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STATISTICAL TESTING OF KEY EFFECTIVENESS INDICATORS OF THE COMPANIES (CASE FOR UKRAINE IN 2012)

The system efficiency of the company functioning depends on the quality potential, level of functional organization and operativeness of management decisions. All these aspects need to be shown results indicators of enterprises. Under effectiveness is to be understood the degree of achieve of the strategic goals of the enterprises. The most well-known base of the company functioning evaluating is model of balanced scorecard (BSC) of R. Kaplan and D. Norton. This system includes four aspects: financial, customer, internal business processes, training and development of staff. The purpose of this paper is the statistical testing of possibility to separate key effectiveness indicators for these groups and determination of their composition.
With the use of multivariate factor analysis was identified the most significant indicators of the effectiveness of engineering companies. The hypothesis of R. Kaplan and D. Norton about the allocation of the four groups of key effectiveness indicators has been confirmed.
JEL: C4; D2; O25

1. Introduction

The system efficiency of the company functioning depends on the quality potential, level of functional organization and operativeness of management decisions. All these aspects need to be shown in results indicators of enterprises [1].

Effectiveness of enterprises depends on the level of conformity the real or possible results and goals, i.e. the degree of achievement of the strategic goals of enterprise functioning.

For any company the result has the life cycle and goes through three phases:

a) the desired result, , i.e. the goal;

b) the intermediate result, including the amount of used resources;

c) the final result.

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As well known, now in economic science has not developed a consensus on global goal of enterprise function: in classical and neoclassical theory it is maximization of company profits, in the institutional theory it is minimization of transaction costs, in evolutionary theory it is stability of development.

But due to the fact that the end result and purpose associated with the satisfaction of any demand, so (in a broad sense) the impact assesses the quality of the result, i.e. the relations of stakeholders to the consumer properties of specific products (benefits) of business enterprises functioning.

2. Description of the Problem and its Solution

2.1. Analysis of last researches

Based on the fact that the outcome should provide long-term and sustainable enjoyment of the dominant domestic needs of the system can be predicted that:

a) the result parameters of economic activities should be based on parameters of reproductive cycle of the enterprise;

b) description of the results, along with the dynamics of the productive forces must include the parameters of the dynamics of industrial relations;

c) for handling of the result its key indicators should correspond with the functional responsibilities of the main structural units (supply, sales and marketing, production, organization and coordination).

According to the authors, these requirements most modern meet the following approaches:

- balanced scorecard model (BSC) of Norton&Kaplan [2-6];
- balanced scorecard model of Meysel [7; 8];
- integrated model of balanced scorecard and economic indicator of added value (VA) [9];
- efficiency pyramid of McNair, Lunch, and Cross [10];
- *EP²M* model of Adams&Roberts [11].

The presented approaches are quite similar on the composition of groups of parameters that describe the results of a company working.

There is a customer satisfaction of level of product quality and service, scientific and technical level of technical and technological base of production, the degree of satisfaction of work employees, financial indicators of economic activity.

Given the scope of applicability, *EP²M* and pyramid of efficiency models are mainly used for financial institutions.

Balanced scorecard model of Meysel used for financial institutions and services, and an integrated model of balanced scorecard and economic indicator of added value mostly used in the service sector.

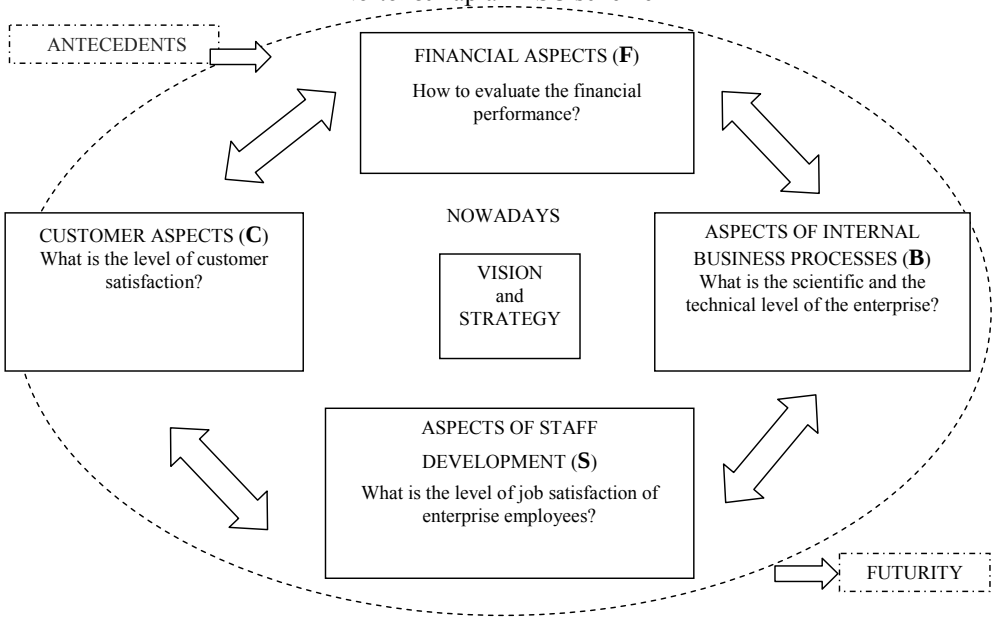
Balanced Scorecard model of Norton&Kaplan has a wider scope for businesses of all sizes and industry sector, what is why it can and will be used in our further studies.

2.2. Norton&Kaplan BSC approach

BSC of Norton&Kaplan approach allows to control the current efficiency and alsow aimed at processing of information about the future prospects of the functioning of the enterprises (fig. 1).

