

# Information Technology for Strategic Analysis of IT Company Projects

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## Abstract

The application of strategic analysis methods for solving a strategic problem and determining the IT company's development directions was considered. The scientific publication analysis of strategic analysis methods to determine the development prospects for companies in various industries was carried out. The IT company that produced several software products or implemented projects for the development of several software types (IT projects) was considered. These software products are used to determine the company's development direction. The IT projects' strategic analysis and their prospects analysis to increase the company's competitiveness were carried out. Information technology for the strategic analysis of a company's software products was proposed. It includes the following steps: 1) strengths and weaknesses analysis of software products using the SWOT analysis for each product and company; 2) software products competitiveness analysis and their market prospects using the SWOT analysis results; 3) identification of the company's main risks associated with the further development and sale of each software; 4) identification of factors and forces that affect the IT-project risks and the company's risks; 5) determination of priorities for the company's IT project development in accordance with the analytical hierarchy process. As a result, prospective software products were determined to improve the company's competitiveness.

## Keywords 1

Information technology, IT projects, software products, a company's competitiveness, SWOT analysis, and the analytical hierarchy process

## 1. Introduction

Strategic analysis is the process of examining a company's performance in order to develop strategies to achieve a strategic goal. The key goal of strategic analysis is to determine the effectiveness of the current strategy and strategic goal of the company in a changing business environment.

The strategic analysis involves several common characteristics [1]:

- Identifying data on the activities of the company and its environment, this is all the data that is necessary to evaluate and form the company's strategy
- Defining and evaluating the internal and external environments to be analysed
- Using multiple analytical methods such as Porter's five forces analysis, SWOT analysis, value chain analysis and others to solve strategic problems

The strategic analysis process includes such basic steps.

1. Performing the company's current strategic of the internal and external environmentenvironment analysis.
2. When companies research the environment, they focus on issues such as constraints associated with financial problems, operational inefficiencies, employee morale, unmanaged

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business processes, etc. Environmental considerations include political and economic trends, market shifts, changes in consumer preferences and the competitor's emergence, etc.

3. Determining the existing strategies' effectiveness. Determine how the implementation of existing strategies ensures the achievement of company goals

4. Goal formulation and alternative strategy proposals. Strategists can suggest ways to reduce costs and optimise business process. Potential strategic alternatives include changes in a company's capital structure, changes in supply chain management, or any other business process

5. Recommendation and implementation of the most viable strategy. After evaluating the proposed alternative strategies, formulate a recommendation. After evaluating all possible strategic alternatives, the most viable and quantitatively profitable strategy is selected

6. Once recommendations are made, the entire strategic analysis process is iteratively repeated. When there are no questions about the choice and strategy implementation, the strategies are agreed upon, and then they begin to implement them. For this, the company's strategic plan is being developed

Strategies need to be implemented, evaluated, and re-evaluated. They must change because the business environment is dynamic.

Various techniques and tools are used for strategic analysis. Here are the most commonly used in strategic analysis practise [3].

- Gap Analysis is a effective internal analysis tool that helps identify gaps in the company's activities. These gaps impede progress towards the company's objectives and vision. It is recommended to compare the company's current state to its desired future state.
- The VRIO Analysis is an internal analysis tool for evaluating a company's resources. As a result of applying this analysis, organisational resources that may potentially create sustainable competitive advantages for the company is identified.
- The Four Corners Analysis framework assesses the company's future strategy. The strategy needs to be more precise because it puts the corporation one step ahead of its competitors.
- The Value chain analysis is a effective tool to identify and help establish a company's competitive advantage. The Value chain framework achieves this by examining the range of activities in the business. It is necessary to understand what value each of the activities brings to the final product or service
- SWOT is a structured planning method that evaluates those four elements: Strengths, Weaknesses, Opportunities, and Threats.
- This process involves specifying the objective of the business or project and identifying the internal and external factors that are favorable and unfavorable in achieving that objective. The company's SWOT analysis reveals various points that the organisation should focus on to get the exact business needs; this is imperative in both current and future business situations [4]
- Strategy Evaluation. A Strategic Evaluation investigates the strategy previously or currently implemented throughout the company
- Porter's Five Forces Framework scans the company's external environment and helps to gain insight into the current market a company operates in, answering questions such as: why does the industry look the way it does today, what forces of competition outside are shaping it, what is its position among competitors, what is profitable, and what is difficult to do in the market?
- PESTEL Analysis is an acronym for the elements: political, economic, social, technological, environmental, and legal. The analysis basis is to scan each of the elements to estimate their potentially impact on the industry and thus on the company.

