Journal of Information Technology Management

Print ISSN: 2008-5893

Online ISSN: 2423-5059

Strategize Company’s Sustainable Management of Investment Project Evaluation Based on the Information Support

Kathrin Dumanska

*Corresponding author, Candidate of Economic Sciences, Associate Professor of Department of Enterprise Economics and Entrepreneurship, Khmelnytsky National University, Khmelnytsky, Ukraine. Email: KathrynD@bigmir.net

Inna Chaikovska

PhD in Economics, Assistant Professor of Department of Mathematics, Statistics and Information Technologies, Leonid Yuzkov Khmelnitskyi University of Management and Law, Khmelnytsky, Ukraine Email: inna.chaikovska@gmail.com

Liudmyla Vahanova

PhD in Economics, Associate Professor of Department of Public Management and Administration, Leonid Yuzkov Khmelnitskyi University of Management and Law, Khmelnytsky, Ukraine. Email: milascincevaganova@gmail.com

Dmytro Kobets

Candidate of Economic Sciences, Associate Professor of Department of Accountancy, Audit and Taxation, Khmelnytsky National University, Khmelnytsky, Ukraine. Email: asstejnnki@gmail.com

Abstract

This paper focuses on the problems of company’s sustainable management in an emergent environment. The authors’ vision of the functioning peculiarities in the formulation of a company’s strategy based on the information support is presented in the article. The world experience of studying the development of investment projects in companies of different industry sectors is investigated and analyzed according to the economic and mathematical modeling. A multivariate model of evaluation and selection of the investment project based on the hierarchy criterion of company's economic objectives with the information technology is developed as an embodiment of the strategic goal of ensuring the company's sustainability. The essence of the hierarchy criterion method is to determine the order and the value of priority of each individual criterion, thus, application of this method allows providing recommendations for making an

effective management decision in unpredictable environment. The proposed *model* based on the hierarchy criterion of company's economic tasks allows providing sustainability in emergent environment. The analysis and substantiation of the necessity of applying the proposed model with the information technology support is presented in this paper.

Keywords: Management information systems, Sustainability, Strategize company, Investment project, Economic and mathematical modeling, Multivariate model, Evaluation criterion, Sustainable management.

DOI: 10.22059/jitm.2021.80743 Document Type: Research Paper

Introduction

The investigations of current trends in the world economy development emphasize that the actualization of issues of country's economic stabilization in the conditions of emergence both at the world and national levels is manifested in the background of company's sustainability. Cyclic processes of changes in the levels of company's development: from profitable to unprofitable and vice versa, change the sizes of country's GDP, the volumes of export-import turnover between countries, the sectoral competitiveness in the world market. And in order to stabilize the country's economy and ensure its economic growth, it is necessary to identify the main trends of strategic sustainability and successful activity of companies, and to create the most favorable conditions for their sustainable development. Among the possibilities of ensuring the company's economic stability authors introduce the idea of strategize company's sustainable management due to the increase of investment projects. From the authors' point of view, the most strategize companies are those that are provided with portfolio of flexible strategies on management vertical from corporate to functional with a wide range of methodological apparatus for responding to changes in the economic environment. In order to ensure company's sustainability the authors propose the use of investment programs and projects as one of the effective methods of sustainable management. In recent years, a high level of sustainability has been recorded precisely in the strategizing energy, metallurgical, trading and agricultural companies of Ukraine, which have attracted investments in the processes of business activity. In order to ensure the company's sustainable management, regardless of the branch of operation, a universal approach to the criterion evaluation of an investment project is proposed. The author's vision of strategizing as one of the company's activity optimization directions is offered and the basis of such direction is the choice of the most effective investment project. To solve the problem of selecting and evaluating the most effective investment project according to the criteria of company's sustainability our authors' group propose a *multivariate model of evaluation and selection of the investment project* based on the criterion hierarchy of company's economic objectives.

The main issues of company's sustainability that focus their attention the organizational and economic aspects of stability management are widely discussed (Amini and Bienstock, 2014). In accordance with the results of the statistics study the implementation of effective corporate projects are analyzed (Sabini, 2016). In its tern, the determining and evaluating processes of company's sustainability level on the basis of different theories have studied. It was also proved that company's non-financial reporting stimulates the increase of the investors' interests and, as a result, growth of investments in such a company (Delgado-Ceballos and Monteil, 2014). The investor attraction to companies and business, taking into account the sustainability management as a leading factor in investment activities increasing was investigated (Grewal, Serafeim and Yoon, 2016). Voynarenko, Dumanska and Ponomaryova (2019) studying company's strategic positioning process in emergent environment have argued the existence of direct relationship between company's sustainability and its effective strategic management. «The mechanism of strategic management of the company provides such conditions of its functioning that ensure stability of the development and the ability to respond flexibly to the challenges of the external environment» (Voynarenko, et al., 2019).

In view of the scientific experience of company's innovative projects developing, it was analyzed the approaches to the formation of the project management system in the direction of its essence and constituent components (Derynska, 2019). Such like approaches are criticized by our authors' group for the lack of evaluating criteria of innovation project effectiveness, because this topic is quite important at the level of implementation of systematic business process management. From the point of view of planning and implementation of trade enterprise development projects (Kirdina, 2018, Brin, 2020), for example, in practice it is possible to use two different in their content approaches, namely: controllability of the project development process and implementation and distribution of managerial influence between functional project managers by types of processes performed. However, as in the previous case, this position of the author does not characterize the effectiveness of the actual innovation process implementation.

