industry and Ukraine in general, insufficient financing, as well as insufficient organization of management of the industry.

The **main reasons for the deterioration of the level of development of the transport and tourism** in the crisis years are:

- socio-economic stress;
- deterioration of the transport situation;
- a sharp appreciation of the US dollar, euro and Swiss franc, as well as other currencies against the hryvnia;
- decrease in demand for tourism, which increased its prime cost per served tourist;
- reducing the investment and tourist attractiveness of Ukraine in the international arena, creating an impression about it as unfriendly and dangerous for tourists;
- decrease in the purchasing power of the actual incomes of the population.

1. *Дикань В.Л.* Основи логістичної інтеграції при формуванні логістичних систем через утворення територіально-промислового кластера. «Українські залізниці». Центр інформації транспорту України, 2014. №9. с. 22-26; 2. Значение Евро-2012 в развитии туризма, рекреации и спорта в Украине и Польше (сборник наук. Трудов III научно-практической конференции к 10-летию создания Института украинском-польской сотрудничества и 20-летия создания Общества «Украина-Польша»). Под общ. ред. Карягина Ю.А. Варшава-Киев-Винница-Кельце, 2010. 178 с.; 3. *Мальская М.П., Худо В.В.* Туристический бизнес: Теория и практика. Киев: Центр учебной литературы, 2017; 4. *Олійник Я.Б., Смірнов І.Г.* Міжнародна логістика: навч. посіб. К.: Обрії, 2011. 540 с.; 5. *Скобкин С.С.* Экономика организации в гостиничном сервисе: ученик и практикум для СПО. 2-е изд., испр. и доп. М.: Издательство Юрайт, 2018. 432 с.; 6. *Слюсаревський М.М., Блінова О.Є.* Психологія міграції. Кіровоград: Імекс. 2013. 244 с.; 7. *Ткачук Л.* Сутність туризму як багатоаспектного суспільного явища. Вісник КНУ ім. Шевченко. 2017. № 66-67. с. 109—113; 8. *Pawlicz A.* (2011). Turystyka międzynarodowa. W: P. Panasiuk (red.). Ekonomika turystyki, Warszawa: PWN, s. 182—199.

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ВИКОРИСТАННЯ МЕТОДУ АНАЛІЗУ ІЄРАРХІЙ ПРИ ПРИЙНЯТТІ УПРАВЛІНСЬКИХ РІШЕНЬ ЩОДО ІНТЕРНАЦІОНАЛІЗАЦІЇ ПРОМИСЛОВИХ ПІДПРИЄМСТВ

У статті вирішена актуальна задача прийняття ефективних управлінських рішень щодо інтернаціоналізації машинобудівних підприємств методом аналізу ієрархій (MAI) з використанням MS Excel. Запропоновано критерії, за якими здійснювали оцінку ефективності інтернаціоналізації різного масштабу машинобудівних підприємств: торгівельний, фінансово-інвестиційний, виробничий, технологічний, інфраструктурний, науковий, освітній, мотиваційний (особистісний). Кожен з критеріїв оцінено за декількома субкритеріями. Методом експертних оцінок встановлено переважність кожного з критеріїв та субкритеріїв при їх попарних порівняннях. При

достатньо високому рівні узгодженості критеріїв (менше 10%), виявлено, що найважливішими серед них є фінансово-інвестиційний, науковий та освітній критерії.

The relevant problem of effective decision-making regarding the internationalization of machine-building enterprises using the method of analysis of hierarchies (MAI) and MS Excel is solved in the article. In the conditions of multicriteria, uncertainty and lack of information, it is advisable to use this method developed by T. Saati, based on a pairwise comparison of options at different levels of the hierarchy and their mathematical evaluation. This method is used to justify the decision in various spheres. In order to make an effective decision on machine-building enterprises internationalization, it is necessary to evaluate its effectiveness in certain areas (criteria). To do so four enterprises of the Western region of Ukraine were analyzed. The criteria for assessing the efficiency of internationalization of various scale machine-building enterprises are suggested: commercial, financial-investment, production, technological, infrastructure, scientific, educational, motivational (personal). Each of the criteria is evaluated by several subcriteria. For scientific, educational and motivational (personal) ccriteria, a number of subcriteria associated with the entry into or expansion on external markets were established. Also additional criteria aimed at increasing their competitive potential were suggested although they were not taken into account in the calculations. The relative importance of the criteria and subcriteria was established on the basis of questionnaires of enterprise managersThe method of expert evaluations has established the predominance of each criteria and subcriteria in their pairwise comparisons. At a sufficiently high level of consistency of criteria (less than 10%), there were defined most important ones: financial-investment, scientific and educational criteria. Structural-logical scheme of estimation the efficiency of industrial enterprises internationalization according to the polycriteria approach is developed. An analysis of enterprises local priorities with respect to the elements of subcriteria according to all suggested criteria indicates that medium and large enterprises that are already internationalized have advantages compared to medium and small enterprises that are only planning to go global. However, a small high-tech enterprise with a strong human resources potential, within almost all subcriteria, has an advantage over an average enterprise that is planning to enter the markets of developing countries.