It is recommended to use strategic business analysis to improve team efficiency in IT company projects and achieve better project outcomes. The implementation of successful projects allows IT companies to achieve their strategic goals with improved long-term economic results. Linking projects to company strategy can improve project management, including planning, resource allocation, risk management, budgetary control, and performance management.

For example, the BA Times stats that using strategic business analysis ensures project outcomes align with the goals and objectives of the entire company [5]. The BA Times recommends nine areas of strategic business analysis that a company should follow:

- Understanding the business's structure, staff, and culture

- Conducting the company's capability analysis
- Company leaders must recognise the company's strengths and weaknesses and identify opportunities and threats
- Analysis of business problems, opportunities and solutions, from simple process improvement, sales and cost reduction to a strategic decision
- Performing a feasibility and risk analysis of potential solutions; comparing alternative solution, pros-and-cons discussions, and benefits analysis; and developing decision grid to prioritise decisions
- Determining the change initiatives on business, structure, and organisational parameters and capabilities of company
- Development of a business case for investments and expected returns externally or internally for the key initiatives
- Creation of a communications plan to guide the company through changes in line with initiatives that are implemented
- Creation of a roadmap to use best practises in project management implementation, key initiatives, tactical focus and reporting structure

## 2. Problem statement

This paper discusses the activities of a Ukrainian IT company that develops several types of software products (IT projects). The IT company must determine the prospects for its development in the planned period to achieve a strategic goal: increasing the company's competitiveness in the IT market.

IT projects are presented in different market segments. Each type of IT project is considered a possible direction for the company's development.

The problem is considered: the choice of strategic analysis methods and the development of a method for determining priority directions for the development of the company based on strategic analysis data.

The IT market is changing rapidly, so it is necessary to regularly analyse the company's activities (including analysing the effectiveness of software development projects), determine development priorities, and invest in promising IT projects. It is proposed to develop information technology to determine the priority directions for the company's development based on market data and the company's results. The introduction of information technology into the management loop will effectively determine the prioritisation of the company's development directions and make timely management decisions to increase the company's competitiveness in the strategic period based on up-to-date information about the IT market.

## 3. Background and Related Work

The tools and principles of strategic analysis are successfully applied to the strategic management of IT companies and companies in various industries.

The aim of the study [6] is to determine the best strategy and small business management development via SWOT, and the Analytical hierarchy process (AHP) is used in combination. For this purpose, SWOT analysis was implemented for a small-scale enterprise in the food sector (a milk factory), and alternative strategies were determined based on SWOT factors. The SWOT matrix was converted into a hierarchical structure. The AHP model was built, and the general structure of the enterprise was generated. The model structure was solved with the AHP method.

In the paper [7], a novel AHP application in combination with specific ranking for the maintenance strategy at a newly established chemical fertilizers plant is proposed. The main and sub-criteria pertinent to maintenance practise in this industry are defined.

The results of surveys, brainstorming, and expert consultation for form data were used. Pair-wise comparisons and consistency calculations were carried out on the chosen criteria for using to assess candidate maintenance strategies through a special scoring process.

In [8], the SWOT analysis data was turned into a hierarchical structure, and the model formed was solved by means of the FAHP method (the fuzzy analytic hierarchy process). The method application was performed on the strategy selection problem of a state university in Turkey. Surveys conducted among academic staff at the university were evaluated by SWOT analysis. For the six main strategies and 13 sub-strategies obtained as the result of the analyses, pairwise comparison surveys with 37 university senior managers were conducted. Questionnaires were analysed by the FAHP method, and it was concluded that the most important strategy for the university is "to be in the country's top 5 universities and in the world's top 500 universities".

Content Management System (CMS) has become a key information technology for organisations to communicate with their internal and external environments of the company. With the constant development of the Internet and communication technologies, CMS allows you to publish, edit and modify content through a central interface. The CMS as the IT project selection consists of various tangible and intangible criteria that contain uncertainty and incomplete information.