Comprehensive studies of project management (Gowtham and Peter, 2017) make it possible for the authors to reveal the basic methods of financing investment projects. In its tern, features and ways of influence of risk-management on the development of successful investment projects with the introduction of effectiveness evaluating methodology of investing were proposed in the work of group of authors from Hungary and Bulgaria (Jovanovic, Milijic, Dimitrova and Mihajlovic, 2016). Such group of authors (Busheyev, Busheyev and Yaroshenko, 2018) has analyzed the changes in the environment from "rational economy" to "behavioral economy", which require additional researches in the sphere of effectiveness of application of existing methodologies, knowledge systems and competencies of project managers. The problems of improving the project management effectiveness have received much attention in the researches of Spalek, who proposed an analytical model of the components of project

evaluation (Spalek, 2014). As a result of their explorations the representatives of the Office of European Commission for Urban Policy Management have offered a textbook on cost-effectiveness analysis of investment projects with detailed recommendations on the analytical and practical aspects of selecting, evaluating and implementing effective projects in the regional economy. Such a textbook helps to ensure the sustainability of economy of the regions that implement investment projects (Guide to Cost-Benefit Analysis of Investment Project, 2015).

It is necessary to emphasize that some authors (Medvedeva, Yegorchenkova, 2018) consider the organizational structure of electronic project management, and show that interrelations between roles form areas of responsibility for project team members, which are represented as interaction pyramids, creating interaction between project roles and interaction of roles with electronic project manager. In their further studies it is formalizes the definition of the management model, as well as the characteristics of its application. In spite of individual achievements, the above scientific positions are not fully substantiated, since there is no process to develop a method of establishing a link between the description of such a project and management models. Particularly attention should be paid to the opinion on the role of using project management methodology in strategic enterprise development. In its term, Kogut has introduced project management model that combines basic project management functions with the tools used for this purpose (Kogut, 2016). Studying the algorithm for information and analytical support for project management processes presented in Kramarenko's scientific researches, we can admit that the result of its implementation is to establish an effective communication system within the project between the team, stakeholders and other employees in case of project team activities within the framework of already established organizational structure of the enterprise (Kramarenko, 2018).

Such authors as Chaikovska, Fasolko, Vaganova, Barabash (2017; 2016) proposed an economic and mathematical model of project team formation, which uses combinatorial elements, expert survey and method of direct assessment (Babenko, et al., 2021). For a comprehensive assessment of the optimal project team composition, it is suggested to take into account professional, intellectual, social component indicators as well as knowledge, interest and experience of solving similar problems (Chaikovska, et al., 2017; 2016). In scientific research of other authors we've faced with solutions of higher education sustainable management problems in an emergent environment. These authors emphasize that "the development of economic subsystem of higher education institution in the conditions of changeable environment shows its ability to sustain its competitive ability on the market of educational services; the ability to carry out its activities while maintaining the stable high level of profitability" (Gontareva, et al., 2019). Taking into consideration research results of difficulties with international e-commerce providing where revealed, an authors' group (Babenko, et al., 2019; Vdovenko et al., 2019) has investigated the model of differentiation in the development of integration processes in the global

e-commerce market. Obtained results of studies proved the necessity of intensification in research processes of global commerce and investment projects to achieve the strategize company's sustainability. In its term, problems of modeling managerial system as a mechanism of comparing macroeconomic indicators of assets, liabilities and net wealth was disclosed by such an authors group (Krutova et al., 2018). At last, as Orlov, Dumanska, Ponomaryova and Kobets revealed "the key aspect of strategize company's sustainability management is to be the transformation of the strategic potential of success and aspects of competitive status into factors of success, taking into consideration all the peculiarities of environment emergent influence on company's activity" (Orlov et al., 2020).

As a result of foregoing discussion we can underline that views of scientists on the development, implementation and evaluation of investment projects in strategizing companies from the point of view of sustainable management are vary and contradictory (Mavlutova et al., 2021). Not enough attention is paid to the alternatives and variability of actions within the investment project at each of the stage. Therefore, in this research we propose a *multivariate model of evaluation and selection of the investment project* based on the hierarchy criterion of company's economic objectives.

Research methods and models

In this section of the paper the authors introduce the developed multivariate model of evaluation and selection of the investment project based on the criterion hierarchy of entities' economic objectives in order to ensure improvement of company's sustainable management. The essence of the proposed model is to identify and evaluate the criteria for the effectiveness of the company's investment project and subsequent selection of the most promising projects based on the results of evaluation according to each criterion. In order to evaluate and select the best investment project the paper offers three ones for production of new commodities.

According to the method of hierarchies, the experts, i.e. the authors, set the following criteria with the appropriate sub-criteria, which can be used to select the most profitable investment company's project. Such criteria include: (1) the company's goals, strategy, policies and values; (2) marketing; (3) innovation; (4) finance; (5) production. Each subsection of this section reflects one of the stages of implementation of the proposed model, i.e. the criterion of evaluation of investment projects according to the hierarchy of criteria, namely: (3.1) - presentation of the problem in the form of hierarchy; (3.2) - establishment of priority criteria and evaluation of alternatives; (3.3) - analysis of all subcriteria according to the levels and elements; (3.4) - determination of global priority elements according to the principle of synthesis; (3.5) - determination of local priorities for each criterion of the corresponding level; (3.6) - determination of global priorities of the most promising elements according to the principle of synthesis. According to authors' idea the proposed *model* is based on the *hierarchy analysis*

method that allows quantifying the relative importance of the criteria and sub-criteria for evaluating each project according to established criteria and sub-criteria.

