quite informative. Thus, more than 92 % of surveyed engineers chose the cost-benefit ratio as the main area for establishing risk appetite in the company. In fairness, it should be said that most domestic IT companies work in the field of outsourcing. More than 77.8 % of respondents said that the area of propensity to take risks at the company and project levels is the expectations of stakeholders (customer requirements). The respondents were equally distributed regarding legal requirements and socio-economic factors of risk appetite formation – 29.6 %, respectively.

Regarding the methods of establishing risk appetite used in companies, respondents identified the following:

- 63 % of surveyed engineers chose a method based on an expert survey. In this case, the risk appetite is established on the basis of the opinions of specialists of the enterprise, its management, and external experts;
- 37 % of respondents indicated a method based on the cost of risk management measures. In this method, the criterion for assessing risk appetite is the ratio between the cost of risk management measures and the magnitude of risk in a certain period of time;
- 37 % of respondents also chose a method based on the current level of enterprise risk. The total risk appetite of the enterprise in a certain period of time is calculated as the sum of possible losses for each type of risk. The overall level of risk appetite can be expressed both in absolute and relative terms;
- 22.2 % of surveyed engineers noted a method based on stress testing. The factors that have a significant impact on the activities of the enterprise (internal and external indicators) are selected.

Successful risk appetite management directly depends on how correctly the company has chosen a scale by which it will measure risk appetite and risk tolerance. For organizations seeking to determine their propensity to take risks scale, it is important to consider the likelihood of a particular risk event occurring and the impact of that risk. Propensity to take risks can be assessed by analyzing the following parameters:

- acceptable risk limits and appropriate actions of the company: what exactly the organization is ready to do within the “acceptable” level of risk appetite;
- risk impact: based on the desired set of actions and outcomes, the risk increases, decreases, or remains unchanged. The level of risk affects the risk appetite for any particular project or approach, as well as the overall vector of the organization;
- analysis of the achievability of long-term goals: organizations should reconcile risk taking considerations with long-term goals.

When exploring the issue of risk appetite in information support development projects, it is advisable to consider the risk appetite of the project as the level of risk that the

organization or/ or stakeholder is ready to accept, expecting rewards from its implementation. An organization's risk appetite shows how willing it is to take risks in order to implement a project on time, in full, and within the agreed budget.

The definition of risk appetite is a systemic process, so one needs to approach it comprehensively. In scientific works, in particular “On the meaning and use of the concept of risk appetite. Risk analysis” [6], an approach describing a risk appetite framework is becoming increasingly popular.

The Risk Appetite Framework is a set of approaches, policies, processes, controls, and systems through which propensity to take risks is established, monitored, and controlled. The risk appetite framework contains a statement on propensity to take risks, risk limitation, and a description of the roles and responsibilities of those overseeing the implementation and monitoring of the concept of propensity to take risks. In the context of the framework, risk appetite is much more than a complex system of key performance indicators (KPIs) for risk management. It is the main tool for better alignment of overall corporate strategy, capital allocation, and risk. The complex structure of risk appetite is the basis of a new risk management architecture [23]. It is embedded in the corporate strategy and risk culture of the enterprise.

Risk appetite must be communicated to all project employees, for this purpose a statement of propensity to take risks must be formed. A Risk Appetite Statement is a written statement of an integrated level and types of risk that a firm is willing to accept or avoid in order to achieve its goals.

### 5.3. Substantiation of components in the integrated risk appetite management system of an IT project

Developing and implementing an effective risk appetite concept is an iterative and evolutionary process that requires constant dialogue within the company to achieve interest throughout the organization. On the other hand, the definition of risk appetite at the level of an individual project or company as a whole should be systemic in nature and require direct synergy with other components of the management ecosystem. Taking into account the above conditions, the components of the integrated system are substantiated for risk appetite management at the project level (Fig. 4).

Determining the level of risk appetite for a project begins with determining the project goals set by the project manager and how they relate to the goals and interests of stakeholders (project stakeholders). Here it is appropriate to mention the relevance of using the stakeholder matrix [24], which groups stakeholders by degree of influence and level of interest into 4 relevant groups (Fig. 5).

According to ISO 26000, a “stakeholder” or interested person is a person or group of persons who has an interest in any decisions or actions of an organization. Stakeholder analysis in project implementation is one of the key stages carried out by the project manager in order to ensure the successful implementation of the project, as well as to achieve the goals announced by stakeholders. Grouping stakeholders into specific groups, based on two key parameters – the level of impact on the project and the level of interest from its implementation – helps the manager build a communication management plan correctly.