In [9], CMS selection is considered as a multi-criteria decision-making problem. The decision model consists of seven criteria and four alternatives. The AHP-integrated Grey-TOPSIS (Technique for Order Preference by Similarity to the Ideal Solution) method is built. In the model, the criteria weights are determined by the AHP method, and the alternatives are evaluated by Grey-TOPSIS. Sensitivity analysis is provided to monitor the method's robustness. The effects of using different distance functions: Manhattan, Euclidian, and Minkowski distance functions, on the results are examined. The AHP-integrated Grey-TOPSIS method is used to select the CMS of a Turkish foreign trade company.

The article [10], the AHP method for the supplier selection process in the Turkish construction industry was applied. The industry has a rather strong and complex competitive structure. Therefore, it is important to investigate the problem the multi-criteria nature of the corporate environment. It was proposed to solve this problem using the fuzzy AHP method. As a result, using the fuzzy AHP method allowed to simplify the complex and tangled process of choosing a supplier in the Turkish construction industry.

One of the main problems in the IT company's strategic management is project analysis and project portfolio formation [11]. With the rapid increase in complexity, choosing projects that further the IT company's business goals has become a complex problem. More alternatives and an increasingly turbulent business environment increase complexity of the project portfolio management [12]. In the project portfolio management scope, the correct action prioritisation leads to the achievement of the organisational strategic objectives [13].

Issues and the quality of decisions made at the project portfolio level can be addressed using multi-criteria decision-making (MCDM) methods in combination with strategic analysis tools.

Project portfolio management (PPM) has become a key service for many consulting organisations. The paper [14] identifies PPM's key challenges and presents an application literature review of MCDM methods for PPM.

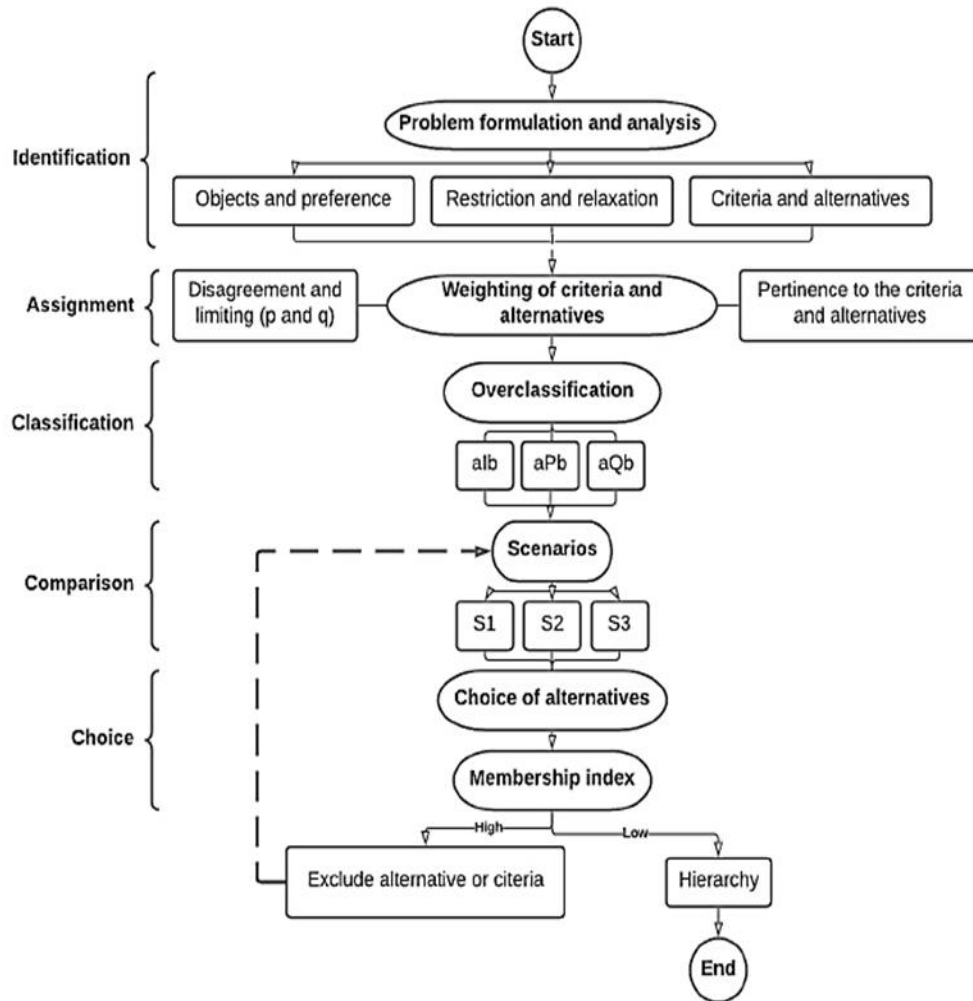
One of the features of project management in an IT company is to take into account the interdependence of projects. However, this problem is not given due attention by researchers in the field of project management. Most studies of IT projects portfolio formation do not consider interdependencies among candidate projects. In the paper [15], a multi-attribute decision-making (MADM) approach for IT project selection is proposed. The proposed MADM model considers both quantitative and qualitative attributes of IT projects and the interdependencies among projects. In a hybrid multi-attribute decision-making model, the technique for order preference by similarity to the ideal solution integrates with multi-objective decision-making (MODM). The multi-attribute decision-making approach is used for the sorting or ranking of IT projects according to multiple attributes and then MODM is used for driving a vector optimisation-based solution.