Figure 1

Norton&Kaplan BSC scheme



Let consider each of the components for BSC of Norton&Kaplan. The financial aspect for selecting of indexes of effectiveness must be based on the fact that indicators of functioning of the enterprise management and other stakeholders will take as it's success. For many enterprises there are sufficient monitoring and processing of financial information which helps usage of corporate databases.

Modern management indicates a growing awareness of the importance of orientation to customers and level of their satisfaction, that named as the client's aspect. If the consumer is not satisfied with the products, he will find another supplier. Thus, relevant indicators would testify prospects for the company from customer's point of view. Unsatisfactory

value of indicators (characterizing the client aspect) indicates deterioration of the company in the present and possible future bankruptcy.

All changes based on the aspect of internal business processes, show to managers - how effective functioning of the company, whether the products and services corresponds to customer requirements, which processes the company must improve to meet the expectations of customers and shareholders (owners). The internal business processes in addition to strategic processes include related missions and supporting processes.

Aspect of personnel development describes the directions of its training and development to achieve of assigned purposes. This aspect includes employee training and corporate cultural relations relating to individual and corporate self-improvement. It is clear that for the company where works highly skilled professionals, these people are the main resource. In today's environment of rapid technological changes for this professionals is needed the lifelong learning, which includes many items such as mentoring, established channels of communication between staff etc.

Every aspect of Norton&Kaplan BSC includes key question the answer to which is the goal to achieve business strategy. The process of strategy implementation for the company, which has completed the development of a balanced scorecard, first carried out from top to bottom.

In the first phase based on the vision of senior management, defined financial goals and benchmarks. Further defined range of problems associated with the identification of customers, developing measures to improve customer perception of products or services of the company.

Once the desired objectives defined begins to find the necessary funds for their achievements. For this defined measures (project idea) to improve internal business processes that are necessary for create quality proposals for consumers and for obtain the intended financial results. Improvement of internal business processes largely depends on the technologies used, qualifications and experience of staff, internal climate in the team, and other factors.

When using indicators the aim is to reach desired values as indicators, and an action plan is shown as a trajectory to the target presented in time. Among the objectives of the balanced scorecard there are causal relationships. The balance represents the link between financial and non-financial indicators, strategic and operational levels of management, past and future results, as well as internal and external aspects of company activities.

Thus, the balanced scorecard enables managers to combine strategy of the enterprise with a set of indicators, individually designed for different levels of management and interconnected.

As part of the balanced scorecard it is necessary to distinguish indicators that measure achieved results and indicators that reflect the processes that contribute to obtaining this result.

Therefore, on the one hand it includes indicators that are not measured in accounting, on the other – the causal relationships between indicators. For example, volume of production

should reflect the demand for it, but the change in sales show changing of consumer attitudes toward these products. Both categories of indicators should be interdependent of each other, because for achieve the first need to implement the latter.

The advantages of balanced scorecard include the following:

with this system the company is able to focus on a few key indicators to achieve the best results;

four main aspects (financial, client, internal business processes, learning and growth) form a comprehensive scheme for the implementation of business strategy from the upper to the lower hierarchical level;

system allows to integrate various corporate programs such as the development of quality, reorganization, initiatives of the departments of work with buyers, and others;

this conception integrates with the system of controlling and agrees with management practices aimed to increasing of enterprise value;

this approach allows to break the strategic objectives and changes into smaller components, so that managers, heads of departments and employees are able to understand what they need to achieve the desired results and improve system efficiency (system efficiency).

Along with the benefits, the balanced scorecard model of Norton&Kaplan has a drawback: it is the uncertainty of some parameters that characterize the effectiveness of the functioning of the company.

For this reason, when we calculate the result (total effectiveness) there is a problem of determining the minimum required list of indicators that would characterize multi-attribute result of the operation of the enterprise as a complex socio-economic system.

Therefore the aims of our study and paper are the statistical testing of capabilities of partitioning for key effectiveness indicators into four groups and definition of their composition (based on machine-building enterprises of Ukraine).

2.3. Statistical data deals with machine building in Ukraine as of 2012

Earlier industrial enterprises always have significant influence on the gross domestic product of Ukraine, but in 2012 this trend changed. Recently, the share of industry in total net profit is only 5.8%, return on assets decreased to 0.15%.

The largest share in volumes of realized production in the industrial enterprises of Ukraine has manufacturing (63.6%), so from changes in the efficiency of this trend is more dependent situation in all industry. there was a slowdown (1.4%) of sales growth in the processing industry in 2012. Machine building has the third regarding a share in manufacturing – 16.1%. The largest share have a metallurgy and manufacture of fabricated metal products and food processing, beverages and tobacco products.

Indeed, in industrial countries 30-50% of total production relates to machine-building enterprises, namely in Germany – 53.6%, Japan – 51.5%, England – 39.6%, Italy – 36.4%, China – 35.2% [13]. In our view, in Ukraine machine building industry should be the basis of the economy and main tool to develop the means of production, to the mechanization and automation of various industries.

The total volume of realized production for engineering companies are reduced. Thus, in 2012, the largest share of sales of machinery products – 29.2% have a companies that produce rolling stock, 10% – repair of machinery and equipment, 9% – manufacture of other transport equipment.

At the same time, is worsens financial position of these enterprises. Current liabilities of industrial enterprises in Ukraine increased by 20-30% in 2008-2012 years. The structure of debt takes the largest share of payables and it increases from 80% in 2008 to 87% in 2012. Short-term bank loans increased in monetary terms, but their share in total current liabilities decreased from 17% to 11%. Current portion of long-term debt varies within 3-4% of the loan capital of industrial enterprises in Ukraine during 2008-2012.

Overall in 2012, capital investment of industrial enterprises in Ukraine up to 95 billion UAH. Much of fraction of them (40.1%) falls on the manufacturing industry, including engineering.