Ключові слова: підприємство, інтернаціоналізація, метод аналізу ієрархій, критерії, субкритерії

Keywords: enterprise, internationalization, method of hierarchy analysis, criteria, subcriteria

Formulation of the problem. The development of machine building as an important budget-making industry of Ukraine in terms of the variability of external influences is inextricably linked with the processes of attracting investment resources, the introduction of innovative technologies for the modernization of enterprises in order to update the range of products of high quality, expansion of traditional and development of new markets. One of the ways of realizing these strategic tasks is the internationalization of machine-building enterprises.

Taking into account the fact that recent years the production of machine-building products has shifted to a segment of medium and small businesses, the adoption of managerial decisions regarding the company's exit to foreign markets and their effectiveness depends on a limited number of executives. They should have a "political" will and sufficient intellectual, educational level to rely on their own experience, knowledge and intuition, take into account the position of expert experts and use the achievements of economic science. Given the limited financial resources and risks in making decisions that can lead to bankruptcy, the use of economics and mathematical methods of system plan-

ning is especially important for top-management of such enterprises for making informed informed decisions and choosing the best option from a variety of alternatives.

Analysis of recent research and publications. Methods of system analytic modeling are widely used to solve complexly structured problems when making managerial decisions. The study of this problem is devoted to the works of such foreign and domestic scientists as: O. Ananiev, V. Vitlinsky, G. Velikoivanenko [1], I. Grozny, V. Eitingon, R. Eckenrode, L. Zade, E. Zenchenko, M. Candel , P. Kini, V. Kigel [2], S. Klimenko, K. Lancaster, A. Mariuta, E. Nauman, L. Polischuk, I. Skitter, N. Tkalenko, A. Trunova [3], D. Tobin , E. Helfert, S. Schmidt and many others.

Under multicriteria condition, uncertainty and insufficiency of information it is expedient to use the method of analysis of hierarchies (MAI) developed by T. Saati, based on a pairwise comparison of options at different levels of the hierarchy and their mathematical estimation [2, 4, 5, 6].

This method is used to justify the decision in various spheres. In particular, Ukrainian scientists used MAIs to select investment projects, a franchise network [7], software development tools [8], suppliers [9], to assess the marketing activity of trading enterprises [10], to develop a model for identifying production processes that require urgent adaptive measures [11], to the tasks of benchmarking [12].

Selection of previously unsettled parts of the general problem. Latitude coverage of branches using the Saati method indicates the possibility of its use in the adoption of management decisions. However, in the scientific literature, there is practically no information on the algorithm for making decisions on the internationalization of machine-building enterprises by the MAI method.

The purpose of the article is to justify the adoption of managerial decisions regarding the internationalization of machine-building enterprises by the MAI method.

Presenting main material. In order to make an informed decision on the internationalization of machine-building enterprises, it is necessary to evaluate its effectiveness in certain areas (criteria). The four enterprises of the Western region of Ukraine are considered, before which there is a choice of the strategic goal of their further development:

Enterprise 1: small enterprise, high level of technological equipment, high level of personnel qualification, single and small-scale production of unique equipment, which is low demand on the domestic market and which is planned to be manufactured for export;

Enterprise 2: medium-sized enterprise, average level of technological equipment, average personnel qualification, small and large-scale production, high level of competition in the domestic market, management plans to enter the markets of developing countries;

Enterprise 3: medium-sized enterprise, high level of technological equipment, average and high level of personnel qualification, small and large-scale production, carries out foreign economic activity, management plans to expand its presence on foreign markets in order to maximize profits;

Enterprise 4: large enterprise, high level of technological equipment, average and high level of personnel qualification, small and large-scale and mass production, provides foreign economic activity, management plans to expand its presence in foreign markets in order to maximize profits for the proceeding incl. socially responsible activity.

According to the IAI, the criteria for assessing the effectiveness of internationalization are defined: trade, financial-investment, production, technological, infrastructure, scientific,

educational, motivational (personal). For the scientific, educational and motivational (personal) set the subcriteria associated with the entry into or expansion of external markets, and additional, aimed at increasing their competitive potential, although they were not taken into account in the calculations. The relative importance of the criteria and subcriteria was established on the basis of questionnaires of enterprise managers. Table 1 provides subcriteria for each criterion.

