

DOI: 10.55643/fcaptop.6.65.2025.5054

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Received: 01/11/2025

Accepted: 19/12/2025

Published: 31/12/2025

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ASSESSMENT AND RANKING OF FINANCIAL RESOURCES IN STRATEGIC MANAGEMENT OF IT ENTERPRISES IN THE CONTEXT OF INCREASING COMPETITIVENESS

ABSTRACT

The purpose of the study is to develop a reproducible model for assessing and ranking financial resources in the system of strategic management of enterprises in the IT sector, which would ensure an increase in competitiveness at an acceptable level. To achieve this goal, the article solves the following tasks: to determine a list of the most significant financial resources as objects of assessment in the strategic management of IT enterprises, to explain the criteria for their selection in terms of their impact on competitiveness; to formalize three target levels of competitiveness of an enterprise in the field of information technologies, to determine indicators reflecting the achievements of each level, and to link them to the state of financial resources; to calculate utility functions and integral estimates "U" for each financial resource, to form an ordered rating of their impact on the competitiveness of the enterprise and to interpret the results obtained from the perspective of strategic management. Thus, a list of 18 forms of financial resources was substantiated, and a three-level system of competitiveness goals was formed: minimum, normal, and maximum. Also, a quantitative assessment was carried out based on matrices of pairwise comparisons, and integral utility estimates were constructed for each resource. It is shown that the basis of the portfolio for accelerating growth is formed by investments and venture capital, private placements of shares, convertible instruments, and venture debt. An important role in stabilization is played by operating cash flow, long-term client contracts, credit lines, and factoring. A mechanism for implementing management actions and control indicators for the most significant financial resources is proposed. The scientific novelty lies in the combination of a three-level goal of competitiveness with a multi-criteria ordering of the list of financing sources and operational action maps. The practical significance lies in the possibility of quickly forming a rational financing portfolio depending on the selected target level of competitiveness.

Keywords: financial resources management, enterprise competitiveness, pairwise comparison matrices, integral utility assessment, portfolio of financing sources

JEL Classification: G31, G32, M15, L86, O32, C44

INTRODUCTION

Today, access to financial resources has increased thanks to a combination of several trends. Digital channels have developed, from open banking to platform lending and factoring, remote client identification has been simplified, transaction costs have decreased, and risk analytics have improved. Competition between banks, non-banking institutions, and technology companies has expanded product selection, with the emergence of tools such as invoice financing, crowdfunding, and insurance solutions with dynamic pricing. Additionally, guarantee and support programs from international partners, development funds, and donors are in place, which is particularly noticeable in the reality of a full-scale armed invasion in Ukraine. Today, modern management of a company's own financial resources involves the targeted formation, distribution, and control of owner-owned assets, primarily retained earnings, depreciation charges, internal reserves, and special funds. This involves a continuous cycle of cash flow planning, in-

vestment budgeting, working capital management, dividend policy, and liquidity reserves. Own resources are less expensive, so they determine financial autonomy, speed of decision-making, and the ability to withstand shocks without losing control. By effectively managing its own resources, a company reduces its weighted average cost of capital, shortens its operating cycle, maintains solvency, increases return on equity, and creates room for long-term investment. A strong equity base provides pricing freedom, allows for temporary margin reductions to capture market share, finances innovation without excessive risk, and implements a flexible marketing policy. Effective management in today's external environment requires dynamic capital allocation among projects based on their strategic contribution and a metric system that balances liquidity, profitability, and growth. If its own resources are planned and managed, a company enjoys more favorable terms with creditors, a higher rate of innovation, and a stable market position. In practice, this means turning financial strength into a long-term competitive advantage.

It should be noted that there are a number of problems related to strategic financial management, financial stability, and the role of internal and external sources of financing in supporting the safe development of enterprises. At the same time, the connection between cash flow planning, controlling, financial security diagnostics, access to credit resources, and the stability or growth of enterprises needs to be clarified. But along with this, for IT enterprises, there is still a lack of integrated models that simultaneously rank a wide portfolio of financial resources, link it to clearly defined levels of competitiveness, and translate the results into specific management decisions at the operational level. The range of unresolved issues considered in our article includes ways to aggregate expert assessments of the importance of various financial resources into a transparent quantitative rating, delimitation of the minimum, normal, and maximum target states of competitiveness, as well as the formation of a rational financing portfolio for each of these states in conditions of increased uncertainty.

LITERATURE REVIEW

Modern developments of scientists and practitioners only confirm that effective management of financial resources is the basis of the stability and security of an enterprise, especially in the context of modern economic challenges and unpredictable situations. Therefore, But and Netudyhata (2020) determine that in order to achieve financial stability of an enterprise, it is necessary to apply a comprehensive approach to the analysis of financial flows, in particular, to monitor liquidity, profitability, and solvency. They emphasize that financial stability depends on the ability of an enterprise to adapt to changes in the market, as well as on the effective use of its own financial resources, such as retained earnings and depreciation.

Davydova (2019) emphasizes the importance of financial support for economic development, indicating that access to financial resources and their effective use contribute to the stable growth and development of enterprises, which in turn support their competitiveness.

Pokynchereda and Timchenko (2024) examine cash flow management, noting that accurate accounting and cash flow forecasting are necessary to maintain liquidity and ensure the financial stability of an enterprise in a changing external environment.

Studies conducted by scholars such as Mazur et al. (2021) point to the role of controlling in the management of an enterprise's financial resources. They propose methods for improving financial control that allow for more accurate determination of investment needs and help maintain the stability of an enterprise even in crisis situations. Vakhovych et al. (2024) assess the impact of financial and non-financial instruments on equity and cash flows as a basis for decision-making to increase it and increase competitiveness.

Onikiienko et al. (2021) examine the prior assessment of creditworthiness for long-term projects of small and medium-sized enterprises in cases where cash flows are nonstandard. The authors propose an auxiliary screening approach for loan applications that incorporates principles of value-based management and uses the internal rate of return as an initial criterion for lending decisions. Shygun and Bezverkyhi (2025) consider sustainability reporting as a practical tool of corporate social responsibility that helps firms disclose non-financial information beyond traditional financial performance. The study develops a classification of corporate reporting in sustainability contexts based on the type of indicators, the standard of non-financial reporting, the areas of disclosure, and the format of disclosure, either as part of an annual report or as a separate sustainability report.

For example, Zakharchenko (2022) emphasizes the importance of financial management for ensuring the innovative development of enterprises, noting that strategic financial management allows enterprises to maintain competitiveness even when the external environment is unstable. Another example is Elhossary et al. (2020), who consider strategic financial

management as the basis for integrating sustainable development goals into financial decisions, in particular into financing policy, investment selection, and risk management, showing that financial decisions should directly support a sustainable competitive position of the enterprise, and not only short-term profitability. But Maksimova (2019) emphasizes that the financial system of the enterprise should adapt to the digitalization of processes, new information technologies, and online platforms that affect the management of cash flows, investments, and financial risks. In the work of Otoo (2024), it is empirically proven that the quality of financial practices significantly affects the performance of small and medium-sized enterprises. The researcher shows a positive relationship between working capital management practices, investment planning, and overall efficiency of enterprises and concludes that systemic financial management is one of the key factors of their competitiveness.