The highest share of exports in the industry for the period 2008-2012 years was observed in 2008 and amounted to 43.82%. Since 2013, the share of exports in industrial enterprises of Ukraine is reduced. Moreover, among the Ukrainian engineering companies the largest share of exports have a companies producing electrical, electronic and optical equipment.

Today the structure (by size) of machine-building and engineering enterprises in Ukraine is the next – large enterprises up 0.9 %, average enterprises – 12.1%, small enterprises – 87.0%. However the total sales for large companies makes 65%, for average – 30.1%, for small – 4.9%.

Large and medium-sized enterprises occupy 85.1% of the machinery market, and above 39.7% of them have a losses. Thus, although machine building enterprises have considerable influence on the development of Ukraine, but results of their activities greatly deteriorating in recent years.

Therefore, in this paper work we will study and consider medium and large machine-building and engineering companies.

2.4 Processing of the statistical data

Provisional selection of indicators according to recommended in BSC list was carried out by expert assessments of enterprises managers. The corresponding results are presented in publications [1,12].

To clarify the composition of parameters were used methods of multivariate analysis.

Table 1

Large and medium machine-building enterprises of Ukraine (short version)

No	Name of enterprise	Total sales, ths. uah	Proportion in the sphere, %
1.	AZOVOBSCHEMASH, PJSC	5407222	4.65
2.	Motor Sich PJSC	5001803	4.30
3.	PJSC "KRYUKOVSKY RAILWAY CAR BUILDING WORKS"	4368956	3.76
4.	"Novokramatorsky Mashinostroitelny Zavod", PJSC	3347200	2.88
5.	"Stakhanov Wagon Works", OJSC	2880624	2.48
6.	Mariupol Heavy Machine Building Plant, PJSC	2728795	2.35
7.	CJSC "Zaporizhia Automobile Building Plant "	2690000	2.31
8.	UkrAVTO Corporation,	2688092	2.31
9.	PC "Dniprovahonmash"	2361722	2.03
10.	PJSC «Zaporozhtransformator»	2285786	1.96
11.	ANTONOV Company	2246010	1.93
12.	PJSC «Sumy Frunze NPO»	2135846	1.84
13.	PJSC Automobile Company Bogdan Motors	1708036	1.47
14.	PJSC "Energomashspetsstal"	1340812	1.15
15.	OJSC "Druzhkovsky engineering factory"	1154204	0.99
16.	***NORD JSC***	948525	0.82
17.	OJSC "Turboatom"	942329	0.81
18.	State Enterprise plant "Electrotyazhmash"	882636	0.76
19.	JSC ***Luganskteplovoz***	859395	0.74
20.	***OJSC Kharkov Bearing Plant*** ("HARP")	648108	0.56
21.	Public Joint-Stock Company "AvtoKrAZ"	605359	0.52
22.	Starokramatorsk engineering works, PbJSC	556723	0.48
23.	JSC ***Lozovaya Forging-Mechanical Plant*** (LKMZ)	466693	0.40
24.	"Azovmash", JSC	450890	0.39
25.	JSC "SKF Ukraine"	437870	0.38
26.	JSC "Zaliv Shipyard"	420197	0.36
27.	***Kremenchug Wheel Plant*** JSC	416919	0.36
28.	Artem, State Joint-Stock Holding Company	412580	0.35
29.	Dneprotyazhmash PJSC	395767	0.34
30.	SVITLO SHAKHTARIA Kharkiv Machine Building Plant	391983	0.34
31.	"NASOSENERGOMASH Pump Engineering Works Sumy"	377292	0.32
32.	PJSC Kherson Shipyard	352937	0.30
33.	OJSC "Donetskgormach"	329430	0.28
34.	Kharkiv Tractor Plant n.a. Ordzhonikidze Public JSC	325908	0.28
35.	Zaporizhia Electric Locomotive Repair Plant,***JSC***	283848	0.24
36.	The Kharkov Frunze Plant JSC	250888	0.22
37.	AB machinery plant "Astra"	211613	0.18
38.	OJSC «Lviv Locomotive Repair Plant»	183808	0.16
39.	Kharkov State Aircraft Manufacturing Company	156936	0.13
40.	PJSC «ZAVOD «LTAVA»	148690	0.13
41.	***Wadan Yards Okean OJSC***	142754	0.12
42.	Dniepropetrovsk Diesel ***Locomotive Works*** PLC	142174	0.12
43.	PJSC «Elektrodvyhun (Elecrical Motors)»	88543	0.08
44.	OJSC NVK Kyiv G.I. Petrovsky Automatics Plant	35306	0.03
45.	JSC "***Kramatorsk Heavy Machine*** Tool Building Works"	33249	0.03
46.	Dniprovsky machine-building plant, PJSC	16504	0.01
	Total	54260962	46.64

We must recall that the multivariate analysis is part of mathematical statistics, which combines a set of different methods designed to study multidimensional phenomena.

In our research has been applied the most known in the world and in Ukraine (in particular) software package Statistica 6. It is intended for processing and analysis of quantitative and qualitative data of different origin.

This program includes many modules which are logically interrelated through procedures for statistical computing and specialized tools for visualization and data exchange with other software.