Table 1

Subcriteria for assessing the effectiveness of internationalization of industrial enterprises

№	Criterion internationalization	Designation of the criterion	Subcriteria	Subcriteria designation
1.	Shopping	C1	Profit / loss from direct export of goods and services	SC11
			Income / loss from indirect exports of goods and services	SC12
			Costs of import of goods, materials, raw materials, equipment, services, etc.	SC13
2.	Financial and investment	C2	Share of direct foreign investments in the structure of capital	SC21
			Profit / loss from the activities of branches opened abroad	SC22
			Expenditures on the development and implementation of marketing strategies for access to or expansion of external markets	SC23
3.	Industrial	C3	Profit / loss from sales of products manufactured at a production located abroad	SC31
			Profit / loss from sales of products manufactured under foreign patents	SC32
			Profit / loss from sales of products manufactured for export in the country of origin	SC33
4.	Technological	C4	Profit / loss from sales of products manufactured using technologies (including innovations) implemented under foreign licenses	SC41
			Profit / loss from sales of products manufactured according to modernized technologies due to the purchase of equipment abroad, incl. by leasing	SC42
			Profit / loss from sales of products manufactured using innovative and upgraded technologies subject to standardization, certification, environmental expertise	SC43
5.	Infrastructure	C5	Costs for the maintenance of units (employees) engaged in implementing the strategy of entering the external markets / expanding the presence therein	SC51
			Costs of informatization of units involved in the implementation of the strategy of entering the external markets / expansion of presence on it	SC52
			Costs for legal support of access to foreign markets / expansion of presence on it	SC53

6.	Scientific	C6	Profit / loss from the activities of units (employees) engaged in conducting research and development works (R&D)	SC61
			Profit / Loss from R&D, incl. costs of patenting	SC62
			Funds borrowed from abroad for R&D purposes	SC63
			Costs of technology transfer	SC64
			Number of agreements entered into with universities and research institutions for R&D	*DSC6*
7.	Educational	C7	The share of employees who speak foreign languages is not lower than B2	SC71
			Specific weight of the employees who have undergone an internship, advanced training abroad	SC72
			The share of workers who took part in exhibitions, seminars, workshops, etc.	SC73
			The share of workers with higher education in the specialty	DSC7.1
			Number of students of universities, colleges, pupils of schools, including foreign ones. who have passed the practice of the enterprise	DSC7.2
			Number of excursions, seminars held for students of schools, colleges, college students and universities	DSC7.3
8.	Motivational (personal)	C8	The share of employees who have received career growth by implementing a strategy of entering or expanding on foreign markets	SC81
			The share of employees paid for the results of activity on entering the external markets or expansion of presence	SC82
			The share of workers who receive bonuses for using a foreign language at work	SC83
			Number of foreign specialists invited to work, internships, training of staff	DSC8

Source: development by autor

The structural and logical scheme of estimation of internationalization of industrial enterprises by the polycrystalline approach is shown at Fig.

To determine the criteria priorities and evaluate each of the alternatives according to these criteria, we construct a matrix of pairwise comparisons (Table 2). To determine the overwhelmingness of the criterion we use the scale of the relative importance of the criterion [11].