The biggest difficulty for IT companies nowadays is to prioritise their projects so that the portfolio contains projects of greater value and better cost-benefit to the company. This difficulty exists because of the various conflicting criteria that need to be considered when prioritising. The article [16] reviews the literature and checks which methods are used to select a project's portfolio or set priorities, including digital transformation projects.

According to the THOR method the decision maker to value a significant amount of information during the judgement insertion stage. This may cause severe cognitive fatigue in the decision maker.

The article [17], it was proposed to change the THOR algorithm in the judgement insertion stage. The Inclusion of a fuzzy measurement scale allowed the decision maker to express only a single-value judgement. This reformulation includes three steps of a fuzzy system: fuzzification, fuzzy inference, and defuzzification. A comparative analysis of the THOR algorithm and its new version based on fuzzy scale construction showed a decrease in the decision-making complexity. The reformulation of the THOR method does not compromise the methodological efficiency of the THOR algorithm.

The main steps of the THOR method in flowchart format are presented in Figure 1.



**Figure 1:** THOR algorithm

The first four steps of the algorithm are the same as those adopted in the classic multicriteria methods.

At the identification stage, the decision-maker and other experts participate in the formulation and analysis of the problem and in the definition of criteria and alternatives.

At the assignment stage, the decision-maker is informed of the weightings for criteria and alternatives and their respective pertinence. This means that for each evaluation, the decision-maker must be capable of indicating the certainty level of his answer. For each criterion, disagreement and limiting values are determined, the latter determining relevant and irrelevant differences for the decision-maker.

The following stages are classification and comparison and occur without the intervention of the decision-maker. These steps are designed to perform the over-ranking of alternatives with each of the criteria in a paired manner, and three scenarios are built to yield the attractiveness score.

S1 is considered the most demanding scenario when compared to S2 and S3. In the final choice stage, the veracity of the proposed model is verified by means of the pertinence index. At this stage,

the decision-maker, utilising the pertinence index, has the responsibility of excluding or retaining certain criteria or alternatives that might increase system inaccuracy. The decision maker is the one who chooses the best alternative; the method only suggests an ordering of alternatives.

Thus, if the decision maker opts for exclusion, then it is necessary to return to the comparison stage. Otherwise, the hierarchy is established, and the THOR algorithm is concluded. With the description of the THOR algorithm, it is important to bear in mind that it remains little explored due to the cognitive effort demanded of the decision-maker.

Of the total five stages (identification, assignment, classification, comparison, and choice), the decision-maker has cognitive responsibility over three of them. Based on the strategic planning of a technology consulting company, the paper [18] presents an alternative model for project prioritisation from the perspective that the project selection decision is a vital process in technological associations in two ways.

1. The software development project budget requires a large investment and must be in alignment with the strategic objectives of the company
2. The multidimensionality of organisational returns on projects is naturally risky in terms of the expected outcome

This study considers the project analysis based on a multicriteria approach by the THOR method. This method is called Multicriteria Decision Support Hybrid Algorithm for Decision Making Processes with Discrete Alternatives. This method allowed to provide transparent evaluation, highlighting the most important problem's variables, and identifying the most favorable solution.

The study [19] considers the concept of systematic and non-systematic risks of a project portfolio. Modern Portfolio Theory presents systematic and non-systematic risks as the main conceptual factors influencing portfolio management. Project portfolio non-systematic risk is independent risk. Every project has inherent non-systematic risks. Systematic risk is interdependence risk. Systematic risk relates to the project portfolio's exposure to environmental and market conditions. These risks affect the project portfolio on a global scale.