1 Representing a problem in the form of a hierarchy

Providing the independent analysis, selected by to authors' experts, have established the following criteria and sub-criteria by which the project selection should be made:

1. *The goals, strategy, policies and values of the company* (project compliance level of the company's objectives, compliance level of the draft company strategy, compliance level of the company's project policy, compliance level of the company's project values). For further simplicity criterion and sub-criteria can be called: Enterprise (Goals (GO), Strategy (ST), Value (VA), Policy (PO)). Project 1 is characterized by the highest compliance with these sub-criteria, the Project 2 is medium compliance, Project 3 is the least relevant.
2. *Marketing* (projected demand for new products, deadline for new products, evaluation of potential competitors, distribution system for new product distribution). For further simplicity criterion and sub-criteria can be called: Marketing (Demand (DE), Term (TE), Competitors (CO), Sale (SA)). Project 3 has the highest projected demand for new products, Project 2 has the average projected demand for new products and project 1 has the lowest one. Projects 2 and 3 are almost identical in the terms of production, and project 1 has much longer production terms. Project 1 has fewer potential competitors than Project 2 and 3. The sales system is the widest in Project 2, it is average in project 1, and in Project 3 is the narrowest one.
3. *Innovation* (probability of achieving the scientific and technical indicators of the required level (within the limits of allocated funds and deadlines), long-term prospects of the project, impact on the environment, impact on the activities of the units). For further simplicity criterion and sub-criteria can be called: Innovation (Scientific and Technical (ST), Longevity (LO), Environment (EN), Units (UN)). Experts have found that the highest probability of achieving the scientific and technical indicators of the required level is in the Project 2, the average is in the Project 1 and the lowest is in the Project 3. The long-term prospects are characteristic of the Project 3. Environmental impact in all projects is at the average level, but the best situation is in Project 2. The activities of the units and their cohesion will be best influenced by Project 1, the worst one is Project 3.
4. *Finance* (scientific and research activities costs, capital investment in production capacity, initial start-up costs, possibility of attracting external investment). For further simplicity criterion and sub-criteria can be called: Finances (scientific and research activities costs (SR), capital investment in production capacity (CI), initial start up costs (SC), possibility of attracting foreign investment (EI)). Project 3 requires the most SR expenditure, Project 2 has the average level, Project 1 is the least. The most capital investment in production capacity is Project 2, Project 3 is the least. Project 1 demands the main part of initial start-

up costs, the least part is in Project 2. The possibility of attraction capital external investments is in Project 3, in Projects 1 and 2 it is at the same level.

5. *Production* (production facilities, equipment, staffing, company's location assessment for project implementation). For further simplicity criterion and sub-criteria can be called: Production (Production Facilities (PF), Equipment (EQ), Personnel (PE), and Location Assessment for the project (LA)). For Project 1, there are enough production facilities available, Projects 2 and 3 require additional facilities. All projects require additional equipment. Projects 3 and 1 require the involvement of additional highly qualified staff. The location is the most favorable for Project 2, the least comfortable is for Project 3.

Let us present the decomposition of the problem into the following hierarchy (Fig. 2).

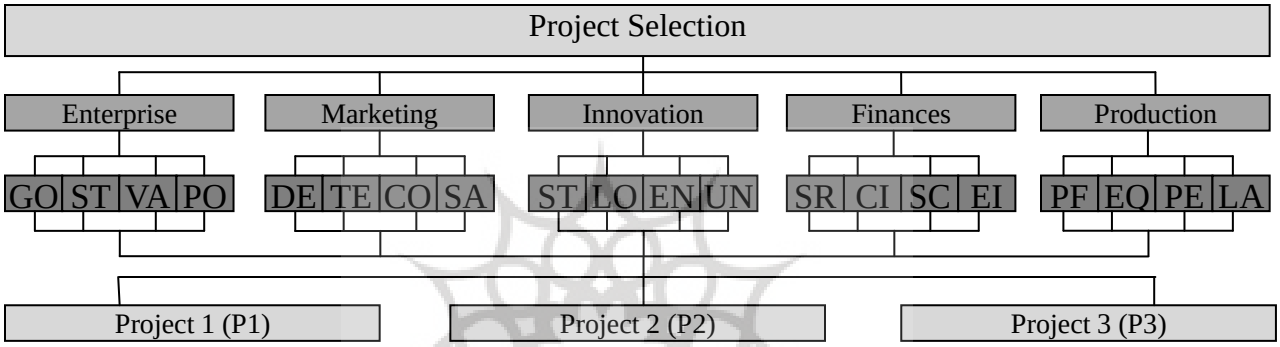

Fig. 1. Hierarchical model of project selection

2. Setting the priority of criteria and evaluating each of alternatives by criteria, identifying the most important ones

Presented scale of relative importance is used for the quantitative comparison of criteria and sub-criteria, where 1 is the equal importance of the compared requirements; 3 is the moderate advantage of one criterion over another; 5 is the significant advantage of one over the other; 7 is a clear advantage; 9 is an absolute advantage; 2, 4, 6, 8 are intermediate grades.

If we compare one selection criterion (i) with others, we get: a(ij) = b, then comparing the other criterion with the first one it will have the following form (ajj) = 1/b (Table 2).