Separate studies, such as the work of Owusu et.al. (2021), show that the presence of a sufficient level of financial resources is an important factor for small and medium-sized businesses, as it allows them to respond to market changes and improve organizational efficiency.

Yasinovska and Bei (2019) point to the problems of formation and effective use of financial resources by domestic enterprises, noting that improper management of resources can lead to a decrease in competitiveness and financial instability.

AIMS AND OBJECTIVES

The purpose of the study is to develop a reproducible model for evaluating and ranking financial resources in the system of strategic management of enterprises in the IT sector, which would ensure an increase in competitiveness at an acceptable level. To achieve this goal, the following tasks are solved in the article:

- to determine a list of the most significant financial resources as objects of evaluation in the strategic management of enterprises, and to explain the criteria for their selection in terms of their impact on competitiveness;
- to formalize three target levels of competitiveness of an enterprise in the field of information technology, to determine indicators reflecting the achievements of each level, and to link them to the state of financial resources;
- to calculate utility functions and integral estimates "u" for each financial resource, to form an ordered rating of their impact on the competitiveness of the enterprise, and to interpret the results obtained from the standpoint of strategic management.

METHODS

Research design

Our methodology includes a number of methods, the implementation of which is aimed at achieving the research goal. Accordingly, the problem was systematically structured, and a decision-making hierarchy was developed based on the Analytic Hierarchy Process. We formed a scale of relative importance of pairwise comparisons using the fundamental 9-point Saati scale (Salomon, 2024; Hussain, 2024). Subsequently, we constructed pairwise comparison matrices for resources and checked the consistency of judgments. The quality of the input data was controlled through the consistency index and consistency ratio using tabular values of the random index. This type of procedure made it possible to correctly compare financial resource alternatives within a clearly defined hierarchy of goals and criteria, while maintaining the transparency of logic and the reproducibility of assessments. Next, we calculated local weights from the pairwise comparison matrices using the geometric mean method by rows, which is equivalent to logarithmic least squares. This approach is applicable to both complete and incomplete matrices, demonstrates robustness to minor variations in judgments, and offers a clear interpretation through multiplicative aggregation. For additional consistency control, we used the geometric consistency index and its modifications at the triad level, and also relied on modern results on the effectiveness of weights obtained by the geometric mean. Such a combination increases the reliability of the priorities themselves without complicating the calculations (Kuřakowski, 2020). We also synthesized the global utility as a weighted sum of local utilities at three levels of resource demand, using refined level weights. This is a classic additive aggregation in multi-criteria problems, which is well consistent with the analytic hierarchy process and allows for transparent ranking of alternatives. Next, we checked the acceptability of consistency and, if necessary, improved it by targeted changes to the most problematic judgments of both our and the experts involved. This workflow of structuring, evaluating, reconciling, and aggregating is consistent with best practices for applying the analytical hierarchy process to finance, particularly for selecting and prioritizing financial resources for enterprises in today's competitive environment.

Data Analysis

Thus, in our study, the method of hierarchy analysis was used as the main method of multi-criteria decision-making for prioritizing financial resources in view of the competitiveness of the enterprise. Initially, a three-level hierarchy of the decision-making task was defined. At the top level, the general goal of increasing the competitiveness of IT enterprises was formulated. Thus, at the intermediate level, three target levels of competitiveness were identified. At the bottom level, 18 financial resources were placed, which are considered alternatives to managerial influence. Pairwise comparisons were carried out for financial resources regarding their contribution to achieving each of the three target levels of competitiveness, as well as for the target levels themselves relative to the general goal. During each comparison, experts answered the question of which of the two financial resources is more important for strengthening the competitiveness of the enterprise, and how important it is.

RESULTS

If we look at the dynamics of the results of the activities of IT enterprises in the period from the beginning of the COVID-19 pandemic to the period after the full-scale armed invasion, we see not just a gradual increase in the volume of activity, but actually an almost fourfold increase in financial results over several years. Thus, when quarantine restrictions were in effect and businesses were being restructured to remote models, profitability dropped, which reflects the defensive reaction of the market and the costs of adaptation. Then, after the start of full-scale hostilities, the situation paradoxically changed. Instead of reducing their operational volumes, IT companies significantly increased contract volumes, maintained overseas sales channels, and demonstrated stable double-digit profitability even in the face of increased systemic risks (Figure 1).

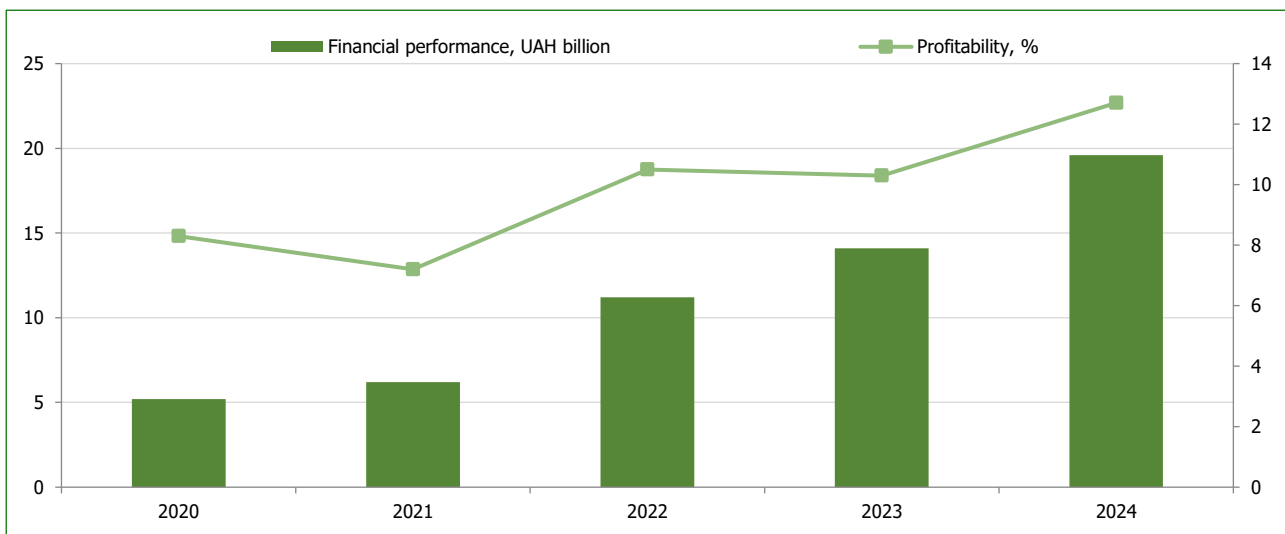


Figure 1. Financial results of Ukrainian IT enterprises for the period 2020-2024. (Source: State Statistics Service of Ukraine)

In fact, we have a movement from maintaining viability to aggressive scaling and commercialization of competencies, including services with high added value. This explains why financial resource management in the context of competitiveness cannot be reduced only to cost control, but should be considered as a selection of a portfolio of financing sources, depending on the target level of further development, even in today's conditions. In the early phase, own funds and client prepayments are decisive, but then the role of credit lines and factoring increases, and at the scaling stage, venture capital, convertible instruments, and private placements become necessary.