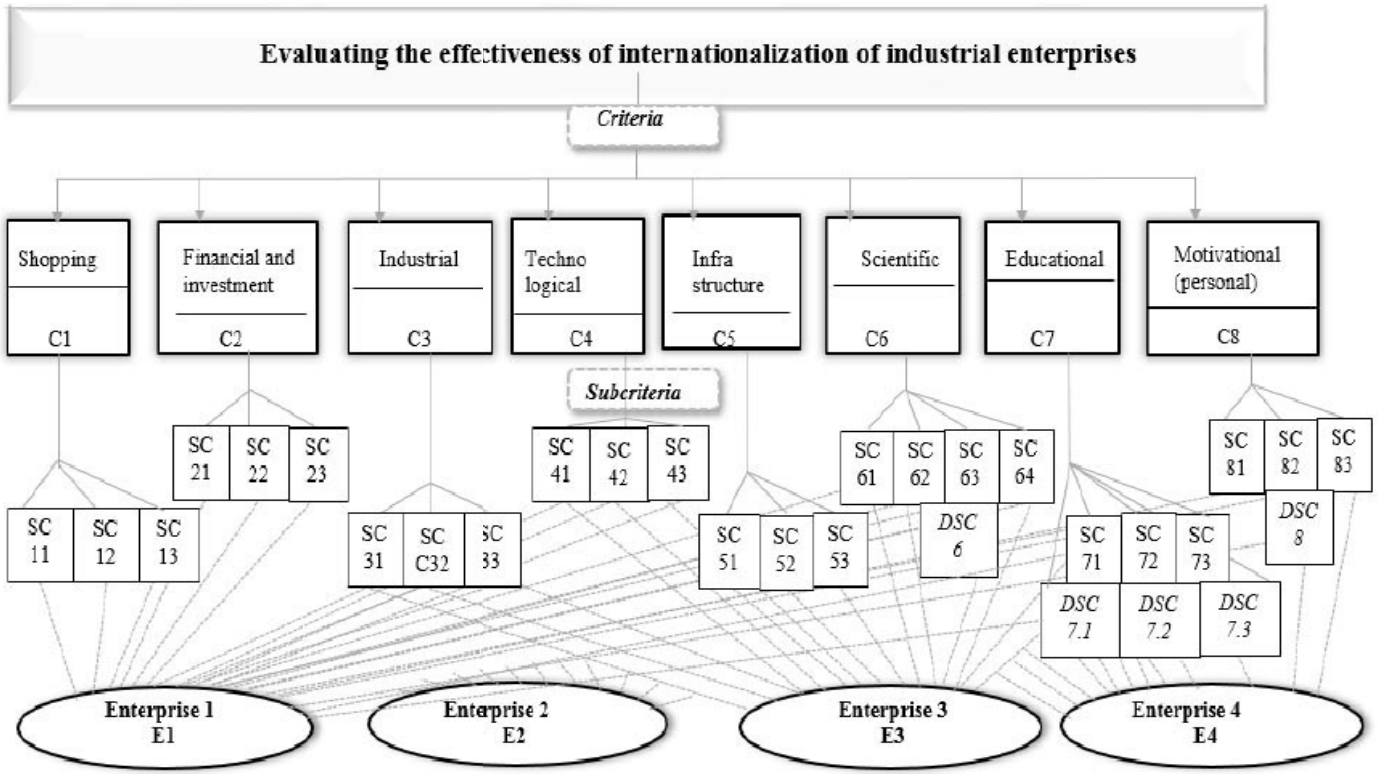

Figure 1. Structural-logical scheme of estimation of the efficiency of internationalization of industrial enterprises by the polycrystalline approach

source: development by author

Table 2

Matrix of pairwise comparisons of internationalization criteria

Name of the comparison criterion	Позначення критерію	Designation of the criterion								Local Priorities, a_i
		C1	C2	C3	C4	C5	C6	C7	C8	
Shopping	C1	1	1/7	1/3	1/3	7	1/5	1/3	3	0,0503
Financial and investment	C2	7	1	3	3	9	3	3	7	0,3000
Industrial	C3	3	1/3	1	1/3	7	1/5	1/3	5	0,0784
Technological	C4	3	1/3	3	1	5	1/3	1/3	5	0,1055
Infrastructure	C5	1/7	1/9	1/5	1/7	1	1/7	1/7	1/3	0,0166
Scientific	C6	5	1/3	5	3	7	1	3	5	0,2165
Educational	C7	3	1/3	3	3	7	1/3	1	5	0,1448
Motivational (personal)	C8	1/5	1/7	1/5	1/5	3	1/5	1/5	1	0,0284
λ_{max} = 8,907; I_y=0,1296; B_y=0,0919 (9,19%)										

All computations are carried out according to the formulas given in [11]:
local priorities of the criteria:

$$a_i \sqrt[n]{\prod_{j=1}^{n} x_{ij}} \quad (1)$$

normalized intrinsic matrix vector:

$$A_i = \sqrt[n]{\prod_{j=1}^{n} x_{ij}} \Big/ \sum_{i=1}^{n} \sqrt[n]{\prod_{j=1}^{n} x_{ij}} \quad (2)$$

most actual number of matrix:

$$\lambda_{\max} = \sum_{j=1}^{n} \sum_{i=1}^{n} a_{ij} \times A_i \quad (3)$$

coherence Index:

$$Iy = \frac{|\lambda \max - n|}{n-1} \quad (4)$$

relative consistency: $B_y = I_y / I_{ув,}$ (5)

where:

$I_{ув}$ – table value of the index of consistency for n criteria.

The results of calculating the components of the own local priorities vector for the number of criteria 8 by the corresponding calculations presented below using MS Excel are given in the last column of Table 2.

To assess the relative importance of the criteria, the Coherence Index (B_y) and relative consistency (I_y) were determined, taking into account λ_{max} = 8,907:

$$Iy = \frac{|8,9073 - 8|}{7} = 0.1296$$

$$B_y = I_y / I_{yB} = 0,1296 / 1,41 = 0,0919,$$

where I_{yB}=1,41 – table matched agreement for eight criteria [11].