Table 1. Matrix of pair wise comparisons

	A_1	…	A_n
A_1	1	…	$1/b_n$
…	…	1	…
A_n	b	…	1

Component of the vector of local priorities are calculated using formulas:

$$\overline{u_i} = \sqrt[n]{\prod_{j=1}^{n} a_{ij}}; i = \overline{1,n}; \quad (1)$$

where a_{ij} - i-th element of the j-th column of the matrix of pairwise comparisons criteria;
n - number of criteria.

$$u_i = \frac{\overline{u_i}}{\sum_{i=1}^{n} \overline{u_i}}; i = \overline{1,n}; \quad (2)$$

Corresponding calculation for our example:

$$n = 5; \overline{u_1} = \sqrt[5]{1 \cdot 1 \cdot \frac{1}{3} \cdot \frac{1}{4} \cdot 3} = 0{,}758; \overline{u_2} = \sqrt[5]{1 \cdot 1 \cdot \frac{1}{4} \cdot \frac{1}{5} \cdot 3} = 0{,}684; \overline{u_3} = \sqrt[5]{3 \cdot 4 \cdot 1 \cdot \frac{1}{4} \cdot 4} = 1{,}644;$$

$$\overline{u_4} = \sqrt[5]{4 \cdot 5 \cdot 4 \cdot 1 \cdot 8} = 3{,}641; \overline{u_5} = \sqrt[5]{\frac{1}{3} \cdot \frac{1}{3} \cdot \frac{1}{4} \cdot \frac{1}{8} \cdot 1} = 0{,}322.$$

$$\sum_{i=1}^{5} (0{,}758 + 0{,}684 + 1{,}644 + 3{,}641 + 0{,}322) = 7{,}049.$$

$$u_1 = \frac{0{,}758}{7{,}049} = 0{,}108; u_2 = \frac{0{,}684}{7{,}049} = 0{,}097; u_3 = \frac{1{,}644}{7{,}049} = 0{,}233; u_4 = \frac{3{,}61}{7{,}049} = 0{,}517; u_5 = \frac{0{,}322}{7{,}049} = 0{,}046.$$

The maximum eigenvalue inversely symmetrical matrix of pairwise comparisons is defined as follows:

$$\lambda_{\max} \approx \sum_{j=1}^{n} u_j \left(\sum_{i=1}^{n} a_{ij} \right). \quad (3)$$

We build a matrix of pair wise comparisons by defined criteria (level 2 in the decomposition task) (Table 3).

Table 2. Matrix pairwise comparisons for level 2 items

№	name elements compared to the second level hierarchical model	name elements compared to the second level hierarchical model					Local priorities, u_i
		Enterprise	Marketing	Innovation	Finances	Production	
1	Enterprise	1	1	1/3	1/4	3	0,108
2	Marketing	1	1	1/4	1/5	3	0,097
3	Innovation	3	4	1	1/4	4	0,233
4	Finances	4	5	4	1	8	0,517
5	Production	1/3	1/3	1/4	1/8	1	0,046
λ_{max}=5,275; IU=0,069; VU= 0,061.							

Corresponding calculation for our example:

$$\sum_{i=1}^{5} a_{i1} = 1+1+3+4+\frac{1}{3} = 9{,}333; \sum_{i=1}^{5} a_{i2} = 1+1+4+5+\frac{1}{3} = 11{,}333; \sum_{i=1}^{5} a_{i3} = \frac{1}{3}+\frac{1}{4}+1+4+\frac{1}{4} = 5{,}833;$$

$$\sum_{i=1}^{5} a_{i4} = \frac{1}{4}+\frac{1}{5}+\frac{1}{4}+1+\frac{1}{8} = 1{,}825; \sum_{i=1}^{5} a_{i5} = 3+3+4+8+1 = 19{,}000.$$

$$\lambda_{\max} = 0{,}108 \cdot 9{,}333 + 0{,}097 \cdot 11{,}333 + 0{,}233 \cdot 5{,}833 + 0{,}517 \cdot 1{,}825 + 0{,}046 \cdot 19{,}000 = 5{,}275.$$

Estimates of the relative importance of the elements to be compared must be agreed, so we define the index (IU) and ratio consistency (VU):

$$IU = \frac{\lambda_{max} - n}{n-1} = \frac{5{,}275-5}{5-1} = 0{,}069; \quad (4)$$

$$VU = \frac{IU}{VI} = \frac{0{,}069}{1{,}12} = 0{,}061. \quad (5)$$

where VI – random index (when n=5 → VI=1,12, when n=4→ VI=0,9, when n=3 → VI=0,58)
If the VU < 0,1, then the matrix of priorities considered satisfactory, and when this condition is not met, the experts recommend to reconsider its judgment and edit a matrix of pair wise comparisons.