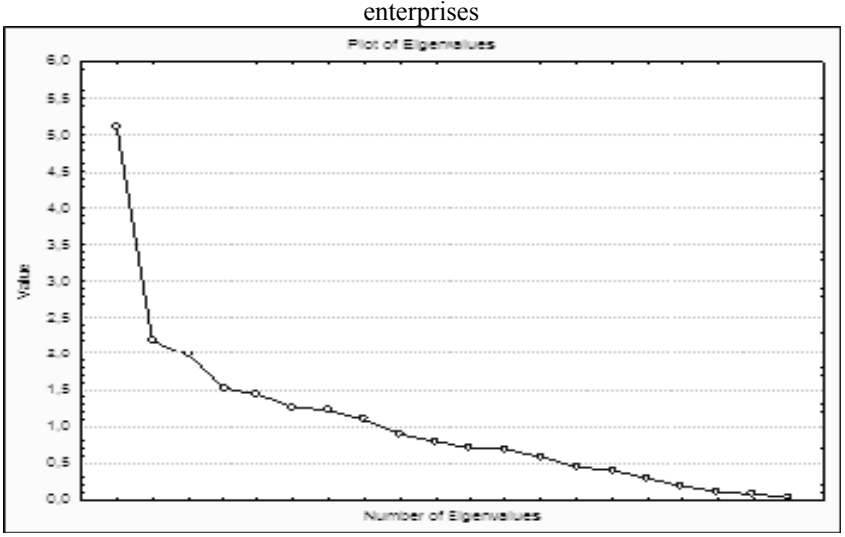
Original data of forty-six Ukrainian machine-building enterprises are presented in Table 1 (short version) and appendix (detailed version) according to the source [14].

Factual basis of the study are results on economic activity of forty-six enterprises are 46.64% total market of machine-building industry in Ukraine. According to the data from table 1 the largest percent of production sales among the studied companies has «Azovobschemash» - 4.65% and «Motor Sich» - 4.30%.

We assume that economic activity each company is given by a vector of twenty one indicators. Multivariate statistical analysis makes it possible to obtain general conclusions relative to the entire data set. At the first stage of data processing was obtained diagram of "rain stones" (fig. 2).

Figure 2

"Rain stones" diagram of *effectiveness* indicators for operations of machine-building enterprises



Calculations and corresponding graph (see fig.2) show that the program doesn't reduced the number of parameters describing the result. For twenty one input parameters after calculations proved to be significant twenty factors.

Therefore it is necessary to make the selection of factors according to their importance according to the criteria adopted in statistical multivariate factor analysis.

According to the graph in Fig. 1 (according to Kaiser' criteria) we can identify eight major factors (principal components), with eigenvalues greater than one (fig. 3).

Figure 3

Eigenvalues for main factors (under Kaiser' criteria)

Value	Eigenvalues (data) Extraction: Principal components			
	Eigenvalue	% Total variance	Cumulative Eigenvalue	Cumulative %
1	5,115452	24,35929	5,11545	24,35929
2	2,188528	10,42156	7,30398	34,78086
3	1,982848	9,44213	9,28683	44,22299
4	1,518322	7,23011	10,80515	51,45310
5	1,437205	6,84383	12,24236	58,29693
6	1,262530	6,01205	13,50488	64,30898
7	1,218024	5,80011	14,72291	70,10909
8	1,088692	5,18425	15,81160	75,29334

Besides eigenvalue for each of eight factors in fig. 3 are defined absolute and percentage value of factor for explaining the total variance of result parameters, and their total (cumulative) significances.

Fig. 3 shows that eight major factors (on Kaiser criteria) explained about 75% variance of the original information.

The last five of the eight factors have close eigenvalues, so (on Cattell criteria), we can proceed to the consideration only four factors. This fact, somewhat, confirming the hypothesis of balanced scorecard model of Kaplan&Norton. For further analysis of factors have been identified factor loadings, i.e. the correlation between variables (fig. 4).

Fig.4 shows that a group of financial indicators include five indicators. These are indicators: cost of sold products, ratio of paid dividends to the market capitalization of the company, the weighted average cost of capital, economic profit, capital investment. Overall significance of this group is 33%.

The group as internal business processes include four indicators. These are such indicators: capital productivity, the cost of new technologies, the coefficient of life for fixed assets, the coefficient of update for technical and technological base. Overall significance of this group is 28%.

The group of consumers includes two indicators: volume of sales and the proportion of exports in total sales. Overall significance of this group is 14%.

Figure 4

Factor loadings for indicators of machinery companies functioning

Variable	Factor Loadings (Varimax raw) (data) Extraction: Principal components (Marked loadings are >,700000) Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	**Factor 8**
Cost of products	0,888834	0,028299	0,206920	0,165519	0,114110	-0,029642	0,038394	-0,049925
Residual income	0,759424	0,008018	-0,121426	-0,284913	-0,021346	0,085793	-0,233768	0,106171
Investment capital	0,600606	0,701428	-0,037974	0,040153	0,048903	0,078891	0,050769	-0,007712
Weighted average cost of capital	-0,045583	-0,032926	0,025738	-0,054833	0,188379	-0,777959	0,005506	0,073417
Ratio of dividends paid to a market capitalization of the company	-0,035184	-0,069018	0,055513	-0,068259	0,010007	0,001103	-0,886103	-0,904180
Attracted funds	0,506346	0,361683	0,160924	0,294866	-0,100898	-0,435977	0,196439	-0,141921
Paid in capital	0,140001	0,674989	0,089888	0,366174	-0,076048	-0,156285	0,122465	0,069493
Utilization rate of capacity	0,321662	0,165640	0,265550	-0,602118	-0,003793	0,217367	-0,157268	0,213903
Capital productivity	-0,043058	0,033794	0,906475	-0,115284	-0,108307	-0,000847	-0,007895	-0,040697
Coefficient suitability of fixed assets	0,195536	0,145171	-0,043394	0,055531	0,812888	-0,035198	0,003876	-0,078834
Coefficient renewal technical and technological base	-0,015414	0,801967	0,013391	-0,129332	0,176623	-0,090880	-0,163194	-0,039552
The costs of new technologies (research and experimental development)	0,145968	0,887249	-0,049505	-0,016768	0,045556	0,070148	0,069608	0,002870
Total sales	0,953650	0,106041	0,129486	0,067259	0,102186	-0,005388	0,004151	-0,023721
The share of exports	-0,031085	0,002294	0,038851	-0,071907	-0,043042	0,031241	0,146027	0,789202
Coefficient turnover of receivables	-0,061043	-0,311196	-0,080941	-0,127481	0,368257	0,447399	0,141611	0,399155
Wage fund	0,118017	0,042491	0,091759	0,842406	0,033838	0,094290	-0,014817	0,031918
Productivity labour personnel of the enterprise	0,290531	-0,104172	0,792772	0,221350	0,206795	-0,045632	-0,050617	0,028409
Capital-labor ratio	-0,051237	-0,067791	-0,114945	0,016017	-0,731967	0,069273	0,051085	-0,017830
Average number of employees	0,733167	0,499356	-0,230753	-0,140088	-0,002217	0,020578	0,062888	0,095752
Coefficient of the average annual number of employees	0,135495	0,101802	-0,262671	0,211782	-0,142677	-0,399437	-0,327263	0,511721
Income level employees of the month	0,343374	0,252504	-0,006149	0,266568	0,118280	0,449022	-0,423589	0,163264
Expl.Var	3,860802	3,013979	1,790569	1,655188	1,535167	1,474392	1,291051	1,190453
Prp.Totl	0,183848	0,143523	0,085265	0,078818	0,073103	0,070209	0,061479	0,056688