The relative consistency of the criteria is 9.19%, that is within the normal range (no more than 10%), which indicates good consistency of the criteria. The most important financial and investment, scientific and educational criteria are the most important for assessing the effectiveness of internationalization.

Tables 3-7 show the results of calculations of local priorities vectors according to the subcriteria for each of the criteria of the previous level when their coherence is less than 10%, the maximal eigenvalues of the matrices (λ), coherence indices ($I_{y)}$ and relative coherence (B_y).

Table 3.

Matrix of pairwise comparisons for subcriteria for trade and financial-investment criteria

Criteria									
Shopping					Financial and investment				
Designation of the subcriteria	SC11	SC12	SC13	Local prioritie, v_1	Designation of the subcriteria	SC21	SC22	SC23	Local priorities, v_2
SC11	1	3	7	0,616	SC21	1	9	5	0,796
SC12	1/3	1	5	0,265	SC22	1/9	1	1/3	0,075
SC13	1/7	1/5	1	0,068	SC23	1/5	5	1	0,189
λ = 3,065, I_y=0,0324, B_y=0,056 (5,6%)					λ = 3,029, I_y=0,0145, B_y=0,025 (2,5%)				

From the subcriteria of a trading criterion for assessing the effectiveness of internationalization of an enterprise in terms of maximizing profits, the most important factor is the gain / loss derived from direct exports of goods and services, and from the financial and investment criterion, the share of direct foreign investment in the capital structure.

Table 4.

Matrix of pairwise comparisons for subcriteria according to production and technological criteria

Criteria									
Industrial					Technological				
Designation of the subcriteria	CK31	CK32	CK33	Local prioritie, v_3	Designation of the subcriteria	CK41	CK42	CK43	Local priorities, v_4
SC31	1	1/3	3	0,259	SC41	1	3	7	0,616
SC32	3	1	5	0,636	SC42	1/3	1	5	0,265
SC33	1/3	1/5	1	0,105	SC43	1/7	1/5	1	0,069
$\lambda = 3,037$, $I_y=0,019$, $B_y=0,033$ (3,3%)					$\lambda = 3,065$, $I_y=0,032$, $B_y=0,0559$ (5,6%)				

For manufacturing and technological criteria, the most important are the subcriteria associated with innovation - profit / loss derived from the sale of products manufactured under foreign patents and profit / loss derived from the sale of products manufactured by technology (including innovation), implemented under foreign licenses.

Table 5.

Matrix of pairwise comparisons for subcriteria according to the infrastructure criterion

Designation of the subcriteria	SC51	SC52	SC53	Local priorities, v_5
SC51	1	5	7	0,769
SC52	1/5	1	3	0,199
SC53	1/7	1/3	1	0,085
$\lambda = 3,065$, $I_y=0,032$, $B_y=0,0559$ (5,6%)				

The cost of maintaining units (employees) engaged in implementing the strategy of entering the external markets / expanding the presence of it in the strategic plan of internationalization of the enterprise are the main, since the local priority is maximal - 0,769.

Table 6.

Matrix of pairwise comparisons for subcriteria according to the scientific criterion

Designation of the subcriteria	SC61	SC62	SC63	SC64	Local priorities, v_6
SC61	1	5	1/3	5	0,293
SC62	1/5	1	1/5	3	0,101
SC63	3	5	1	7	0,551
SC64	1/5	1/3	1/7	1	0,054
$\lambda = 4,228$, $I_y=0,0759$, $B_y=0,0844$ (8,4%)					

From the subcriteria of the scientific criterion, the funds attracted from abroad for the implementation of R & D and profits / losses from the activities of units (employees) engaged in conducting research and development (R & D) are important.

Table 7.

Matrix of pairwise comparisons for subcriteria for educational and motivational (personal) criteria

Criteria									
Educational					Motivational (personal)				
Designation of the subcriteria	SC71	SC72	SC73	Local priorities, v_7	Designation of the subcriteria	SC81	SC82	SC83	Local priorities, v_8
SC71	1	1/5	1/3	0,105	CK81	1	5	3	0,637
SC72	5	1	5	0,637	CK82	1/5	1	1/3	0,105
SC73	3	1/5	1	0,258	CK83	1/3	3	1	0,258
λ = 3,039, I_y=0,019, B_y=0,0332 (3,33%)					λ = 3,039, I_y=0,019, B_y=0,0332 (3,32%)				

Human capital in the process of internationalization of the enterprise is the dominant factor providing the maximum income. Among the most important factors, we note the training and qualification of employees abroad, as well as their career growth, connected with the implementation of the strategy of entering or expanding on foreign markets.