Group I is characterized by a relatively high level of impact on the project, but their interest is quite low, so the strategy of the project manager for this circle of stakeholders is to maintain their level of satisfaction and inform about the status of project implementation.

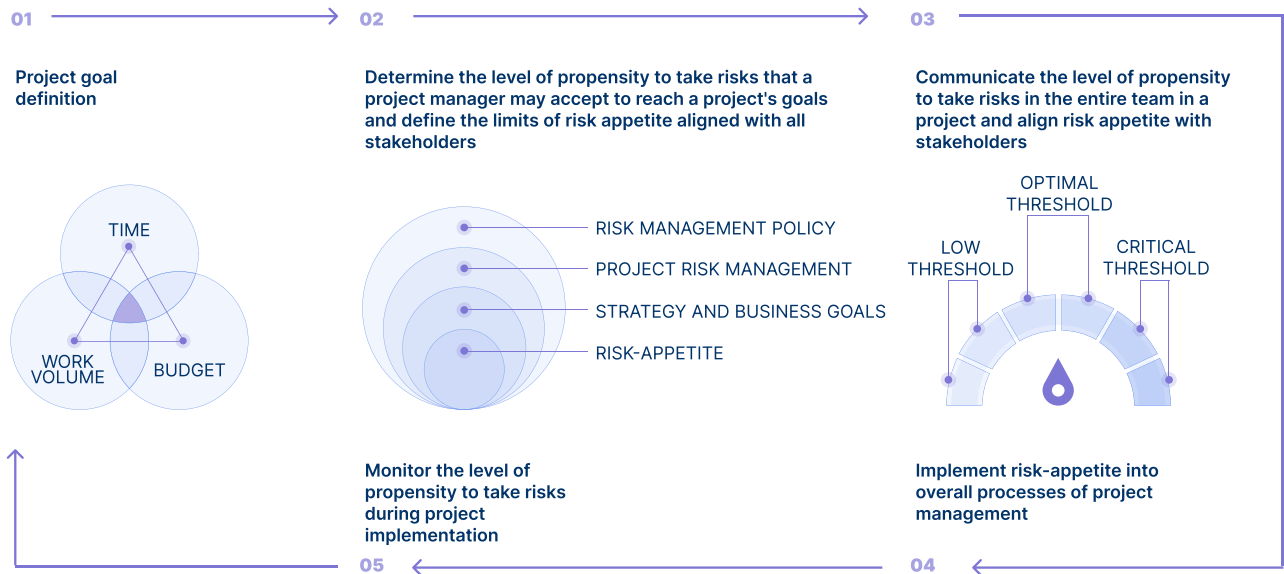


Fig. 4. Components of an integrated IT project risk management system

Group II is the main stakeholders with whom the project manager must work closely and keep them informed about the progress of the project.

Group III is a circle of stakeholders who have virtually no power and, therefore, cannot significantly influence one's project, nor show interest in it. Therefore, the project manager should devote a minimum of his/her time to meeting their needs.

Group VI are stakeholders who have virtually no sufficient power to influence the success of the project but show great interest in it. In this case, it will be appropriate for the project manager to keep them informed.

It is important to note that grouping stakeholders by their level of influence and interest in the project is a dynamic process because during the implementation of the project stakeholders can change, and accordingly their interests in the project change.

In accordance with the distribution of stakeholders, a communications management policy is also formed, which is detailed and recommended in the PMVOC Guideline (6<sup>th</sup> edition) Chapter 10.

After determining the objectives of the project, the direct determination of the level of risk appetite or propensity to take risks begins. This is an integrated indicator that directly depends on the following factors:

- strategy and business goals of the project itself;
- the risk management process used on the project. The risk management process on the project means a set of practices, methods, and techniques related to risk identification, their assessment, monitoring, etc.;

- risk management policy agreed upon for the project and used by all members of the project team.

The main components of the risk appetite of the project are:

- time risks associated with project deadlines;
- budget risks that regulate the financial capacity for project implementation;

- risks of the scope of work – a set of functional and non-functional requirements declared by stakeholders (Fig. 6).