At the same time, any situation that has occurred in the activities of an IT enterprise involves the implementation of a number of interrelated actions aimed at obtaining initial information, processing it, determining the presence of trends that could indicate the appearance of signs of a certain threat, tracking certain processes, forecasting possible consequences, and developing adequate management response measures. All management actions, being performed by management entities, require the use of certain resources, but the most important are financial ones. Due to the specifics of their activities, IT enterprises have a large number of opportunities to attract and use financial resources. Within the framework of modeling, we present a list of financial resources that are advisable to use for most IT enterprises in terms of maintaining their own competitiveness (Table 1).

Table 1. List of financial resources necessary to guarantee an acceptable level of competitiveness for IT enterprises.

Element	Marking	List of financial resources
Competitiveness assurance system	A	Operating cash flow from the sale of products and services. This is a universal base for most businesses, as it does not dilute ownership and remains the most cost-effective option
	B	Retained earnings and internal reserve funds. In information technology, such funds are often directed to product development, scaling cloud infrastructure, and entering new markets
	C	Deferred revenues and customer subscriptions. For the IT sector, the subscription model provides a stable cash flow that supports intensive hiring of specialists and rapid releases
	D	Depreciation and amortization. In the information technology sector, the share of intangible assets is high, so the amortization of software licenses and proprietary developments helps to plan investment cycles without unnecessary debt
	E	Redistribution of funds between areas and products within a group of companies. This increases the efficiency of cash use and reduces the cost of capital
	F	Founders' contributions and additional contributions from participants. This is a standard starting resource for most businesses
	G	Private placements of shares and initial public offerings of shares. For IT, this source provides large investment rounds, accelerating global scaling
	H	Angel investments and venture capital. In IT, it is particularly relevant due to scalable models and high costs of customer acquisition, data and expertise
	I	Convertible loans and simple future share agreements. They allow you to quickly close financial gaps and not delay development
	J	Bank loans and lines of credit. This represents a classic approach for most businesses due to its well-defined terms and conditions
	K	Venture debt financing. This is an intermediate solution between a bank loan and venture capital
	L	Leasing equipment and software assets with long-term licenses. This stretches capital expenditures over time and frees up cash for critical investments in product and marketing
	M	Factoring and forfeiting receivables. This facilitates faster cash flow generation
	N	Revenue-linked financing. For businesses with a subscription model, this is a convenient form of raising capital without diluting ownership
	O	Government grants, innovation support programs, and tax incentives for research and development. For information technology, such programs often cover the costs of research, cybersecurity, and expansion into foreign markets
	P	Upfront payments and long-term customer contracts. In the IT sector, large service contracts and joint developments are becoming an important source of financing for growth
	Q	Monetizing intellectual property through licensing and selling property rights. This converts intangible assets into cash flow and enhances capital turnover
	R	Partnership programs from infrastructure providers with financial impact. Cloud resource credits and partner marketing support are not direct money, but they reduce the need for external financing and increase the efficiency of cash flow

The availability of these financial resources determines which strategic and operational projects the enterprise can finance and how strongly these projects improve its competitive position in the market. In addition, we believe that any management measures should be formed on an alternative basis, that is, provide for several options for action with a combination of the need and use of certain financial resources to achieve the required level of competitiveness. Therefore, the resource financial support of the process of guaranteeing competitiveness for an IT enterprise should be based on the calculation of its provision indicator k_{kk} (1):

$$k_{kk} = \frac{P_{available}}{P_{necessary}} \quad (1)$$

$P_{available}$ is the total available financial resources that the enterprise can realistically direct to initiatives to increase competitiveness in the planning period; $P_{necessary}$ is the totality of necessary financial resources to implement the selected initiative or their combination.

If $k_{kk} > 1$, the implementation of the option is resource-secured. If $k_{kk} < 1$, the resources are insufficient for the expected result.

At the same time, the total set of necessary resources $P_{available}$ cannot be greater than the expected economic gain from the initiative in monetary terms, taking into account the discount and risk E_{kw} , its mean (2):

$$P_{available} \leq E_{kw}, \text{ but } I_{kk} \rightarrow \max \quad (2)$$

E_{kw} is the expected economic benefit from the initiative in monetary terms, taking into account discount and risk, such as an increase in net cash flows or the value of the customer base; I_{kk} is an integral competitiveness index that increases due to the implementation of the initiative.

Thus, all management actions in the model are oriented toward achieving the maximum attainable level of competitiveness I_{kk} , and we formalize this by the functional relationship presented in formula (3) between the required financial resources and the competitiveness provision indicator (3):

$$K_{kk} = \{k_{f.r.}, I_{kk}\}, \quad (3)$$

$k_{f.r.}$ this is the need for financial resources.

It should be noted that all formulas (1), (2), and (3) are modified and adapted for our study, generalizing the work of predecessors (Tang, 2012; Puska, 2018).

It is advisable to assess the level of competitiveness that can be achieved as a result of the implementation of a certain combination of financial resources using a generalized three-level scale. Also, its purpose is to determine whether the selected combination of financial resources is capable of only restraining the loss of positions, or stabilizing and restoring growth, or ensuring an advantage over competitors in terms of scaling and innovation rates (Table 2).

Competitiveness level	Marking	Characteristics
minimum	g1	slows down the loss of market positions, curbs customer churn, and maintains the basic performance of services
normal	g2	enables stabilization of market share, halts negative trends, eliminates their consequences, restores organic revenue growth
maximum	g3	ensures ahead of competitors, enables scaling into new segments, minimizes the effects of market shocks, and eliminates the root causes of loss of advantages

Let a_{ij} be a number that determines the advantage of one level of competitiveness of an IT enterprise in relation to another. Then, the numbers a_{ij} are called ranks of advantages. In our model, each competitiveness level has a clearly defined role, and the relative importance of this role is fully reflected by the weight assigned to the level. Since the levels we are studying have a certain functional load, we can state that the degree of its significance is a function of the weight of the level, i.e., $M(z_i) = F(z_i(g_i))$. Let us place the set of weight values of the levels in the matrix A , i.e., $A = (a_{ij})$. The matrix of pairwise comparisons $A=(a_{ij})$ is inversely symmetric. The element a_{ij} reflects the advantage of the level of competitiveness g_i over g_j . The inverse element sets the inverse relationship. This property is the basis for checking the consistency of judgments (4):

$$A_{ij}=1/A_{ji} \quad (4)$$

A consistent matrix has a principal eigenvector g with an eigenvalue n , where n is the matrix dimension, i.e., the number of levels being compared. If $a_{ii}=1$ for all i , then the sum of the eigenvalues is equal to the trace of the matrix, which in our case is n . Hence, for complete consistency, we have $\lambda_{max}=n$, the other eigenvalues tend to zero, and the deviation from consistency is estimated by the deviation of λ_{max} from n . In this case, the deviation value λ_{max} from n can be a measure of the consistency or adequacy of expert judgments regarding the weights of levels, depending on their importance for ensuring the competitiveness of an IT enterprise. The deviation from consistency is called the consistency index and is expressed by the value IU . The consistency index IU measures the deviation of expert judgments from ideal consistency (5):

$$IU = \frac{\lambda_{max} - n}{n - 1} \quad (5)$$

It should be noted that the so-called expert judgments in our article are the answers of the involved specialists to the question of which of the two compared levels of competitiveness or financial resources is more important for strengthening the competitive position of an IT enterprise, and to what extent. Therefore, in the pairwise comparison matrices themselves, they consistently compare three levels of competitiveness (minimum, normal, maximum), as well as 18 financial resources relative to each level, in order to quantitatively determine the weights of the levels and resources for further

formation of the rating of their impact on competitiveness. The indicators λ_{max} , the consistency index IU, and the consistency ratio WU are used to assess the extent to which those expert judgments are internally consistent, that is, whether the obtained weights and the constructed rating can be trusted as an adequate reflection of the collective opinion of experts.