The local priorities of enterprises in relation to elements of sub criteria were determined. The results are presented in Tables 8-11.

Table 8.

Local priorities of enterprises regarding elements of subcriteria for trade and financial and economic criteria

SC11	E1	E2	E3	E4	Local priorities w_{11}	SC21	E1	E2	E3	E4	Local priorities w_{21}
E1	1	1/3	1/5	1/7	0,054	E1	1	3	1/3	1/5	0,129
E2	3	1	1/5	1/5	0,101	E2	1/3	1	1/3	1/5	0,074
E3	5	5	1	1/3	0,293	E3	3	3	1	1/3	0,254
E4	7	5	3	1	0,551	E4	5	5	3	1	0,568
λ =4,228; I_y=0, 076; B_y=0,084 (8,44%)						λ = 4,197; I_y=0,066; B_y=0,073 (7,3%)					
SC12	E1	E2	E3	E4	Local priorities w_{12}	SC22	E1	E2	E3	E4	Local priorities w_{22}
E1	1	3	1/5	1/7	0,091	E1	1	1/3	1/5	1/7	0,053
E2	1/3	1	1/5	1/7	0,053	E2	3	1	1/5	1/7	0,091
E3	5	5	1	1/3	0,287	E3	5	5	1	1/3	0,287
E4	7	7	5	1	0,588	E4	7	7	3	1	0,588
λ =4,228; I_y=0, 076; B_y=0,084 (8,44%)						λ = 4,228 IУ=0, 076 ВУ=0,084 (8,44%)					
SC13	E1	E2	E3	E4	Local priorities w_{13}	SC23	E1	E2	E3	E4	Local priorities w_{23}
E1	1	3	1/5	1/5	0,121	E1	1	1/3	1/5	1/5	0,061
E2	1/3	1	1/5	1/7	0,230	E2	3	1	1/3	1/7	0,110
E3	5	5	1	1/5	0,351	E3	5	3	1	1/3	0,269
E4	5	7	5	1	0,661	E4	5	7	3	1	0,576
λ =4,228; I_y=0, 076; B_y=0,084 (8,44%)						λ = 4,275; I_y=0,078; B_y=0,087 (8,7%)					

Table 9.

Local priorities of enterprises regarding elements of subcriteria according to production and technological criteria

SC31	E1	E2	E3	E4	Local priorities w_{31}	SC41	E1	E2	E3	E4	Local priorities w_{41}
E1	1	1/3	1/7	1/9	0,042	E1	1	5	3	1/3	0,257
E2	3	1	1/5	1/7	0,085	E2	1/5	1	1/5	1/7	0,047
E3	7	5	1	1/3	0,290	E3	1/3	5	1	1/3	0,148
E4	9	7	3	1	0,582	E4	3	7	3	1	0,484
$\lambda = 4,164$, $I_y=0,055$, $B_y=0,061$ (6,1%)						$\lambda = 4,228$, $I_y=0,076$, $B_y=0,0844$ (8,44%)					
SC32	E1	E2	E3	E4	Local priorities w_{32}	SC42	E1	E2	E3	E4	Local priorities w_{42}
E1	1	3	1/3	1/7	0,126	E1	1	3	1/5	1/7	0,112
E2	1/3	1	1/5	1/7	0,064	E2	1/3	1	1/5	1/9	0,065
E3	3	5	1	1/3	0,305	E3	5	5	1	1/3	0,353
E4	7	7	3	1	0,711	E4	7	7	3	1	0,723
$\lambda = 4,139$, $I_y=0,046$, $B_y=0,052$ (5,2%)						$\lambda = 4,226$, $I_y=0,076$, $B_y=0,0844$ (8,4%)					
SC33	E1	E2	E3	E4	Local priorities w_{33}	SC43	E1	E2	E3	E4	Local priorities w_{43}
E1	1	3	1/3	1/5	0,129	E1	1	3	1/5	1/7	0,088
E2	1/3	1	1/3	1/5	0,074	E2	1/3	1	1/5	1/9	0,048
E3	3	3	1	1/3	0,254	E3	5	5	1	1/3	0,278
E4	5	5	3	1	0,568	E4	7	9	3	1	0,606
$\lambda = 4,197$, $I_y=0,066$, $B_y=0,073$ (7,3%)						$\lambda = 4,175$, $I_y=0,058$, $B_y=0,065$ (6,5%)					

Table 10.