If the timing of the project and its budget are critical for stakeholders, then a decision is made to reduce the amount of non-functional requirements that are not mandatory for the minimum viable product (MVP). As a result, only those that have value to end users remain.

An equally important step at this stage is the definition of risk appetite limits, namely risk limits, which, if violated, will require immediate escalation and corrective action. In other words, these are the maximum extreme points (max) beyond which the risk profile cannot go since this will already be the amount of risk that the project manager is not ready to accept and does not have the authority.

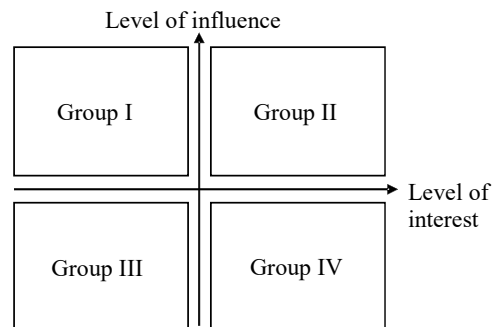


Fig. 5. Stakeholder matrix

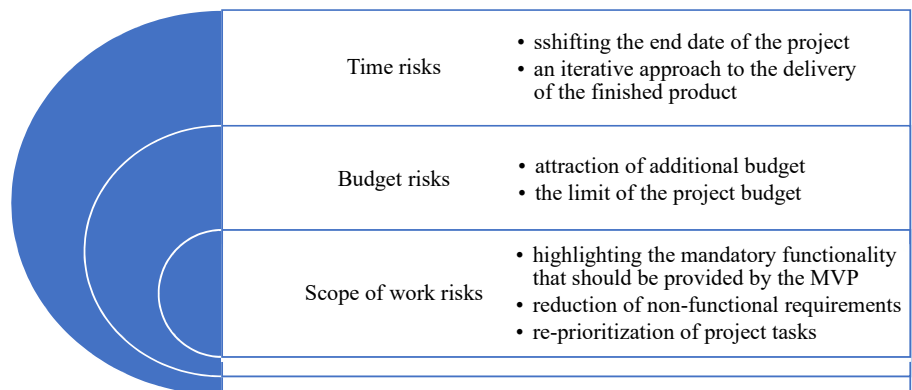


Fig. 6. Components of the project's risk appetite



An example of propensity to take risks limits can be the timing of project completion or achievement of certain milestones. For example, stakeholders allow the project completion date to shift within 3–5 days, which is acceptable to them. However, a delay in the delivery of the project for more than 5 days is no longer acceptable. Thus, the project manager can manage the project schedule and completion dates, which are detailed and recommended by the PMI in the sixth section of the PMVOC Guidelines (6<sup>th</sup> edition).

The next step in determining propensity to take risks is to agree on the risk appetite and its limits with stakeholders and project team members. It is on the latter that compliance with deviations in the implementation of the project within the limits agreed with all parties depends. At this stage, the key point is the construction of the Risk Appetite Statement, which is a mandatory artifact of the proposed framework. The propensity to take risks statement must be documented and is a mandatory attribute of project management.

The next stage of the framework will be the implementation of risk appetite in the overall project management processes. Thus, decision-making on certain issues related to the achievement of goals will be adjusted to the level of uncertainty with which the project manager and stakeholders agree. It is important that propensity to take risks and its limits are documented and specified in the Project Risk Management Plan, as well as in the Risk Register and the Risk Report.

And the final stage is monitoring the level of risk appetite in the process of project implementation. Since working with risks during project implementation is a permanent process, it must occur constantly and requires a systematic approach. It is important to note that as the project moves towards completion, the level of uncertainty and the probability of occurrence of risks decrease, as shown in Fig. 7, but, at the same time, the cost of making changes to the project increases.

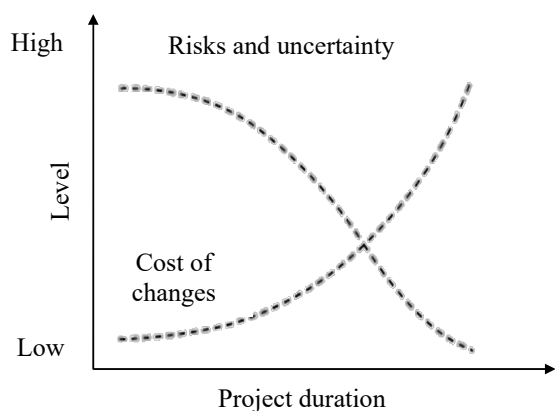


Fig. 7. The cost of making changes to the project over time  
Source: PMBOK (6<sup>th</sup> ed.) [24]

This is primarily due to the cost of finalizing the already implemented functionality, which was successfully completed and delivered to the customer. The processing of already implemented requirements requires additional elaboration of interdependencies that the latter may affect. That is why the risks associated with the scope of work have been proposed by us as one of the key components of the project’s risk appetite. Risks of the scope of work are changes in the set of works that the project manager is ready to undertake in order to successfully implement the project and fulfill all customer requirements.