In IT enterprises, the difference between the minimum, normal, and maximum levels of competitiveness significantly affects cash flows, the speed of customer acquisition, and the ability to finance innovations. Therefore, the use of a nine-point scale with intermediate values provides sufficient sensitivity for expert judgments regarding the relative importance of levels. At the same time, this kind of scale is used for pairwise comparisons of levels, which allows building inversely symmetric matrices and checking the consistency of judgments. In our formulation, the same ensures the correct assessment of competitiveness priorities determined by the configuration of certain financial resources (Table 3).

Table 3. Scale of relative importance of enterprise competitiveness levels in the IT sector.

Importance assessment	Comparison criteria	Explanation of the choice of the criterion
1	levels are equivalent	there is no advantage of level g1 over level g2
3	one level slightly outweighs the other	there is a weak advantage of level g1 over level g2 in terms of impact on achieving strategic growth goals
5	one level outweighs the other	there is a significant advantage of level g1 over level g2 for market position and speed of scaling
7	one level significantly outweighs the other	there is a clear advantage of level g1 over level g2 in creating long-term advantages and financial stability
9	one level absolutely outweighs the other	the absolute advantage of level g1 over level g2 is beyond doubt in all key competitiveness indicators
2, 4, 6, 8	intermediate values	auxiliary comparative assessments for close judgments

Thus, we see that it is the g3 level that is interpreted as the maximum level of competitiveness. In the field of information technology, the transition to this level requires more significant and rapid financial investments in the product, data, marketing, and infrastructure, but gives a sharply higher return due to scalability. Therefore, compared to the minimum level g1, its advantage is set as 9. The advantage over the normal level g2 is set as 3. The normal level significantly outperforms the minimum level due to income stabilization and better capitalization; the ratio 7 was chosen. The numbers 3 and 7 are taken from the 9th Saati scale and reflect the expert judgment that the maximum level of competitiveness only moderately outperforms the normal one (therefore 3, not 5 or 7), while the normal one has a very strong, but not absolute, advantage over the minimum due to income stabilization and better capitalization (therefore 7, not 8 or 9):

g_i	g_1	g_2	g_3
g_1 :	1	1/7	1/9
g_2 :	7	1	1/3
g_3 :	9	3	1

Next, it is necessary to determine the measure of consistency of the numerical values of pairwise comparisons. For this purpose, the priority vector of the matrix is used, which is obtained by calculating the principal eigenvector and subsequently normalizing it. In essence, E is a vector of geometric means for the rows of the pairwise comparison matrix. For each row, we multiply its elements and take the root of the power n, where n is the number of levels. Next, we normalize E by dividing by the sum of all its components and obtain E_n . The vector E_n is an approximate main eigenvector, which specifies the weights of the compared levels g1, g2, and g3. In our case, $E = (0.251; 1.326; 3)$. That is, after normalization, we have $(0.054; 0.289; 0.655)$. This means that it is logical that it is the maximum level of competitiveness that has the greatest weight, the normal one is intermediate, and the minimum one has the least weight. Then we calculate the approximate principal eigenvalue λ_{max} , then the consistency index IU is equal, in our case, to 0.041 for n=3 (only three levels of competitive efficiency). Then we compare it with the reference random index WI from the tabular values and get the consistency ratio WU, which should be no more than 0.1. For our matrix, we have WU equal to 0.069, so the consistency is acceptable. For n=3 we take $WI=0.58$. This gave us WU equal to 0.069 for the given matrix (Table 4).

Table 4. Table of random index values.

Number of objects	3	4	5	6	7	8	9	10
WI index reference value	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

In economic terms, the consistency check and the priority vector E_n ensure that the expert comparisons of competitiveness levels reflect a coherent picture of financial consequences for IT enterprises. A transition from the minimum to the normal level and then to the maximum level is interpreted as a monotonic improvement in expected cash flows, access to external and internal financing, and the ability to support innovation and scaling without excessive risk. The normalized eigenvector, therefore, summarizes the collective belief of experts about the relative economic value of each level, and these weights S_1 , S_2 , and S_3 are later used in the integral utility function U_x , which links the chosen configuration of financial resources to expected changes in competitiveness and key financial outcomes of the enterprise.

Now we calculate the weight values of achieving the corresponding levels of competitiveness of IT enterprises, taking into account the need for financial resources. That is, for each pair of alternatives, a rank from the Saati scale is selected. The diagonal elements are equal to one. This corresponds to the conditions of the methodology. Let us present a matrix of pairwise comparisons of financial resources for achieving the minimum level of competitiveness (Table 5).

Table 5. The matrix of pairwise comparisons of financial resources for achieving the minimum level of competitiveness.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
A	1	1	1	1	1	9	7	7	7	3	9	3	1	5	3	1	5	3
B	1	1	1	1	1	9	5	5	5	3	9	3	1	3	3	1	3	1
C	1	1	1	1	1	9	5	5	5	3	9	3	1	3	3	1	3	3
D	1	1	1	1	1	9	5	5	5	1	9	1	1	3	3	1	3	1
E	1	1	1	1	1	7	3	3	3	1	7	1	1	3	3	1	3	1
F	1/9	1/9	1/9	1/9	1/7	1	1/3	1/3	1/3	1/5	1	1/5	1/7	1/3	1/5	1/9	1/3	1/7
G	1/7	1/5	1/5	1/5	1/3	3	1	1	1	1/3	3	1/3	1/3	1	1/3	1/5	1	1/3
H	1/7	1/5	1/5	1/5	1/3	3	1	1	1	1/3	3	1/3	1/3	1	1/3	1/5	1	1/3
I	1/7	1/5	1/5	1/5	1/3	3	1	1	1	1/3	3	1/3	1/3	1	1/3	1/5	1	1/3
J	1/3	1/3	1/3	1	1	5	3	3	3	1	5	1	1	1	1	1/3	1	1
K	1/9	1/9	1/9	1/9	1/7	1	1/3	1/3	1/3	1/5	1	1/5	1/7	1/3	1/5	1/9	1/3	1/7
L	1/3	1/3	1/3	1	1	5	3	3	3	1	5	1	1	1	1	1/3	1	1
M	1	1	1	1	1	7	3	3	3	1	7	1	1	3	3	1	3	1
N	1/5	1/3	1/3	1/3	1/3	3	1	1	1	1	3	1	1/3	1	1	1/3	1	1/3
O	1/3	1/3	1/3	1/3	1/3	5	3	3	3	1	5	1	1/3	1	1	1/3	1	1
P	1	1	1	1	1	9	5	5	5	3	9	3	1	3	3	1	3	3
Q	1/5	1/3	1/3	1/3	1/3	3	1	1	1	1	3	1	1/3	1	1	1/3	1	1/3
R	1/3	1	1/3	1	1	7	3	3	3	1	7	1	1	3	1	1/3	3	1

Next, the vector E_n was calculated through the geometric means of the rows. Therefore, within the framework of our study, the vector E_n itself reflects the economic structure of priorities between financial resources to achieve a certain level of competitiveness. Each of its elements shows what share in the aggregate effect individual sources of financing have, so they can be interpreted as weights in the target portfolio of resources. It is presented in the table of weights on the screen. After discretization, the weights retain the expected hierarchical order. Internal and customer sources remain first. Operating cash flow is denoted (A), prepayments and long-term contracts (P), and deferred income (C). This is followed by retained earnings (B), factoring (M). At the same time, external equity and venture debt instruments have lower values at this level (Figure 2).