The group of staff included four indicators: wage fund, productivity of staff of enterprise, the average number of full time employees, the coefficient (ratio) of basic facilities provision.

It is clear, that described results of the factor analysis refers only to the Ukrainian machine-building enterprises. For companies in other branches of industry and other countries the ratio may be different.

2.5. Comparison of power engineering leaders in Ukraine and abroad

Let consider and compare the activities of leading power and energy machine building enterprises of Ukraine, Russia and the United States.

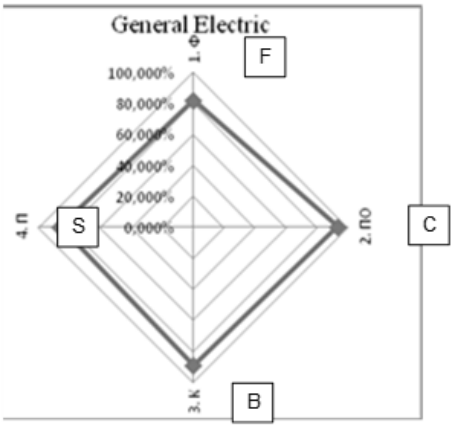
Note that the overall volume of world energy machine building market taking into account alternative energy sources amounted to 208 billion dollars. [15]. The leader in this type of activities is the company General Electric (USA), covering about 24% of the world market. The Russian company OJSC "Power Macines" is the leader in the Russian market and covers 0.88% of the world market. Ukrainian PJSC "Turboatom" is the leader in Ukraine and has 0.04% of the world market [16].

We construct a radial diagram for the four groups of effectiveness for General Electric [17], OJSC "Power Machines" [18] and JSC "Turboatom" [14], shown on Fig. 5 and based on its annual reports.

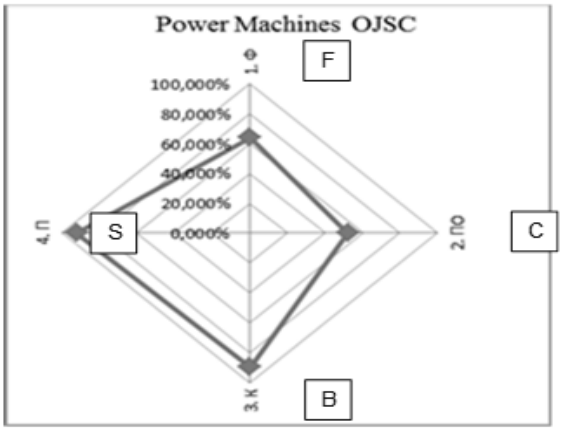
Figure 5

Radial diagram for leaders in energy machine building

a) the United States



b) Russia



c) Ukraine

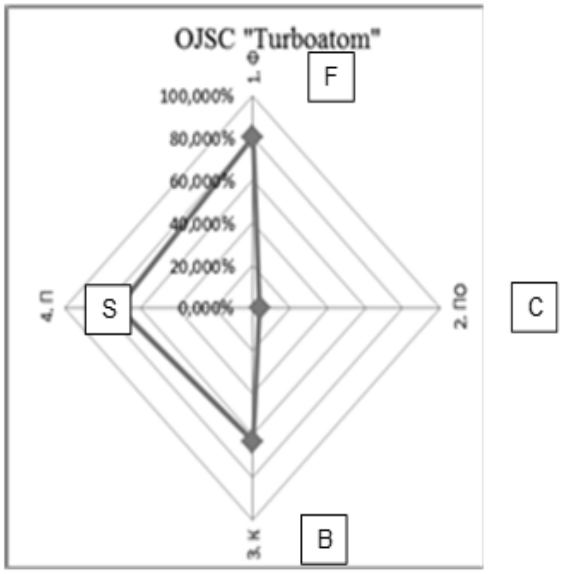


Fig. 5 shows that the most coordinated is effectiveness of General Electric. Its benchmark is further balanced their scientific and technical level of production and personnel for maintaining of leadership positions.

Less coherent than the world leader, is the radial diagram of OJSC "Power Machines". Its priority is to raise the scientific and technological level of production and development of

personnel, and reference point of strategic development is to use these components for effectiveness gain of the largest share of the market.

The least balanced is radial diagram for JSC "Turboatom". Here, the main priority is to improve financial indicators but the level of profit in the future all the time is reduced.

Thus the strategic guideline of Ukrainian enterprise must be the conquest of greater market share on energy engineering market by not only the quality, but also by increasing the volumetric indicators of development.