3 Setting the analysis of all sub-criteria of level 3 according to each element-criterion of level 2 (Table 4–8)

Table 3. Pairwise comparison matrix for level 3 elements by Enterprise criterion

№	name elements compared to the third level hierarchical model	name elements compared to the third level hierarchical model				Local priorities, u_i
		GO	ST	VA	PO	
1	GO	1	3	5	6	0,544
2	ST	1/3	1	4	5	0,284
3	VA	1/5	1/4	1	4	0,118
4	PO	1/6	1/5	1/4	1	0,053
λ_{max}= 4,255; IU= 0,085; VU=.0,095						

Table 4. Pairwise comparison matrix for level 3 elements by Marketing criterion

№	name elements compared to the third level hierarchical model	name elements compared to the third level hierarchical model				Local priorities, u_i
		DE	TE	CO	SA	
1	DE	1	1/2	1/3	1/4	0,093
2	TE	2	1	1/2	1/3	0,157
3	CO	3	2	1	1/3	0,245
4	SA	4	3	3	1	0,505
λ_{max}=4,103; IU= 0,034; VU=.0,038						

Table 5. Pairwise comparison matrix for level 3 elements by Innovation criterion

№	name elements compared to the third level hierarchical model	name elements compared to the third level hierarchical model				Local priorities, u_i
		ST	LO	EN	UN	
1	ST	1	1/5	1/2	1/6	0,064
2	LO	5	1	7	1	0,433
3	EN	2	1/7	1	1/5	0,087
4	UN	6	1	5	1	0,416
λ_{max}= 4,068; IU= 0,023; VU=0,025.						

Table 6. Pairwise comparison matrix for level 3 elements by Finances

№	name elements compared to the third level hierarchical model	name elements compared to the third level hierarchical model				Local priorities, u_i
		RD	CI	SC	EI	
1	RD	1	5	1/2	3	0,324
2	CI	1/5	1	1/6	1/5	0,056
3	SC	2	6	1	2	0,433
4	EI	1/3	5	1/2	1	0,187
λ_{max}= 4,193; IU= 0,064; VU= 0,072.						

Table 7. Pairwise comparison matrix for level 3 elements by Production criterion

№	name elements compared to the third level hierarchical model	name elements compared to the third level hierarchical model				Local priorities, u_i
		FA	EQ	PE	LA	
1	FA	1	1/6	1/7	1/2	0,057
2	EQ	6	1	2	6	0,503
3	PE	7	1/2	1	5	0,353
4	LA	2	1/6	1/5	1	0,088
λ_{max}= 4,108; IU= 0,036; VU= 0,040.						

4. Using the synthesis principle, we determine the global priorities of level 3 elements:

$$Z_i = V_{ij} U_i, \tag{6}$$

where V_{ij} - local priority (weight) i-th element of level 3 with respect to the j-th element-criterion of level 2.

Corresponding calculation for our example:

$Z_1 = 0{,}544 * 0{,}108 = 0{,}059; Z_2 = 0{,}284 * 0{,}108 = 0{,}031; Z_3 = 0{,}118 * 0{,}108 = 0{,}013;$

$Z_4 = 0{,}053 * 0{,}108 = 0{,}006; Z_5 = 0{,}093 * 0{,}097 = 0{,}009; Z_6 = 0{,}157 * 0{,}097 = 0{,}015;$

$Z_7 = 0{,}245 * 0{,}097 = 0{,}024; Z_8 = 0{,}505 * 0{,}097 = 0{,}049; Z_9 = 0{,}064 * 0{,}233 = 0{,}015;$

$Z_{10} = 0{,}433 * 0{,}233 = 0{,}101; Z_{11} = 0{,}087 * 0{,}233 = 0{,}020; Z_{12} = 0{,}416 * 0{,}233 = 0{,}097;$

$Z_{13} = 0{,}324 * 0{,}517 = 0{,}167; Z_{14} = 0{,}056 * 0{,}517 = 0{,}029; Z_{15} = 0{,}433 * 0{,}517 = 0{,}224;$

$Z_{16} = 0{,}187 * 0{,}517 = 0{,}097; Z_{17} = 0{,}057 * 0{,}046 = 0{,}003; Z_{18} = 0{,}503 * 0{,}046 = 0{,}023;$

$Z_{19} = 0{,}353 * 0{,}046 = 0{,}016; Z_{20} = 0{,}088 * 0{,}046 = 0{,}004.$

5. We define local priorities for level 4 according to each criterion of level 3 (Table 9-13)

Table 8. Local priorities of level 4 elements according to Enterprise level 3 criterion

GO	*P1*	*P2*	*P3*	*Local priorities, W_{i1}*	*ST*	*P1*	*P2*	*P3*	*Local priorities, W_{i2}*
P1	1	3	7	0,659	P1	1	4	6	0,682
P2	1/3	1	4	0,263	P2	1/4	1	4	0,236
P3	1/7	1/4	1	0,079	P3	1/6	1/4	1	0,082
λ_{max}= 3,032; IU= 0,016; VU= 0,028.					λ_{max}= 3,108; IU= 0,054; VU=0,093.				
VA	*P1*	*P2*	*P3*	*Local priorities, W_{i3}*	*PO*	*P1*	*P2*	*P3*	*Local priorities, W_{i4}*

P1	1	3	4	0,625	P1	1	2	7	0,592
P2	1/3	1	2	0,238	P2	1/2	1	5	0,333
P3	1/4	1/2	1	0,136	P3	1/7	1/5	1	0,075
λ_{max}=3,018; IU=0,009; VU=0,016.					λ_{max}= 3,014; IU=0,007; VU=0,012.				