Systematic risk has two permutations: 1) it is associated with environmental factors; 2) it includes risks from the relationships between projects. Interdependent risks can produce two consequences: 1) risk integration generates to a reduction in the project portfolio risk; 2) risk integration generates an increase in project portfolio risk.

So, systematic risks and non-systematic risks represent a dichotomist risk categorization. These risks allow you to establish the impact level of various factors that can affect the portfolio. Different risk categorization structures have been proposed for generic project portfolios and for specific project portfolios, e.g. in IT, construction, new product development projects.

Article [20] analyses the results obtained by the information technology governance committee (ITGC). The results of sorting and prioritising the portfolio of IT investment projects of a company's undergoing a strategic realignment are considered. The main problem is sorting and prioritising of project alternatives. The problem is related to multicriteria decision-making (MCDM) and multicriteria decision analysis (MCDA). In the article [20], this problem resolved using a new hybrid multicriteria method. The new hybrid multicriteria method consists of the analytic hierarchy process (AHP) and technique for order by similarity to ideal solution-2 normalisation (TOPSIS-2N) techniques. The application of the hybrid AHP-TOPSIS-2N model proved generating two priority sorting possibilities aligned with the company's strategic situation. Solution to the problem made it possible improved in terms of governance and processes of the company.

The problem of changing the portfolio of projects may arise as a result of the strategic analysis. The portfolio of projects for the development of organisations is considered a flexible structure within a certain perspective and is subject to periodic adjustment considering the emerging changes in the external and internal environment, including changes in the priorities of organisations. The authors of the article [21] consider the idea of using information entropy to manage the development of organisations.

When carrying out a strategic analysis, many additional problems should be solved, for example:

1. Processing of large amounts of data about the IT company's external environment, including missing data restoration [22]
2. Monitoring the quality of project management. The article [23] proposes to evaluate and monitor the quality of project management processes based on the entropy concept of

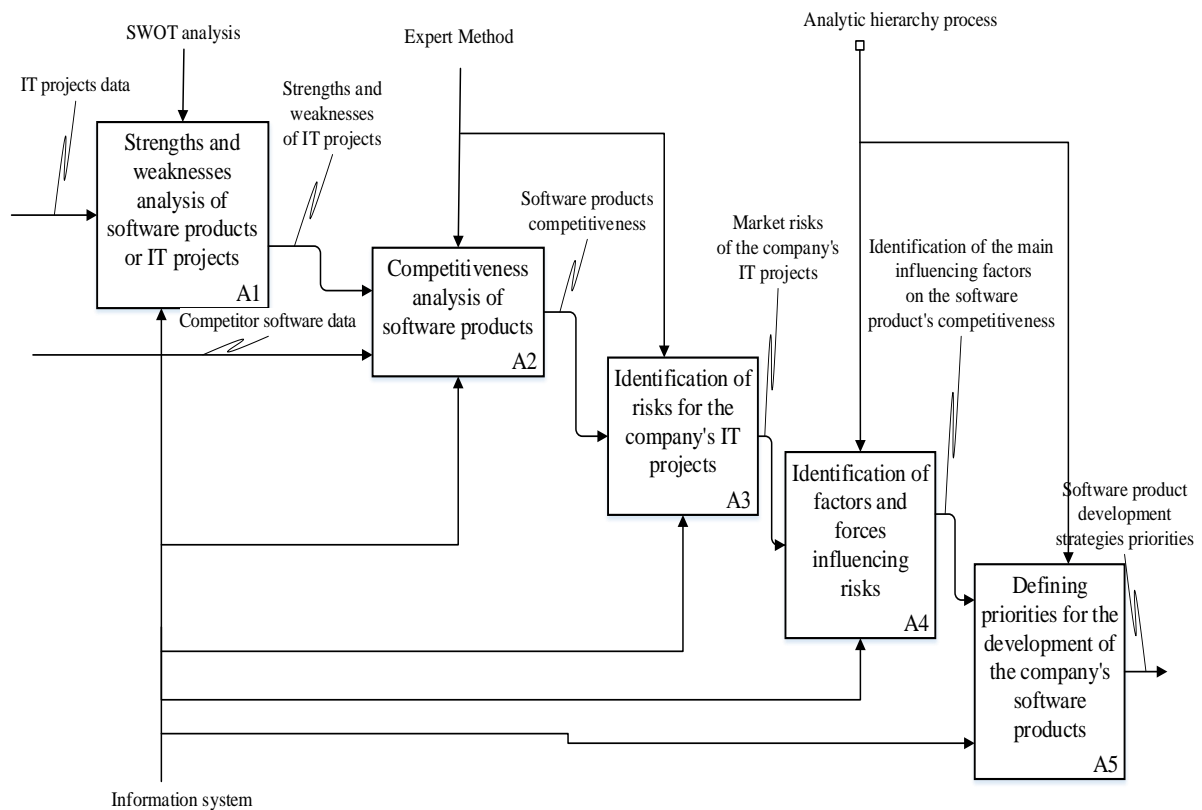
management. The indicator of the project management process's quality is the information project entropy, which meaningfully reflects the "confidence" of the project team in certain project results