3. Conclusions

In this paper, using multivariate analysis was selected the most significant indicators of the functioning for the machine-building enterprises.

Basic indicators classified and sorted to some groups. Was established that the group "financial *effectiveness*" consist of cost of sold products, the ratio of paid dividends to the market capitalization of the company, the weighted average cost of capital, economic profit and capital investment.

"Quality of internal business processes" group include capital productivity, the cost of new technologies, the coefficient of life for fixed assets, the coefficient of update for technical and technological base. Group "consumers" contains volume of sales and the proportion of exports in total sales. In "staff" group are wage fund, productivity of enterprise staff, average number of full time employees, the coefficient of basic facilities provision. This set of indicators can reasonably and properly assess the effectiveness of the functioning of the enterprise and identify bottlenecks in its work.

We assume that main directions for further research must be construction of methodology for application of this technique for companies from various other branches of industry.

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APPENDIX

Large and medium machine-building enterprises of Ukraine (detailed version)

Table 1

№	Name of enterprise	Total sales, ths. uah	Proportion in the sphere, %	Cost of products, ths. uah	Residual income, ths. uah	Investment capital, ths. uah	Weighted average cost of capital	Ratio of dividends paid to a market capitalization of the company	Attracted funds, ths. uah
	Large machine-building enterprises of Ukraine								
1.	AZOVOBSCHEMASH, PJSC	5407222	4.65	4859510	-11330	392230	0.052	0.000	4384128
2.	Motor Sich PJSC	5001803	4.30	2666560	1276705	545481	0.048	0.003	2346902
3.	PJSC “KRYUKOVSKY RAILWAY CAR BUILDING WORKS”	4368956	3.76	3622780	380336	56493	0.027	0.014	493696
4.	PJSC "Novokramatorsky Mashinostroitelny Zavod",	3347200	2.88	2324106	457772	267000	0.010	0.064	30647
5.	"Stakhanov Wagon Works", OJSC	2880624	2.48	2507633	258732	41571	0.126	0.082	1980225

6.	Mariupol Heavy Machine Building Plant, PJSC	2728795	2.35	2476793	26882	21123	0.071	0.000	2172137
7.	CJSC "Zaporizhia Automobile Building Plant "	2690000	2.31	2429708	5893	303690	0.013	0.000	2639172
8.	UkrAVTO Corporation,	2688092	2.31	2276527	-3849	64426	0.000	0.000	1371181
9.	PC "Dniprovahonmash"	2361722	2.03	1912084	361034	7173	0.046	0.512	510952
10.	PJSC «Zaporozhtransformator»	2285786	1.96	1495433	515485	35004	0.091	0.076	3120532
11.	ANTONOV Company	2246010	1.93	1700422	155665	408021	0.011	0.000	2692888
12.	PJSC «Sumy Frunze NPO»	2135846	1.84	1252412	7165	693706	0.000	0.000	2816092
13.	PJSC Automobile Company Bogdan Motors	1708036	1.47	1548824	-47512	32295	0.658	0.000	3868456
14.	PJSC “Energomashspetsstal”	1340812	1.15	1080447	147919	229162	0.002	0.000	2657141
15.	OJSC "Druzhkovsky engineering factory"	1154204	0.99	920397	112412	6874	0.000	0.000	1163604
16.	**NORD JSC**	948525	0.82	828791	-33380	26591	0.000	0.000	212276
17.	OJSC "Turboatom"	942329	0.81	575546	165965	34757	0.005	0.020	481702
18.	State Enterprise plant “Electrotyazhmash”	882636	0.76	695168	91754	35934	0.000	0.000	537087
19.	JSC **Luganskteplovoz**	859395	0.74	747154	9597	5867	0.004	0.000	682317
	Medium machine-building enterprises of Ukraine								
20.	**OJSC Kharkov Bearing Plant** (“HARP”)	648108	0.56	536797	35822	28330	0.026	0.089	572245
21.	Public Joint-Stock Company "AvtoKrAZ"	605359	0.52	489544	26660	7066	0.119	0.024	4530079
22.	Starokramatorsk engineering works, PbJSC	556723	0.48	461834	72108	2701	0.039	0.000	190885
23.	JSC **Lozovaya Forging-Mechanical Plant** (LKMZ)	466693	0.40	404327	22625	12676	1.315	0.011	255457
24.	"Azovmash", JSC	450890	0.39	364307	2802	622	0.000	0.000	177462
25.	JSC "SKF Ukraine"	437870	0.38	345585	36250	48654	0.080	0.206	237991
26.	JSC "Zaliv Shipyard"	420197	0.36	295255	79237	10910	0.054	0.069	888206
27.	**Kremenchug Wheel Plant** JSC	416919	0.36	320171	38628	23487	0.091	0.185	68453
28.	Artem, State Joint-Stock Holding Company	412580	0.35	310609	34893	4157	0.048	0.000	699618
29.	Dneprotyazhmash PJSC	395767	0.34	282037	20395	2619	0.052	0.129	183094
30.	SVITLO SHAKHTARIA Kharkiv Machine Building Plant	391983	0.34	276886	37504	38019	0.000	0.000	40754
31.	“NASOSENERGOMASH Pump Engineering Works Sumy”	377292	0.32	231792	60222	157321	0.012	0.272	970732
32.	PJSC Kherson Shipyard	352937	0.30	246288	99774	2223	0.066	0.000	958968
33.	OJSC "Donetskgormach"	329430	0.28	279109	7676	14199	-0.007	0.414	466972
34.	Kharkiv Tractor Plant n.a. Ordzhonikidze Public JSC	325908	0.28	312932	-90286	10068	0.003	0.000	904678
35.	**JSC** Zaporizhia Electric Locomotive Repair Plant,	283848	0.24	240450	4827	4659	0.018	0.000	82014
36.	The Kharkov Frunze Plant JSC	250888	0.22	207521	14370	7413	0.023	0.000	35168
37.	AB machinery plant “Astra”	211613	0.18	210612	-389	0	0.000	0.000	545607
38.	WebsiOJSC «Lviv Locomotive Repair Plant»	183808	0.16	154248	5058	3290	0.004	0.006	45112
39.	Kharkov State Aircraft Manufacturing Company	156936	0.13	204079	-242425	11792	0.092	0.000	2396151
40.	PJSC «ZAVOD «LTAVA»	148690	0.13	71617	42700	5183	0.000	0.000	16490
41.	**Wadan Yards Okean OJSC**	142754	0.12	210260	-48781	2885	0.002	0.000	803740
42.	Dniepropetrovsk Diesel **Locomotive Works** PLC	142174	0.12	115098	586	2956	0.006	0.002	46462