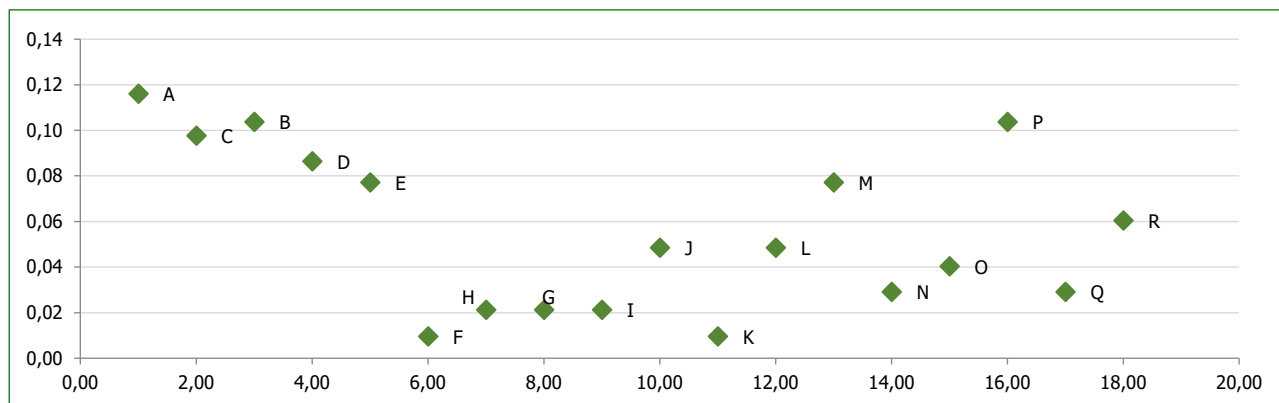


Figure 2. Weights E_n for achieving the minimum level of competitiveness after discretization.

The main eigenvalue is approximately λ_{max} . The consistency index IU is calculated in a standard way according to the formula presented above. For the number of alternatives $n=18$, the reference random index WI from the extended Saati tables (1.62) was used. The consistency ratio $WU=IU/WI$. The obtained values are within the limits of acceptability (0.022). The economically low value of the WU indicator confirms that experts' judgments about the superiority of some financial resources over others are internally consistent. Therefore, this means that their answers about which tools are more important for ensuring a minimum level of competitiveness do not contradict each other and form a holistic picture of the behavior of an IT enterprise in the position defense mode.

The normal level means stabilization and restoration of organic growth. This implies a balanced use of internal sources and available debt, as well as reliance on customer contracts. The numerical relationships are consistent with our previous logic of weights for the normal level, but presented in the discrete form of the Saati scale. To achieve a normal level of competitiveness, a more balanced combination of financial resources will be optimal. That is, a balance between internal funds and instruments with a moderate debt load. Thus, operating cash flow (A) and retained earnings (B) remain important. Credit lines (J) and leasing (L) enhance the possibility of stabilization without diluting ownership. From the perspective of financial management, a normal level of competitiveness describes a situation where the enterprise has already moved out of a purely defensive position and can afford a moderate debt load in order to resume sustainable growth. The dominance of operating cash flow and retained earnings in the E_n vector means that the main source of development remains its own performance, while the emergence of a greater weight of credit lines and leasing reflects the need for smooth financing of infrastructure renewal without one-time large capital expenditures (Table 6).

Table 6. The matrix of pairwise comparisons of financial resources for achieving the normal level of competitiveness.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
A	1	1	3	3	3	5	3	3	3	1	3	3	3	3	3	1	3	3
B	1	1	1	3	3	5	3	3	3	1	3	1	3	3	3	1	3	3
C	1/3	1	1	1	1	3	1	1	1	1	3	1	1	1	1	1	3	3
D	1/3	1/3	1	1	1	3	1	1	1	1	1	1	1	1	1	1/3	1	1
E	1/3	1/3	1	1	1	3	1	1	1	1	1	1	1	1	1	1/3	1	1
F	0,2	0,2	1/3	1/3	1/3	1	1/3	1/3	1/3	1/3	1	1/3	1/3	1/3	1/3	1/2	1	1
G	1/3	1/3	1	1	1	3	1	1	1	1	1	1	1	1	1	1/3	1	1
H	1/3	1/3	1	1	1	3	1	1	1	1	1	1	1	1	1	1/3	1	1
I	1/3	1/3	1	1	1	3	1	1	1	1	1	1	1	1	1	1/3	1	1
J	1	1	1	1	1	3	1	1	1	1	3	1	1	1	1	1	3	3
K	1/3	1/3	1/3	1	1	1	1	1	1	1/3	1	1/3	1	1	1	1/3	1	1
L	1/3	1	1	1	1	3	1	1	1	1	3	1	1	1	1	1	3	3
M	1/3	1/3	1	1	1	3	1	1	1	1	1	1	1	1	1	1/3	1	1
N	1/3	1/3	1	1	1	3	1	1	1	1	1	1	1	1	1	1/3	1	1
O	1/3	1/3	1	1	1	3	1	1	1	1	1	1	1	1	1	1/3	1	1
P	1	1	1	3	3	5	3	3	3	1	3	1	3	3	3	1	3	3
Q	1/3	1/3	1/3	1	1	1	1	1	1	1/3	1	1/3	1	1	1	1/3	1	1
R	1/3	1/3	1/3	1	1	1	1	1	1	1/3	1	1/3	1	1	1	1/3	1	1

Calculated the vector E_n through the geometric means of the rows, the indicators are shown in Figure 3. Therefore, here for $n=18$, the reference random index from the extended Saati table is used. The WU consistency ratio is less than 0.1 (0.024), so the consistency level is acceptable.