Local priorities of enterprises with respect to elements of subcriteria according to the infrastructure and scientific criteria

SC51	E1	E2	E3	E4	Local priorities w_{51}	SC61	E1	E2	E3	E4	Local priorities w_{61}
E1	1	3	1/5	1/9	0,084	E1	1	3	1/5	1/7	0,091
E2	1/3	1	1/5	1/7	0,052	E2	1/3	1	1/3	1/7	0,053
E3	5	5	1	1/3	0,282	E3	5	3	1	1/3	0,287
E4	9	7	3	1	0,615	E4	7	7	3	1	0,588
$\lambda = 4,247$, $I_y=0,0824$, $B_y=0,0916$ (9,16%)						$\lambda = 4,226$, $I_y=0,076$, $B_y=0,0844$ (8,4%)					
SC52	E1	E2	E3	E4	Local priorities w_{52}	SC62	E1	E2	E3	E4	Local priorities w_{62}
E1	1	3	1/5	1/7	0,088	E1	1	1/3	1/3	1/7	0,065
E2	1/3	1	1/7	1/7	0,047	E2	3	1	1/3	1/5	0,122
E3	5	7	1	1/3	0,300	E3	3	3	1	1/5	0,212
E4	7	7	3	1	0,565	E4	7	5	5	1	0,667
$\lambda = 4,228$; $I_y=0, 076$; $B_y=0,084$ (8,44%)											
SC53	E1	E2	E3	E4	Local priorities w_{53}	SC63	E1	E2	E3	E4	Local priorities w_{63}
E1	1	3	1/5	1/7	0,091	E1	1	3	1/3	1/5	0,129
E2	1/3	1	1/5	1/7	0,053	E2	1/3	1	1/3	1/5	0,074
E3	5	5	1	1/3	0,287	E3	3	3	1	1/3	0,254

E4	7	7	3	1	0,588	E4	5	5	3	1	0,568
λ =4,228; I_y=0, 076; B_y=0,084 (8,44%)						λ=4,197, I_y=0,0656, B_y=0,0731 (7,31%)					
						SC64	E1	E2	E3	E4	Local priorities w_{64}
						E1	1	1/3	1/5	1/7	0,054
						E2	3	1	1/3	1/7	0,105
						E3	5	3	1	1/5	0,225
						E4	7	7	5	1	0,677
						λ=4,239 I_y=0,0798, B_y=0,0887 (8,87%)					

Table 11.

Local priorities of enterprises regarding elements of subcriteria for educational and motivational (personal) criteria

SC71	E1	E2	E3	E4	Local priorities w_{71}	SC81	E1	E2	E3	E4	Local priorities w_{81}
E1	1	3	1/3	1/5	0,116	E1	1	3	1/3	1/5	0,129
E2	1/3	1	1/5	1/7	0,054	E2	1/3	1	1/3	1/5	0,074
E3	3	5	1	1/5	0,229	E3	3	3	1	1/3	0,254
E4	5	7	5	1	0,748	E4	5	5	3	1	0,567
λ= 4,2395, I_y=0,07985, B_y=0,0887 (8,87%)						λ = 4,197; I_y=0,066; B_y=0,0731 (7,31%)					
SC72	E1	E2	E3	E4	Local priorities w_{72}	SC82	E1	E2	E3	E4	Local priorities w_{82}
E1	1	3	1/3	1/3	0,132	E1	1	3	1/5	1/5	0,106
E2	1/3	1	1/7	1/7	0,049	E2	1/3	1	1/5	1/5	0,061
E3	3	7	1	1/3	0,282	E3	5	5	1	1/5	0,270
E4	3	7	3	1	0,488	E4	5	5	5	1	0,532
λ = 4,161, I_y=0,05377, B_y=0,0597 (5,97%)						λ= 4,257, I_y=0,086, B_y=0,0953 (9,53%)					
SC73	E1	E2	E3	E4	Local priorities w_{73}	SC83	E1	E2	E3	E4	Local priorities w_{83}
E1	1	3	1/3	1/5	0,129	E1	1	5	1/3	1/3	0,148
E2	1/3	1	1/3	1/5	0,074	E2	1/5	1	1/5	1/7	0,047
E3	3	3	1	1/3	0,254	E3	3	5	1	1/3	0,256
E4	5	5	3	1	0,568	E4	3	7	3	1	0,484
λ = 4,1974, I_y=0,0658, B_y=0,0731 (7,31%)						λ =4,228; I_y=0, 076; B_y=0,0844 (8,44%)					

An analysis of the local priorities of enterprises with respect to the elements of subcriteria according to all the proposed criteria indicates that the medium and large enterprises that are already internationalized have unquestionable advantages compared to medium and small enterprises that are only planning to export their products to foreign markets. However, a small high-tech enterprise with a strong human resources potential, with almost all sub-criteria, has an advantage over an average enterprise that is planning to enter the markets of developing countries.