3. Team adaptation to the project requirements and the search for effective personnel training practises [24] and others

So, many studies confirm the effectiveness of using the SWOT analysis and the AHP. However, in most cases, only the pairwise comparison technique of alternatives for elements of two or three hierarchy levels is taken from the AHP [25]. In this paper, it is proposed to use the AHP for the strategic analysis of IT company products.

#### 4. Information technology for strategic analysis of IT company projects

Let's consider the IT company developing several software products or carrying out projects to develop several software types. These software products determine the company's development direction. It is necessary to carry out these strategic IT project analyses and determine their prospects to increase the company's competitiveness. For this, it is proposed to use the information technology shown in Figure 2.



**Figure 2:** Information technology for strategic analysis of the company's software product

SWOT analysis and the analytical hierarchy process for the implementation of the IT stages are proposed to be used. Information technology for the strategic analysis of a company's software products includes the following steps:

1. Software strengths and weaknesses analysis. The expert group is formed to carry out the SWOT analysis for each IT project and company
2. Software product competitiveness analysis Experts evaluate the competitive advantages of each company's product and their market prospects using the results of a SWOT analysis

3. Risk identification for the company's IT projects Based on the SWOT analysis results, experts identify the company's main risks associated with the further development and sale of each software product
4. Identification of factors and forces influencing risks Experts identify the main stakeholder actors that affect the software products' competitive advantages and related risks and define the actors' policies and goals. As a result, a direct process hierarchy is formed according to the AHP
5. Defining priorities for the development of the company's software products According to the AHP, direct and reverse processes are implemented. As a result, IT project priorities are determined to increase the company's competitiveness

After performing the SWOT analysis, experts listed the advantages and disadvantages of each software product. Experts determine the IT project's competitiveness (software products) and the company's competitiveness using the SWOT analysis results and marketing research data.

Next, the AHP is implemented to determine the impact of the development strategies of each software product on the company's strategic goal (the problem focus). Let's look at this process (information technology procedures A4 and A5) in detail.

The procedures of the AHP's direct and reverse processes are carried out to identify the impact of the software product development strategies implementation (or the appropriate IT-project type) on its competitiveness. It is proposed to implement the following three steps for each strategic goal of the company's software product:

Step 1. AHP's forward and reverse processes for each goal of the software product development (or the IT project) [25].

The AHP direct process Analyse all available data on the factors influencing the IT company's development and identify which stakeholders (actors) and how they affect the IT company's activities.

Analyse the factors influencing the company's development and identify stakeholders (actors) and their impact on the company's activities. Construction of the direct process hierarchy.

The first level is the problem focus (the common goal is increasing the IT company's competitiveness).

The second level is the actors that influence the common goal's achievement, i.e., the main stakeholders of the company's IT project. The actors include the company's IT departments involved in the software product development (relevant IT-project implementation); the project office; company management and functional departments (for example, the financial department, marketing department, and software sales department); companies' competitors; and other stakeholders.

The third level is the goal of each actor.

The fourth level is the policies that guide each actor to achieve their goals.

The fifth level is scenarios-development strategies for each IT project type. In other words, these are possible scenarios for the company's software product development. For example, the strategy for improving the development of a software production process is the production strategy; the strategy for improving the functionality of a software product is the functional strategy; the strategy for improving the development team is the personnel strategy; and the strategy for improving software product promotion in the IT market is the marketing strategy.