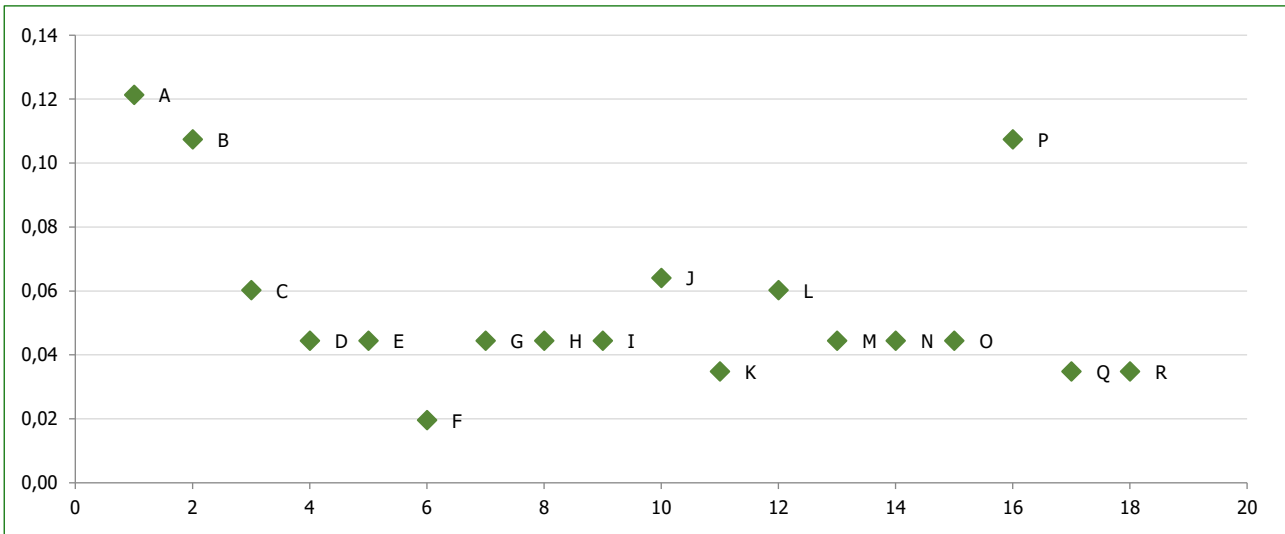


Figure 3. Weights E_n for achieving the normal level of competitiveness after discretization.

The maximum level means aggressive scaling and accelerating innovation. Therefore, for the maximum level, the highest E_n weights have instruments that provide large amounts of financing for rapid growth. Venture capital (H) and private placements (G), as well as convertible instruments (I) and venture debt (K), form the financing basis for this level. Customer contracts (P) and credit lines (J) support the predictability of cash flows. Internal sources remain important, but not decisive for the jump in competitiveness (Table 7).

Table 7. The matrix of pairwise comparisons of financial resources for achieving the maximal level of competitiveness.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
A	1	3	3	3	3	3	1	1/3	1	1	1	3	1	1	3	1	3	3
B	1/3	1	3	1	1	3	1/3	1/3	1/3	1/3	1/3	1	1	1	1	1/3	1	1
C	1/3	1/3	1	1	1	1	1/2	1/7	1/2	1/3	1/2	1	1/3	1/3	1/3	1/3	1/3	1/3
D	1/3	1	1	1	1	1	1/3	1/2	1/3	1/3	1/3	1	1	1	1	1/3	1	1
E	1/3	1	1	1	1	1	1/3	1/2	1/3	1/3	1/3	1	1	1	1	1/3	1	1
F	1/3	1/3	1	1	1	1	1/2	1/7	1/2	1/3	1/2	1	1/3	1/3	1/3	1/3	1/3	1/3
G	1	3	5	3	3	5	1	1	1	1	1	3	3	3	3	1	3	3
H	3	3	7	5	5	7	1	1	1	3	1	5	3	3	3	3	3	3
I	1	3	5	3	3	5	1	1	1	1	1	3	1	1	3	1	3	3
J	1	3	3	3	3	3	1	1/3	1	1	1	3	1	1	3	1	3	3
K	1	3	5	3	3	5	1	1	1	1	1	3	1	1	3	1	3	3
L	1/3	1	1	1	1	1	1/3	1/2	1/3	1/3	1/3	1	1	1	1	1/3	1	1
M	1	1	3	1	1	3	1/3	1/3	1	1	1	1	1	1	1	1	1	1
N	1	1	3	1	1	3	1/3	1/3	1	1	1	1	1	1	1	1	1	1
O	1/3	1	3	1	1	3	1/3	1/3	1/3	1/3	1/3	1	1	1	1	1/3	1	1
P	1	3	3	3	3	3	1	1/3	1	1	1	3	1	1	3	1	3	3
Q	1/3	1	3	1	1	3	1/3	1/3	1/3	1/3	1/3	1	1	1	1	1/3	1	1
R	1/3	1	3	1	1	3	1/3	1/3	1/3	1/3	1/3	1	1	1	1	1/3	1	1

Similarly, the normalized vector E_n was calculated using the geometric means of the rows. The obtained values are within the acceptable limits, so the judgments are consistent (Figure 4).

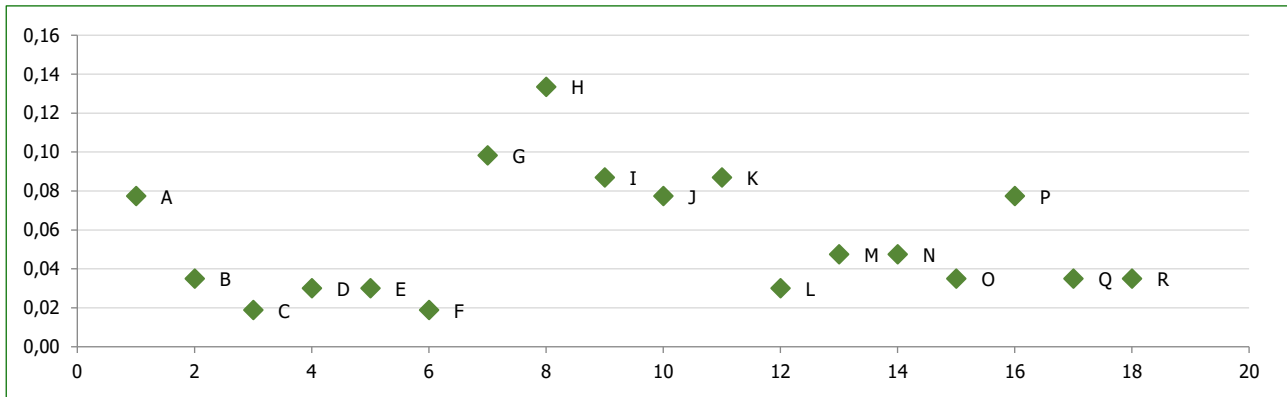


Figure 4. Weights En for achieving the maximal level of competitiveness after discretization.

It should be noted that all components of the normalized principal eigenvector of competitiveness levels, which we have already determined from the level matrix, are used as weights S. The obtained values are as follows: $S_1=0.054$; $S_2=0.289$. $S_3=0.655$ (this was already presented above). In our specific case, there are the following options for calculating the values of the utility function of alternatives. For any alternative X from the set A to R, the integral estimate is determined by formula (6):

$$U_X = S_1 \cdot u_{1X} + S_2 \cdot u_{2X} + S_3 \cdot u_{3X} \tag{6}$$

where u_{1X} , u_{2X} , u_{3X} are the normalized weights of alternative X from the matrices for levels g_1 , g_2 , g_3 .

According to the integral assessment, the top of the rating is instruments that provide scaling and rapid growth in market value and value. These are venture capital and private placements, as well as convertible instruments and venture debt. High positions are occupied by client contracts and bank credit lines, which support the predictability of cash flows and reduce liquidity risk. Internal sources remain significant in the stabilization zone (Table 8).