43.	PJSC «Elektrodvyhun (Elecrical Motors)»	88543	0.08	87893	-2897	110	0.000	0.000	30086
44.	OJSC NVK Kyiv G.I. Petrovsky Automatics Plant	35306	0.03	22685	885	2 158	0.012	0.026	55739
45.	JSC "**Kramatorsk Heavy Machine** Tool Building Works"	33249	0.03	24679	715	3 426	0.004	0.000	363554
46.	Dniprovsky machine-building plant, PJSC	16504	0.01	16844	-11536	164	0.001	0.000	54782
	Total	54260962	46.64						

Table 2

№	Name of enterprise	Paid in capital, ths. uah	Utilization rate of capacity	Capital productivity	Coefficient suitability of fixed assets	Coefficient renewal technical and technological base	The costs of new technologies (research and experimental development), ths. uah	The share of exports, %	Coefficient turnover of receivables
	Large machine-building enterprises of Ukraine								
1.	AZOVOBSCHEMASH, PJSC	11626	0.965	19.92	0.510	0.033	1137	93.22	2.19
2.	Motor Sich PJSC	280529	0.991	1.89	0.474	0.185	85000	91.50	3.62
3.	PJSC “KRYUKOVSKY RAILWAY CAR BUILDING WORKS”	86010	0.155	7.54	0.577	0.004	35911	55.00	8.56
4.	PJSC "Novokramatorsky Mashinostroitelny Zavod"	89326	0.800	1.71	0.552	0.178	0	86.00	6.35
5.	"Stakhanov Wagon Works", OJSC	237709	0.848	4.38	0.367	0.070	260727	71.75	1.83
6.	Mariupol Heavy Machine Building Plant, PJSC	3847	0.364	2.55	0.430	0.035	2200	9.47	3.31
7.	CJSC "Zaporizhia Automobile Building Plant "	605970	0.100	1.23	0.631	0.000	34895	39.31	0.93
8.	UkrAVTO Corporation,	94959	0.946	0.00	0.815	0.022	0	47.17	3.69
9.	PC "Dniprovahonmash"	8318	0.860	17.56	0.288	0.033	734	99.00	4.99
10.	PJSC «Zaporozhtransformator»	22103	0.970	4.18	0.618	0.104	42120	82.60	2.00
11.	ANTONOV Company	1947579	0.750	0.59	0.427	0.095	535057	0.00	3.80
12.	PJSC «Sumy Frunze NPO»	710850	0.835	2.05	0.703	0.600	918960	91.30	0.92
13.	PJSC Automobile Company Bogdan Motors	1081723	0.171	18.48	0.556	0.256	10102	55.00	0.92
14.	PJSC “Energomashspetsstal”	100000	0.929	0.18	0.305	0.035	262	70.90	2.25
15.	OJSC "Druzhkovsky engineering factory"	51884	0.423	2.88	0.486	0.051	1081	0.00	1.18
16.	***NORD JSC***	27	0.424	1.56	0.433	0.065	6044	76.70	10.19
17.	OJSC "Turboatom"	105624	0.632	1.08	0.284	0.029	7771	75.30	9.46
18.	State Enterprise plant “Electrotyazhmash”	88246	0.760	1.70	0.370	0.070	0	67.14	7.08
19.	JSC ***Luganskteplovoz***	54796	0.292	1.99	0.312	0.011	188	84.80	5.64
	Medium machine-building enterprises of Ukraine								
20.	***OJSC Kharkov Bearing Plant*** (“HARP”)	15000	0.512	1.32	0.488	0.196	1723	70.00	3.11
21.	Public Joint-Stock Company "AvtoKrAZ"	565742	0.140	0.21	0.081	0.002	1000	84.00	0.23
22.	Starokramatorsk engineering works, PbJSC	59017	0.780	0.02	0.476	0.018	0	0.00	5.33
23.	JSC ***Lozovaya Forging-Mechanical Plant*** (LKMZ)	22876	0.530	2.92	0.498	0.079	199	34.70	3.91