Table 9. Local priorities of level 4 elements according to Marketing level 3 criterion

DE	*P1*	*P2*	*P3*	*Local priorities, W_{i1}*	*TE*	*P1*	*P2*	*P3*	*Local priorities, W_{i2}*
P1	1	1/5	1/8	0,064	P1	1	1/6	1/5	0,084
P2	5	1	1/4	0,237	P2	6	1	1	0,472
P3	8	4	1	0,699	P3	5	1	1	0,444
λ_{max}= 3,094; IU=0,047; VU= 0,081.					λ_{max}=3,004; IU=0,002; VU=0,003.				
CO	*P1*	*P2*	*P3*	*Local priorities, W_{i3}*	*SA*	*P1*	*P2*	*P3*	*Local priorities, W_{i4}*
P1	1	7	8	0,784	P1	1	1/3	4	0,256
P2	1/7	1	2	0,135	P2	3	1	8	0,671
P3	1/8	1/2	1	0,081	P3	1/4	1/8	1	0,073
λ_{max}=3,035; IU=0,017; VU=0,030.					λ_{max}=3,018; IU=0,009; VU=0,016.				

Table 10. Local priorities of level 4 elements according to Innovation level 3 criterion

ST	*P1*	*P2*	*P3*	*Local priorities, W_{i1}*	*LO*	*P1*	*P2*	*P3*	*Local priorities, W_{i2}*
P1	1	1/4	6	0,243	P1	1	1/2	1/8	0,081
P2	4	1	9	0,701	P2	2	1	1/7	0,135
P3	1/6	1/9	1	0,056	P3	8	7	1	0,784
λ_{max}= 3,108; IU=0,054; VU=0,093.					λ_{max}=3,035; IU= 0,017; VU=0,030.				
EN	*P1*	*P2*	*P3*	*Local priorities, W_{i3}*	*UN*	*P1*	*P2*	*P3*	*Local priorities, W_{i4}*
P1	1	1/3	1	0,210	P1	1	4	7	0,705
P2	3	1	2	0,550	P2	1/4	1	3	0,211
P3	1	1/2	1	0,240	P3	1/7	1/3	1	0,084
λ_{max}=3,018; IU=0,009; VU= 0,016.					λ_{max}= 3,032; IU=0,016; VU=0,028.				

Table 11. Local priorities of level 4 elements according to Finances level 3 criterion

RD	*P1*	*P2*	*P3*	*Local priorities, W_{i1}*	*CI*	*P1*	*P2*	*P3*	*Local priorities, W_{i2}*
P1	1	3	6	0,635	P1	1	3	1/6	0,166
P2	1/3	1	5	0,287	P2	1/3	1	1/8	0,073
P3	1/6	1/5	1	0,078	P3	6	8	1	0,761
λ_{max}=3,094; IU=0,047; VU=0,081.					λ_{max}= 3,074; IU= 0,037; VU= 0,063.				
SC	*P1*	*P2*	*P3*	*Local priorities, W_{i3}*	*EI*	*P1*	*P2*	*P3*	*Local priorities, W_{i4}*
P1	1	1/7	1/2	0,094	P1	1	1	1/6	0,121
P2	7	1	5	0,740	P2	1	1	1/7	0,115
P3	2	1/5	1	0,167	P3	6	7	1	0,764
λ_{max}=3,014; IU=0,007; VU= 0,012.					λ_{max}= 3,003; IU= 0,001; VU= 0,002.				

Table 12. Local priorities of level 4 elements according to Production level 3 criterion

FA	*P1*	*P2*	*P3*	*Local priorities, W_{i1}*	*EQ*	*P1*	*P2*	*P3*	*Local priorities, W_{i2}*
P1	1	4	5	0,683	P1	1	2	1	0,387
P2	1/4	1	2	0,200	P2	1/2	1	1/3	0,169
P3	1/5	1/2	1	0,117	P3	1	3	1	0,443
λ_{max}=3,025; IU= 0,012; VU=0,021.					λ_{max}=3,018; IU=0,009; VU= 0,016.				

PE	*P1*	*P2*	*P3*	*Local priorities,* W_{i3}	*LA*	*P1*	*P2*	*P3*	*Local priorities,* W_{i4}
P1	1	1/5	2	0,162	P1	1	1/4	3	0,218
P2	5	1	8	0,751	P2	4	1	6	0,691
P3	1/2	1/8	1	0,087	P3	1/3	1/6	1	0,091
λ_{max}=3,006; IU=0,003; VU=0,005.					λ_{max}=3,054; IU= 0,027; VU=0,046.				

6. Applying the synthesis principle to determine global priorities for Level 4 elements

Global priorities of level 4 elements are defined as the sum of applications of local priorities of level 4 each element (Wij) to the global priorities of level 3 elements. For Projects 1, 2, 3 we get:

$$WE1 = W11Z1 + W12Z2 + \ldots + W120Z20 = 0{,}346;$$
$$WE2 = W21Z1 + W22Z2 + \ldots + W220Z20 = 0{,}375;$$
$$WE3 = W31Z1 + W32Z2 + \ldots + W320Z20 = 0{,}269;$$

As a result of introduction of the *multivariate model of evaluation and selection of the investment project* on the basis of the hierarchy criterion of company's economic tasks, the authors show that the solution of the set economic task involves managerial structuring of company's sustainability. This structuring is a process of stakeholder coordination to ensure their investment interests through the search and implementation of agreed projects and programs.

Results and discussion

In this section we can observe the results of the implementation of proposed *multivariate model of evaluation and selection of the investment project* and discussion of appropriate scientific view points. Proposed in our research *model* made it possible to identify and select the most effective investment project, based on expert evaluations of priority projects by the method of hierarchy analysis using *paired comparisons*.