Table 8. Integral estimates U for alternatives A–R.

Marking	Financial resource	$u_{1j} (g_1)$	$u_{2j} (g_2)$	$u_{3j} (g_3)$	$U = 0.054 \cdot u_1 + 0.289 \cdot u_2 + 0.655 \cdot u_3$	Rank
H	Angel investments and venture capital	0.02	0.04	0.13	0.101	1
A	Operating cash flow from the sale of products and services	0.12	0.12	0.08	0.094	2
P	Upfront payments and long-term customer contracts	0.10	0.11	0.08	0.087	3
G	Private placements of shares and initial public offerings of shares	0.02	0.04	0.10	0.078	4
J	Bank loans and lines of credit	0.05	0.06	0.08	0.072	5
I	Convertible loans and simple future share agreements	0.02	0.04	0.09	0.071	6
K	Venture debt financing	0.01	0.03	0.09	0.068	7
B	Retained earnings and internal reserve funds	0.10	0.11	0.03	0.059	8
M	Factoring and forfeiting receivables	0.08	0.04	0.05	0.048	9
N	Income-linked financing	0.03	0.04	0.05	0.045	10
L	Leasing equipment and software assets with long-term licenses	0.05	0.06	0.03	0.040	11
O	Government grants, innovation support programs, and tax incentives for research and development	0.04	0.04	0.03	0.038	12
D	Depreciation and amortization	0.09	0.04	0.03	0.037	13
E	Redistribution of funds between areas and products within a group of companies	0.08	0.04	0.03	0.037	14
R	Partnership programs from infrastructure providers with a financial impact	0.06	0.03	0.03	0.036	15
C	Deferred revenues and customer subscriptions	0.10	0.06	0.02	0.035	16
Q	Monetizing intellectual property through licensing and selling property rights	0.03	0.03	0.03	0.035	17
F	Founders' contributions and additional contributions from participants	0.01	0.02	0.02	0.018	18

Thus, we will highlight key recommendations for each of the most important financial resources, according to the ordering by integral score U (Figure 5).

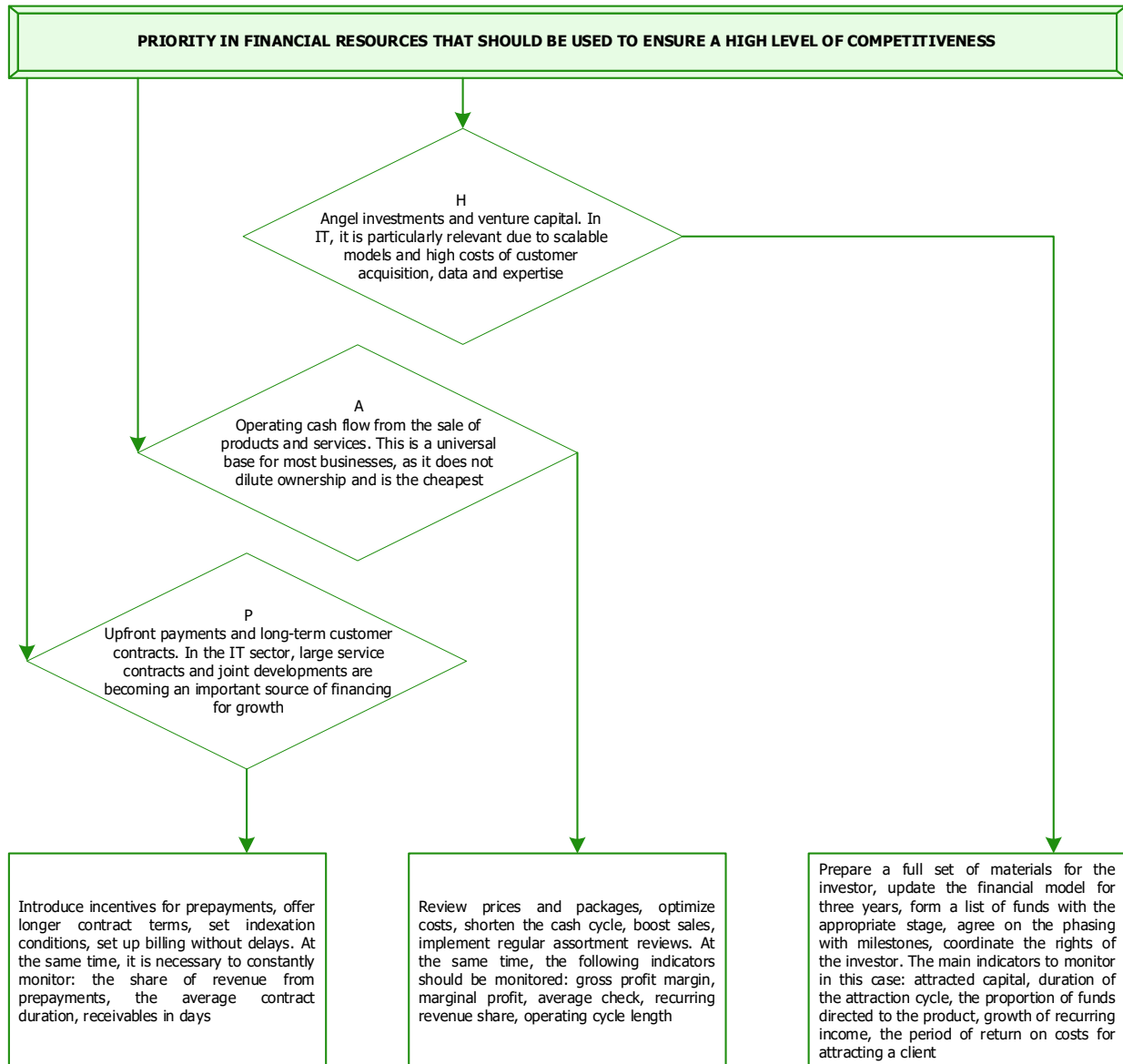


Figure 5. Management actions and recommendations for financial resources in order of priority (for the top three priorities).

Therefore, in our opinion, it is the first three positions, H, A, and P, that form the core of a strategy for rapid strengthening of competitiveness, since they directly support scaling and generate recurrent cash flows. The next group of resources forms a stabilization belt and includes private placements of shares and initial public offerings G, bank loans and credit lines J, convertible loans and simple future share agreements I, venture debt financing K, retained earnings and internal reserve funds B, factoring and forfeiting receivables M, revenue linked financing N, leasing of equipment and software assets with long term licenses L, as well as government grants, innovation support programs and tax incentives O. The list is completed by tools with a narrower scope of application or higher organizational requirements, such as depreciation and amortization D, internal redistribution of funds within a group of companies E, partnership programs from infrastructure providers with financial impact R, deferred revenues and customer subscriptions C, monetizing intellectual property through licensing and selling property rights Q, and founder's contributions and additional contributions from participants F.