Conclusions and suggestions. The MAI method substantiates the acceptance of managerial decisions concerning the internationalization of machine-building enterprises of various sizes, financial capabilities, technological equipment, personnel potential, and others like that.

The criteria for evaluating the effectiveness of internationalization were proposed: trade, financial-investment, production, technological, infrastructure, scientific, educational, motivational (personal), as well as 25 main and 5 additional subcriteria covering practically all aspects of the enterprise's activity.

Structural-logical scheme of estimation of efficiency of internationalization of industrial enterprises according to the polycrystalline approach is constructed.

It is shown that the most important criteria in assessing the efficiency of internationalization of enterprises are financial-investment, scientific and educational criteria. Within each criterion, subcriteria with the highest local priorities are identified.

1. *Vitlinskyj V.V., Velykoivanenko G.I.* (2004). Ryzykologiya v ekonomici ta pidpryyemnycztvi [Risk in economics and entrepreneurship] K.: KNEU [in Ukrainian]; 2. *Kigel V.R.* (2003). Modeli i metody pryjnyattya rishen v rynkovij ekonomici [Models and methods of decision making in a market economy]. KEIM [in Ukrainian]; 3. *Skiter I.S., Tkalenko N.V., Trunova O.V.* (2011). Matematychni metody pryjnyattya upravlinskyx rishen [Mathematical methods of making managerial decisions] [in Ukrainian]; 4. *Saati T., Kerns K.* (1993) Analytycheskoe planyrovanye. Organyzacyya system [Analytical planning. Organization of systems]. M.: Radyosvyaz [in Russian]; 5. *Saati T.* (1993) Prynyatye reshenyj. Metod analyza ierarxij [Decision making. Method of analysis of hierarchies] M: Radyosvyaz [in Russian]; 6. *Ananyev O.M.* (2004). Zastosuvannya metodologiyi analitychnogo planuvannya dlya rozvyazuvannya skladno strukturovanyx zavdan upravlinnya [Application of analytical planning methodology for solving complexly structured management tasks] Socialno-ekonomichni doslidzhennya v perexidnyj period. Statystychne ocinyuvannya socialno-ekonomichnyx yavyshh u regioni: metodologichni pidxody (Shhorichnyk naukovyx pracz). NAN Ukrayiny. Instytut regionalnyx doslidzhen. Lviv [in Ukrainian]; 7. *Gladun T.M.* Zastosuvannya metodu analizu iyerarxij dlya vyboru franchajzyngovoyi merezhi [Application of the hierarchy analysis method for choosing a franchise network]. Lviv Polytechnic National University Institutional Repository. Retrieved from: http://ena.lp.edu.ua (accessed 27.04.19 r.). [in Ukrainian]; 8. *N.P. Stasyuk, A.J. Savyczkyj* (2014). Zastosuvannya metodu analizu iyerarxij pry vybori instrumentalnyx zasobiv rozrobky programnogo zabezpechennya [Application of hierarchy analysis method in the choice of tools for software development] Mizhvidomchyj naukovo-texnichnyj zbirnyk «Adaptyvni systemy avtomatychnogo upravlinnya» [in Ukrainian]; 9. *Tkachova O.K.* (2015). Metod Saati pry pryjnyatti upravlinskyx rishen [Saati's method when making managerial decisions] Derzhava ta regiony, Seriya: Ekonomika ta pidpryyemnycztvo [in Ukrainian]; 10. *Yevstrat D.I., Kushneruk Yu.I.* (2012). Zastosuvannya metodu analizu iyerarxij dlya ocinky marketyngovoyi aktyvnosti torgovelnyx pidpryyemstv [Application of the hierarchy analysis method for assessing the marketing activity of trading enterprises] Matematychni metody ta modeli v ekonomici. Problemy ekonomiky # 2 [in Ukrainian]; 11. *Marynenko N.Yu.* (2016). Model vyznachennya procesiv, shho potrebuyut negajnyx adaptacijnyx zaxodiv [Model for identifying processes that require immediate adaptation] Ekonomika i upravlinnya. Naukovyj zhurnal. Ky`yiv : Yevropejs`ky`j universy`tet, #3 [in Ukrainian]; 12. *Groznyj I.S., Tarasova G.O.* (2014). Zastosuvannya metodu analizu iyerarxij do zadach benchmarkingu vyrobnychyx procesiv promyslovogo pidpryyemstva [Application of the method of analysis of hierarchies to the problems of benchmarking industrial processes of an industrial enterprise] Ekonomika i upravlinnya: naukovyj zhurnal. Kyiv: Yevropejskyj universytet, #3 [in Ukrainian].