During the research authors considered the situation when a strategize company analyzes three investment projects and chooses the most beneficial in terms of further sustainable development. The proposed and used hierarchy analysis method allows us to quantify the relative importance of the evaluation criteria and sub-criteria for each project. The interpretation of obtained analysis results of each project according to the relevant criteria is given in Table. 1.

Table 1. Resulting table of indicators values for company's project selection

Indicator	Project 1	Project 2	Project 3	Remark
Enterprise	0,071	0,028	0,009	Maximum Value in the Project 1
Marketing	0,033	0,045	0,019	Maximum Value in the Project 2
Innovation	0,085	0,056	0,093	Maximum Value in the Project 3
Finances	0,144	0,227	0,146	Maximum Value in the Project 2
Production	0,014	0,019	0,002	Maximum Value in the Project 2
Comprehensive indicator	0,346	0,375	0,269	Maximum value in the Project 2. Therefore, the best project in this situation is the Project 2.

A more detailed graphic representation of the comprehensive assessment for each of the evaluated criteria is presented in Figure 1.

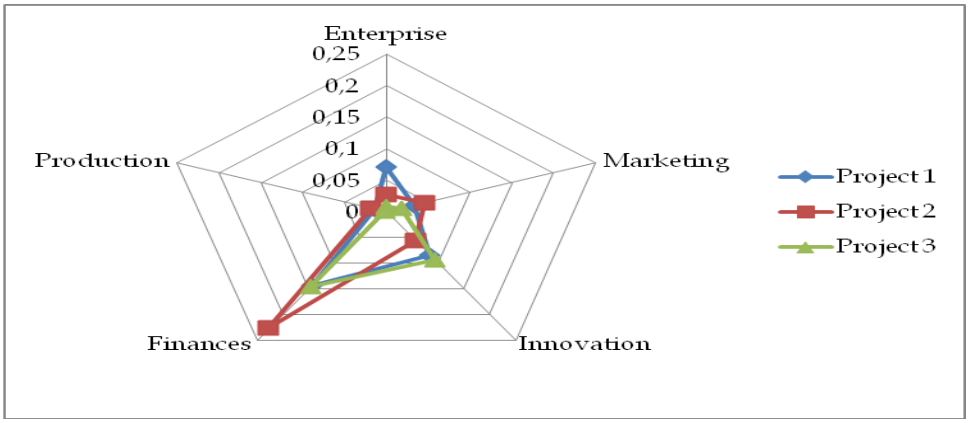

Fig 1. Projects' comparison according to each criterion based on complex evaluation

Taking into consideration the priority of the evaluation criteria, the best investment project was selected to ensure the company's sustainable development. The first place was occupied by Project 2 with a comprehensive assessment of 0.375, the second place was taken by Project 1 with a comprehensive assessment of 0.346, and in the third place is Project 3 with a quantitative assessment of 0.269. Therefore, it is quite obviously that Project 2 (Table. 1, Fig. 1) should be recommended for improvement making an effective managerial decision concerning new commodity production for strategizing company.

Conclusion

The problem of creating and evaluating investment projects is urgent for many companies. Direct investment is a reliable basis for company's sustainable development in the strategic perspective. In the emergence conditions of an unpredictable environment, successful investment projects are a source of financial support and, consequently, an important factor in the sustainable development of the company. The result of practical application of the hierarchy analysis method for selecting one of the three investment projects with the specified characteristics is the calculation of a complex indicator for each of the projects, the largest of indicators underlines that under these conditions and according these criteria and expert opinions, the most profitable project should be chosen. Therefore, summarizing the calculated indicators into one complex taking into account local priorities we obtain the following result: Project 1 - 0.346; Project 2 - 0.375; Project 3 - 0.269. Thus, we can conclude that project 2 can be the most rational choice for the company's investments.

The application of hierarchy analysis method allows providing recommendations for making an effective reasonable managerial decision on the selection of the most profitable

investment project for new commodity production. Proposed in this paper the *multivariate model of evaluation and selection of the investment project* is based on the hierarchy analysis method, that is why, in our point of view, it is necessary to include proposed *model* into the corporate strategy development process. Thus, the problem of choosing the direction of the company's development in the strategic perspective and efficiency improvement of strategizing company's sustainable management is solved.

References

Amini, M. & Bienstock, C.C. (2014) Corporate sustainability: an integrative definition and framework to evaluate corporate practice and guide academic research. *Journal of Cleaner Production*, Vol. 76, pp. 12-19.

Sabini, L. (2016) Project Management and Sustainability. *Newcastle University Business School. Brief for GSDR – 2016.* Available at: https://sustainabilitydevelopment.un.org.

Montiel, I. & Delgado-Ceballos, J. (2014) Defining and measuring corporate sustainability: are We there yet? *Organization & Environment*, Vol 27, No. 2, pp. 113-139.

Grewal, J., Serafeim, G. and Yoon, A. (2016) Shareholder Activism on Sustainability Issues. *Harvard Business School Working Paper*. Available at: http://nrs.harvard.edu/urn3:HUL.InstRepos:2786430.

Voynarenko, M., Dumanska, K. & Ponomaryova, N. (2019) Formation of company's economic activity context in the strategic positioning process in emergent environment conditions. *CEUR Workshop Proceedings.* Vol. 2422, pp. 121-133.

Derenska, Ya.M. (2019) Characteristics of project management system components. *Problems of System Approach in Economics*, Vol. 1, No. 1, pp. 125-133.