Calculate the influence estimates of one hierarchy-level element on the higher-level elements. For this purpose, the AHP pairwise comparison procedure is used. Executed:

- Actors' priorities calculation concerning the problem focuses (the IT company's strategic development)
- Priorities are calculated based on each actor's goals
- Calculation of actors' policy priorities concerning their goals
- Selection of the main actors that have the highest priority regarding the problem focus; determining the priorities and weighted values of actors' policies in relation to their goals; selection of the most important political actors Also, if the non-core actors' policies, according to experts, affect the company's development, then they can be included in the analysis in reverse
- Calculation of development strategy priorities for each software product (or IT project type) regarding the most important actor policies and calculation of weighted priorities As a result, the



development strategies and priorities of the company's software products or relevant IT projects will be determined. They define strategies to achieve the IT company's development goal, subject to the important goals and policies of the main actors - IT project stakeholders

- Determining the degree of impact of the strategies implemented for software product improvement (production, functional, personnel, and marketing strategies) on the IT company's competitiveness. For this, the generalised influence degree is calculated. The aggregate indicator of the product development strategy's influence on the company's competitiveness is calculated based on the paired comparison method.

An analysis of the direct process results is a possible way to form a comprehensive scenario for increasing the IT company's competitiveness based on the implementation of software product development strategies.

If there is no such result, then a decision is made on the need to implement the reverse AHP process.

It is necessary to analyse other factors to achieve the main goal of increasing the IT company's competitiveness.

If necessary, new actor policies and new actors are added-minor actors who can influence goal achievement.

Implementation of the reverse AHP process Construction of the reverse process hierarchy:

- The first level is the desired goal of the company's development, for example, support for the development of all software products (IT projects)
  - The second level is all possible scenarios-strategies for improving software products.
  - The third level is problems and situations that may hinder the implementation of strategies. Here, the results of SWOT analysis and risk analysis are used
  - The fourth level is actors who can influence the solution of these problems (main and additionally selected IT project stakeholders)
  - The fifth level is new policies of the main actors that were not considered in the direct process, as well as the addition of non-main actors' policies that may affect the company's goals
- Next, calculations are made to determine the priorities of the hierarchy elements.

Analysis of the results of direct and reverse processes. An analysis is made of the strategies and priorities for the software product's development in relation to the problem focus.

As a result, actors and politicians with low priority are excluded from further analysis. If necessary, the next iteration of the AHP is carried out. If no new results are obtained with each iteration, then the process ends.

Step 2. Based on the results of the AHP's procedure of direct and reverse processes for all purposes of improving software products, strategies are formed to achieve the main goal. These strategies are for software product development. The goals influence on the degree of development of software products for improving the IT company's competitiveness is also determined. The goals of improving software products are sorted in descending order of the aggregate indicator values of impact on the main goal of the IT company's development.

Step 3. Determination of priority software products (IT projects) to achieve the company's strategic goal. The priority goals list for improving software products and strategies for achieving them is being formed.

The strategic analysis based on the AHP and SWOT allows you to determine the prospects for the development of IT products and their competitiveness in the IT market.

Thus, with the proposed information technology introduction, the company's development prospects are determined.

## 5. Conclusion

In this paper, the IT company producing several software products or implementing projects for the development of software of several types (IT projects) was considered. It is proposed to use the AHP for the strategic analysis of IT-company software products. Based on the research carried out, it was concluded that many studies confirm the effectiveness of using the SWOT analysis and the AHP.

However, in most cases, the pairwise comparison of alternatives technique for elements of two or three hierarchy levels is taken from the AHP.

The IT projects carried out strategic analysis and determined their prospects for increasing the company's competitiveness by producing several software products or implementing projects for the development of software of several types (IT projects) considered. These software products determine the company's development direction.

Information technology for the strategic analysis of a company's software products was proposed. It includes the following steps:

- Strengths and weaknesses analysis of software products using the SWOT analysis for each product and company
- Software products competitiveness analysis and their market prospects using the SWOT analysis results
- Identification of the company's main risks associated with the further development and sale of each software
- Identification of factors and forces that affect the IT project's risks and the company's risks
- Determination of priorities for the company's IT project development in accordance with the analytical hierarchy process

As a result, promising software products are identified to improve the company's competitiveness.

So, the multi-level hierarchy is constructed to analyse the main factors, stakeholders, and their policies that affect the IT company's product competitiveness. As a result, promising software products are identified to improve the company's competitiveness.

The proposed information technology implementation will allow the evaluation of software products from the point of view of the IT company's development prospects.

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