DISCUSSION

One of the critical challenges in managing the financial resources of IT enterprises is aligning capital-raising strategies with operational constraints and liquidity risks. Thus, our results showed that the priority of venture capital, private placements, and convertible instruments at the maximum level of competitiveness is justified, but such a configuration requires high-quality management of investor rights and the rate of scaling. Otherwise, the threat of property dilution and loss of flexibility increases. In this aspect, our approach is consistent with the practical conclusions about the importance of systematic cash flow planning and capital policy, which are presented in the study on the management of financial resources of the enterprise (Stus and Chumachenko, 2024). An alternative approach focused on financial security is proposed by Dokienko (2021) through assessment using integral indicators and threshold values. In our study, this logic is similarly preserved in the form of three target levels of competitiveness with a check on the consistency of judgments, but the focus is shifted from security to actively achieving advantages in scalability and speed of innovation. The results of systematic reviews by Chali and Lakatos (2024) and Sari and Ainun (2024) on the relationship between resource management and performance complement our formulation. In particular, they highlight the importance of human capital as a driver of financial performance, which aligns with our resource framework, where financial decisions should be aligned with policies for engaging engineers, product managers, and data scientists.

In terms of organizing cash transactions and the efficiency of payment processing, our recommendations regarding factoring, credit lines, and long-term customer contracts are consistent with scientific findings. These findings emphasize the impact of payment discipline and proper transaction support on the manageability of the financial resources management system (Rumyk, Dolianovskyi, and Rzazade, 2025). Even cross-sectoral reviews (Yvette G. Gonio et al., 2024) emphasize the importance of transparency, governance, and clear procedures in financial management.

Compared to existing approaches, the novelty of our work lies in the way three elements are combined into a single decision-making framework that is explicitly tailored to IT enterprises. First, we introduce structured levels of competitiveness with weights S_1 , S_2 , and S_3 that are defined not only abstractly but also through observable financial and market indicators, which makes it possible to translate qualitative strategic goals into quantitative targets. Second, we apply pairwise comparison matrices to a broad set of eighteen financing alternatives and obtain consistent local priorities for each target level, which captures how the role of particular instruments changes when the enterprise moves from a defensive position to stabilization and then to aggressive growth.

CONCLUSIONS

In line with the stated aim, the study first identified and justified a list of 18 financial resources that are relevant for strategic management of IT enterprises and that directly affect their competitiveness through cash flows, access to capital, and the ability to scale. Next, we formalized a three-level scale of enterprise competitiveness and linked each level to a set of financial and market indicators, which made it possible to interpret minimum, normal, and maximum states in economic rather than purely qualitative terms.

The conducted modeling showed that in modern management of financial resources of IT enterprises, there is a wide range of internal, external, hybrid, and client sources that can be combined to achieve strategic goals of competitiveness, while the role of digital approaches to planning and control of financial decisions is increasing. In addition, the results of pairwise comparisons showed that the effectiveness of such decisions crucially depends on the ability of the enterprise to quickly rebuild the portfolio of financing sources depending on the target level of competitiveness, from minimum to maximum, taking into account the cost of capital, liquidity risks, and scaling rates. The calculation of utility functions for three pairwise comparison matrices is performed correctly, since the main eigenvalues, consistency indices, and consistency ratios for each matrix are within acceptable limits, which confirms the reliability of expert judgments and gives grounds to use the obtained priorities in making management decisions. Integral utility estimates U for 18 financial resources gave an ordered priority. The basis of the portfolio for accelerating competitiveness is formed by investments and venture capital, private placements, and initial public offerings of shares, convertible instruments, and venture debt. For the minimum level of competitiveness, it is advisable to rely on internal and client sources, operating cash flow, prepayments, deferred income, and factoring, which reduces the burden on equity and does not require expensive investments. And for the maximum level, priority is given to external equity and convertible instruments in conjunction with venture debt, which provides large amounts of financing for scaling, taking into account the risk profile. The resulting integral utility estimates provide an ordered ranking of the 18 resources and can be applied as a decision support instrument in practice. The results are most relevant for product-oriented information technology companies with high growth dynamics and uneven cash inflows, including software as a service, fintech, and digital platform firms, particularly at the scaling

stage. The primary audience includes founders, chief financial officers, financial managers, corporate finance teams, and venture capital investors and lenders who need to align financing instruments with growth stage, repayment capacity, and nonstandard cash flow timing.

A limitation of the study is that the constructed ranking of financial resources is sensitive to changes in the phases of market cycles; therefore, in different circumstances, the priorities of financing instruments may shift and require periodic revision. Prospects for further research include expanding the model through scenario modeling of cash flows, combining the paired comparison method with probabilistic approaches to assessing utility, integrating indicators of the cost of capital and operational risks into a single system for selecting a portfolio of financial resources, and using technologies based on artificial intelligence.

ADDITIONAL INFORMATION

AUTHOR CONTRIBUTIONS

All authors have contributed equally.

FUNDING

The Authors received no funding for this research.

CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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ОЦІНКА ТА РАНЖУВАННЯ ФІНАНСОВИХ РЕСУРСІВ У СТРАТЕГІЧНОМУ УПРАВЛІННІ ПІДПРИЄМСТВ ІТ-ЦАРИНИ В КОНТЕКСТІ ПІДВИЩЕННЯ КОНКУРЕНТОСПРОМОЖНОСТІ

Мета дослідження полягає в розробці відтворюваної моделі оцінювання та ранжування фінансових ресурсів у системі стратегічного управління підприємствами в царині ІТ, яка би забезпечила підвищення конкурентоспроможності на прийнятному рівні. Для досягнення поставленої мети автори виконали такі завдання: визначити перелік найбільш вагомих фінансових ресурсів як об'єктів оцінювання в стратегічному управлінні підприємствами ІТ, пояснити критерії їх добору з огляду на вплив на конкурентоспроможність; формалізувати три цільові рівні конкурентоспроможності підприємства в царині інформаційних технологій, визначити показники, що відображають досягнення кожного рівня, та пов'язати їх зі станом фінансових ресурсів; виконати розрахунок функцій корисності та інтегральних оцінок «U» для кожного фінансового ресурсу, сформувати впорядкований рейтинг їх впливу на конкурентоспроможність підприємства та інтерпретувати отримані результати з позицій стратегічного управління. Отож, було обґрунтовано перелік із 18 форм фінансових ресурсів, визначено три рівні системи цілей конкурентоспроможності: мінімальний, нормальний, максимальний. Також було проведено кількісну оцінку альтернатив на основі матриць парних порівнянь із перевіркою узгодженості експертних і власних суджень, отримано ваги рівнів і побудовано інтегральні оцінки корисності для кожного ресурсу. Показано, що основу портфеля для прискорення зростання формують інвестиції й венчурний капітал, приватні розміщення акцій, конвертовані інструменти та венчурний борг; важливу роль у стабілізації відіграють операційний грошовий потік, довгострокові клієнтські контракти, кредитні лінії та факторинг. Запропоновано механізм реалізації управлінських дій і показників контролю за найбільш вагомими фінансовими ресурсами. Наукова новизна полягає в поєднанні тривірневої мети конкурентоспроможності з багатокритеріальним упорядкуванням переліку джерел фінансування та операційними картами дій; практична значущість полягає в можливості швидкого формування раціонального портфеля фінансування залежно від обраного цільового рівня конкурентоспроможності.

Ключові слова: управління фінансовими ресурсами, конкурентоспроможність підприємства, матриці парних порівнянь, інтегральна оцінка корисності, портфель джерел фінансування

JEL Класифікація: G31, G32, M15, L86, O32, C44