At the same time, it should be noted that the implementation of auxiliary functionality, which details or simplifies

the work of already implemented requirements, is regarded by project managers as a Change Request, which brings additional value to the customer.

## 6. Discussion of results of the study on the construction of an integrated risk appetite management system in an IT project

A comparative analysis of the differences between risk appetite and risk tolerance (Table 1) showed that international standards related to risk management lack an integral view of risk appetite management at the level of the entire company or project. Accordingly, it is assumed that the issue of taking into account risk appetite in project activities requires unification and, at the same time, the development of a mechanism and tools.

The results of the survey are based on the answers of respondents who participated in the survey, as well as analysis of recent publications. Analysis of literary sources [9, 11] showed that the question of determining the limits of risk appetite (propensity to take risks) remains relevant since the scientists involved in the study of this issue offer different approaches.

The results of the survey (Fig. 2, 3) allowed us to substantiate the components of the integrated risk appetite management system of the IT project and determine the relationships between them. Propensity to take risks is determined based on an understanding of the key risks of the project with a qualitative analysis of the relationships between them to determine what risk is acceptable to achieve strategic goals (Fig. 2). The establishment of limit (allowable) values of deviations of the Gross Margin/Contribution Margin targets is considered by the overwhelming number of respondents as the main indicator that allows determining the risk appetite of the project (Fig. 3). The vast majority of respondents identified the “expert method” as the main one used by project managers when setting the risk appetite for IT projects. And this shows overwhelmingly that each company owns a certain expertise in their domain areas and, guided by their experience, sets acceptable limits for deviations of targets.

Integration of risk appetite into the risk management system of an IT project (Fig. 4) describes all the necessary steps to unify integrated risk appetite management as a process, as well as its integration with the enterprise management ecosystem. Here once again it is worth noting the importance of synergy of the proposed framework with the processes existing in the organization. This is done by highlighting at the first stage of the framework (Fig. 4) three main components of risk appetite, which is confirmed by the results obtained (Fig. 2, 3).

In accordance with this, we formed an integrated risk appetite management system for the implementation of an IT project, which is shown in Fig. 4. Taking into account the interests of stakeholders is also reflected in the construction of an integrated risk appetite management system at the level of an IT project (stages 2 and 3 of Fig. 4). Thus, the establishment and monitoring of risk appetite, unlike the approaches existing in most companies, should not only be systemic in nature but also integrated into all project management processes.

It is important to note that the proposed integrated risk appetite management system is relevant for projects implemented in the field of information technology and based on the use of common flexible approaches and methodologies (Agile: Scrum, Kanban). Therefore, one should note certain limitations to the approach proposed by us, namely:

- implementation of projects in the field of information technology, for which the definition of Gross Margin/Contribution Margin targets is relevant;
- the implementation of IT projects is based on flexible methodologies;
- the proposed framework of integrated risk appetite management is typical for service companies involved in the implementation of IT projects.

Among the shortcomings of the study, it is advisable to single out the targeted audience to which the study was directed, namely, service IT companies that implement projects for foreign customers. Therefore, the basic indicators of project management (time, cost, and volume) formed the basis of the proposed integrated risk appetite management system.

However, at the same time, it gives prospects for further research on the issue of risk appetite (propensity to take risks) in product companies, which are currently actively developing in Ukraine and are aimed at creating new IT products of mass consumption. In the future, there is a prospect to study integrated risk appetite management as one of the key functions of the Project Office (RMO) since this issue was not addressed in this paper.

At the same time, it is worth noting the fact that the introduction of martial law in Ukraine has made adjustments to the activities of most IT companies. Before the full-scale war, Ukrainian IT industry was perhaps the largest exporter of IT services among European countries. According to the official report of the Ukrainian IT Association [24], in the first 10 months of 2022, the IT industry generated about USD 6 billion of export earnings and showed an increase of 10 % compared to the same period of the previous year.