Kirdina, O.G. (2018) Theoretical aspects of project management in the activity of a commercial enterprise. *Bulletin of Economics, Transport and Industry*, Vol. 61, pp. 179-188.

Gowtham, C.S. & Peter, M (2017) Role of capital budgeting in project management. *International Journal of Pure and Applied Mathematics*, Vol. 116, No. 16, pp. 351-355.

Jovanović1, F., Milijić, N., Dimitrova, M. & Mihajlović I. (2016) Risk management impact assessment on the success of strategic investment projects: benchmarking among different sector companies. *Acta Polytechnica Hungarica*, Vol. 13, No. 5, pp. 221-241.

Bushuyev, S.D., Bushuyev, D.A. & Yaroshenko R.F. (2018) Project management in the behavioral economy. *Management of Sophisticated Systems Development*, Vol. 33, pp. 22-30.

Spalek, S. (2014) Finding a new way to increase project management efficiency in terms of time reduction. *Inzinerine Ekonomika-Engineering Economics*, Vol. 25, No. 5, pp. 538–548.

Guide to Cost-Benefit Analysis of Investment Projects. Economic appraisal tool for Cohesion Policy 2014-2020 (2015) *European Commission Directorate-General for Regional and Urban policy*. Luxembourg: Publications Office of the European Union, 358 p. doi:10.2776/97516. Available at: http://ec.europa.eu/regional_policy/index_en.cfm

Medvedieva, O.M. & Yehorchenkova, N.Yu. (2018) Organizational structure of electronic project management. *Management of Sophisticated Systems Development*, Vol. 33, pp. 51-56.

Yehorchenkova, N.Yu. (2018) Models of project management in electronic project management. *Bulletin of Kharkiv National Technical University: Kharkiv Polytechnic Institute*. Vol. 9, pp. 112-117.

Kohut, I.V., Lebid, T.V. & Luchko, H.J. (2016) Project management tools in strategic enterprise development. *Bulletin of National University Lviv Polytechnic. Management and Entrepreneurship in Ukraine: Establishing Stages and Development Problems*, Vol. 5, pp. 168-174.

Kramarenko, R.M., Palant, O.Yu. & Achkasov, I.A. (2018) Information-analytical support of project management processes. *Economics. Management. Innovations*, Vol. 2, No. 23. Available at: http://nbuv.gov.ua/UJRN/eui_2018_2_11

Babenko, V., Demyanenkob, O., Lyba, V., Feoktystova, O. (2021). Assessment the Cost-effectiveness of Information Support for the Business Processes of a Virtual Machine-building Enterprise in the Framework of Industry 4.0. *International Journal of Engineering*, 34(1), 171-176.

Chaikovska, I., Fasolko, T., Vaganova, L. & Barabash, O. (2017) Economic-mathematical tools for building up a project team in the system of company knowledge management. *Eastern-European Journal of Enterprise Technologies.* Vol. 3, No. 87, pp. 29-37.

Chaikovska I.I. (2016) Economic-mathematical modeling of employee evaluation in the system of enterprise knowledge management. *Actual Problems of Economics.* Vol. 9, No. 183, pp. 417-428.

Gontareva, I., Borovyk, M., Babenko, V., Perevozova, I. & Mokhnenko, A. (2019) Identification of efficiency factors for control over information and communication provision of sustainable development in higher education institutions. *WSEAS Transactions on Environment and Development*. Vol. 15, pp. 593-604.

Babenko, V., Kulczyk, Z., Perevozova, I., Syniavska, O. & Davydova, O. (2019) Factors of development of international e-commerce in the context of globalization. *CEUR Workshop Proceedings*. Vol. 2422, pp. 345-356. http://ceur-ws.org/Vol-2422/paper28.pdf

Brin, P., Prokhorenko, O., Nehme, M., & Trabulsi, H. (2020). Strategic Contribution of a Business Process to Company's Performance. *Journal of Information Technology Management*, 12(3), 82-99.

Krutova, A.S., Tarasova, T.O., Grytsyshen, D.O. & Levina, M.V. (2018) Management information support formation in the national account system. *Financial and Credit Activity: Problems of Theory and Practice*. Vol. 2, No. 5. Available at: https://doi.org/10.18371/fcaptp.v2i25.136467

Mavlutova, I., Babenko, V., Dykan, V., Prokopenko, N., Kalinichenko, S., Tokmakova, I. (2021). Business Restructuring as a Method of Strengtening Company's Financial Position. *Journal of Optimization in Industrial Engineering*, Vol.14, Issue 1, Winter & Spring 2021, 129-139.

Orlov, O., Dumanska, K., Ponomaryova, N. & Kobets, D. (2020) Company's strategic success as the basis of its potential sustainability. *E3S Web of Conferences*. Vol. 166, 12002. Available at: https://doi.org/10.1051/e3sconf/202016612002

Vdovenko N., Deriy J., Seliverstova L., Kurmaiev P. (2019). Formation of the Information Economy: organizational and financial aspects. International Journal of Supply Chain Management. Vol. 8. № 4, pp. 956–961. http://ojs.excelingtech.co.uk/index.php/IJSCM/article/view/3330

Bibliographic information of this paper for citing:

Dumanska, K., Chaikovska, I., Vaganova, L & Kobets, D. (2021). Strategize Company's Sustainable Management of Investment Project Evaluation Based on the Information Support**,** *Journal of Information Technology Management*, Special Issue, 143-158.