Despite the introduction of martial law, the vast majority of Ukrainian IT companies ensured the continuity of business processes and demonstrated productivity at the level of 85–90 % in the first months of the war and, since April 2022, some IT companies resumed positive growth dynamics.

It is worth noting the main difficulties faced by companies since the beginning of a full-scale war:

- migration of workers and their families from combat zones (Kharkiv, Dnipro, Zaporizhzhia);
- relocation of IT companies to European countries (mainly Poland, Czech Republic, Spain, and Portugal);
- a ban on IT specialists traveling abroad;
- retention of clients and minimization of risks in working with them;
- currency regulation and restrictions imposed by the National Bank of Ukraine.

According to the data of the Ukrainian IT Association, published on the official website, 70.8 % of IT companies conducted unplanned relocation, one-fourth of which resorted to full relocation.

As of the second year of a full-scale war, Ukraine's IT industry remains almost the only sector of the national economy that continues to work fully despite martial law and was able to increase exports compared to last year. The share of IT services exports in GDP in the first 10 months of 2022 increased by 51 % to 5.4 %. Similarly, the share of IT in exports of services increased by 24 % and accounted for almost half (47 %) of all exports of services. According to official data of the State Tax Service of Ukraine, the amount of taxes and fees paid by the IT industry amounted to UAH 26.6 billion.

Ensuring the sustainability of the Ukrainian IT industry would be impossible without the participation of the state and its full support. The key factor in the growth of the industry under wartime conditions was the synergy of business with the state, the development of joint mechanisms and initiatives that allowed the industry to maximize its potential.

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## 7. Conclusions

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1. As a result of the study, a review of the views of scientists on the essence of the concepts of “risk-appetite”, “propensity to take risks”, and “risk tolerance” was carried out. Risk appetite and propensity to take risks are proposed to be considered as identical concepts. Risk appetite should be clearly defined for effective management of the company's behavior and making adequate strategic decisions. It should also be communicated to all employees and understood in all departments of the company. This is the amount of risk that an organization is willing to take in pursuit of strategic goals. It is also the level of risk at which appropriate action is needed to reduce it to an acceptable level. The integrity of the magnitude of risk appetite is due to the need to assess and analyze the total amount of risk appetite that the company is ready to take at a particular point in time to achieve specific goals. The formulation of the company's risk appetite gives board members and top management important information about the breadth of its powers, responsibilities, and points of control. Risk tolerance depends on a variety of factors that determine risk appetite. However, the level of risk tolerance adopted by an organization can vary on a case-by-case basis: factors that include the nature of the project, the time frame of the project, and the experience of the employees involved. Tolerance levels are usually defined for specific risks and can vary depending on the importance of strategic goals for the company and the balancing of costs and benefits to achieve them. Risk tolerance is a residual risk that remains after the implementation of certain measures in order to minimize the consequences of the onset of risk. In other words, this is the level of risk at which the organization is willing to work, given the current constraints.

2. An expert survey of employees of leading IT companies was conducted to determine their understanding of risk appetite in the activities of IT projects. As a result of the survey, it was determined that the most significant risks in the implementation of IT projects are personnel risks associated with the formation of a team and its further management. Also, based on the results of an expert survey, the most used indicators for establishing risk appetite were identified. This is the minimum allowable level of Gross Margin and Contribution Margin (GM/CM), which a company can agree to when achieving its strategic goals and setting limit values of their deviations from the desired values. IT companies set propensity to take risks limits as GM/CM limit values, below which projects will be unprofitable.

3. According to the results of the study, the components of the integrated risk appetite management system were substantiated at the project level, namely: time risks, budgetary risks, and risks of the scope of work. Integrating the concept of risk appetite into the IT project risk management system includes 5 stages. They are the definition of project objectives; the level of risk appetite; the risk appetite limits; the

approval of risk appetite with stakeholders; implementation of risk appetite in project management; monitoring of risk appetite. This approach will take into account the interests of stakeholders during project implementation and align them in balancing acceptable risks and desired benefits in the process of achieving project objectives.

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#### Conflicts of interest

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The authors declare that they have no conflicts of interest in relation to the current study, including financial,

personal, authorship, or any other, that could affect the study and the results reported in this paper.

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#### Data availability

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All data are available in the main text of the manuscript.

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