24.	"Azovmash", JSC	306076	0.990	69.56	0.163	0.115	0	75.80	2.42
25.	JSC "SKF Ukraine"	205688	0.450	1.13	0.462	0.149	0	54.70	5.05
26.	JSC "Zaliv Shipyard"	230049	0.380	0.46	0.560	0.020	0	95.00	0.78
27.	***Kremenchug Wheel Plant*** JSC	56777	0.430	1.15	0.423	0.070	0	75.00	7.99
28.	Artem, State Joint-Stock Holding Company	62563	0.452	1.64	0.548	0.048	0	0.00	1.59
29.	Dneprotyazhmash PJSC	29923	0.462	0.98	0.313	0.005	1584	52.30	2.50
30.	SVITLO SHAKHTARIA Kharkiv Machine Building Plant	3353	0.480	2.31	0.469	0.243	1786	0.00	2.19
31.	"NASOSENERGOMASH Pump Engineering Works Sumy"	24722	0.560	2.73	0.561	0.341	733	93.08	0.54
32.	PJSC Kherson Shipyard	125200	0.350	0.66	0.726	0.001	0	50.00	4.25
33.	OJSC "Donetskgormach"	11363	0.502	1.32	0.502	0.030	11705	0.00	1.66
34.	Kharkiv Tractor Plant n.a. Ordzhonikidze Public JSC	4350	0.300	0.46	0.322	0.035	5583	0.00	7.34
35.	Zaporizhia Electric Locomotive Repair Plant,***JSC***	73704	0.583	0.67	0.237	0.006	9144	0.00	6.90
36.	The Kharkov Frunze Plant JSC	2658	0.725	2.71	0.748	0.080	0	27.00	18.98
37.	AB machinery plant "Astra"	1462	0.700	18.67	0.699	0.000	0	0.00	6.16
38.	WebsiOJSC «Lviv Locomotive Repair Plant»	72635	0.350	0.48	0.257	0.008	35	0.00	9.48
39.	Kharkov State Aircraft Manufacturing Company	377907	0.100	0.51	0.451	0.169	4222	0.00	0.69
40.	PJSC «ZAVOD «LTAVA»	683	0.870	0.90	0.289	0.061	0	0.00	6.03
41.	***Wadan Yards Okean OJSC***	34714	0.100	20.36	0.207	0.203	0	0.00	3.41
42.	Dniepropetrovsk Diesel ***Locomotive Works*** PLC	71426	0.580	0.83	0.472	0.002	0	0.00	7.92
43.	PJSC «Elektrodvyhun (Elecrical Motors)»	13469	0.860	7.01	0.543	0.032	0	0.00	2.82
44.	OJSC NVK Kyiv G.I. Petrovsky Automatics Plant	25916	0.998	0.39	0.310	0.024	0	0.00	1.76
45.	JSC "***Kramatorsk Heavy Machine*** Tool Building Works"	49980	0.495	0.00	0.006	0.000	0	25.00	2.02
46.	Dniprovsky machine-building plant, PJSC	35652	0.400	0.14	0.402	0.001	164	0.00	0.47

Table 3

№	Name of enterprise	Wage fund, ths. uah	Productivity labour personnel of the enterprise, ths. uah/person	Capital-labor ratio, ths. uah/person	Average number of employee, person	Coefficient of the average annual number of employees	Income level employees of the month, ths. uah
	Large machine-building enterprises of Ukraine						
1.	AZOVOBSCHEMASH, PJSC	171069	824.99	20.70	6582	0.786	2166
2.	Motor Sich PJSC	153742	218.15	57.75	21860	0.983	3047
3.	PJSC "KRYUKOVSKY RAILWAY CAR BUILDING WORKS"	337070	596.24	39.51	7128	0.726	3941
4.	PJSC "Novokramatorsky Mashinostroitelny Zavod"	499123	249.79	72.89	13400	0.998	3104
5.	"Stakhanov Wagon Works", OJSC	161440	632.65	72.16	4381	0.738	3071
6.	Mariupol Heavy Machine Building Plant, PJSC	118993	287.28	56.32	5284	0.980	1877
7.	CJSC "Zaporizhia Automobile Building Plant "		876.22	357.04	3070	1.000	
8.	UkrAVTO Corporation,	137762	0.00	313.31	3175	0.956	3616

9.	PC "Dniprovahonmash"	143433	624.55	17.78	4044	0.992	2956
10.	PJSC «Zaporozhtransformator»	181519	562.45	67.23	4685	0.989	3229
11.	ANTONOV Company	620346	178.87	150.60	12557	0.974	4117
12.	PJSC «Sumy Frunze NPO»	461400	163.27	39.73	14455	1.000	2660
13.	PJSC Automobile Company Bogdan Motors	60487	741.64	20.07	2028	0.990	2485
14.	PJSC "Energomashspetsstal"	117169	419.60	1147.77	3026	0.949	3227
15.	OJSC "Druzhkovsky engineering factory"	103085	282.24	48.94	3166	0.995	2713
16.	***NORD JSC***	121405	226.23	72.67	3883	0.547	2605
17.	OJSC "Turboatom"	153742	187.94	87.42	4938	0.998	2595
18.	State Enterprise plant "Electrotyazhmash"	161578	168.43	37.08	5194	0.996	2592
19.	JSC ***Luganskteplovoz***	132542	160.79	40.44	5951	0.923	1856
	Medium machine-building enterprises of Ukraine						
20.	***OJSC Kharkov Bearing Plant*** ("HARP")	88943	203.82	77.09	2983	0.991	2485
21.	Public Joint-Stock Company "AvtoKrAZ"	72795	219.92	533.39	4703	0.972	1290
22.	Starokramatorsk engineering works, PbJSC	22057	3.68	79.48	1207	0.994	1523
23.	JSC ***Lozovaya Forging-Mechanical Plant*** (LKMZ)	48198	123.46	21.11	2430	0.999	1653
24.	"Azovmash", JSC	14199	876.64	6.30	428	0.579	2765
25.	JSC "SKF Ukraine"	51095	462.65	204.91	965	1.000	4412
26.	JSC "Zaliv Shipyard"	49246	123.36	133.84	1920	0.974	2137
27.	***Kremenchug Wheel Plant*** JSC	61222	229.41	100.10	1797	0.993	2839
28.	Artem, State Joint-Stock Holding Company	60541	209.96	64.07	1965	0.613	2567
29.	Dneprotyazhmash PJSC	69700	109.44	56.04	2642	0.989	2198
30.	SVITLO SHAKHTARIA Kharkiv Machine Building Plant	84675	142.97	30.97	2644	0.979	2669
31.	"NASOSENERGOMASH Pump Engineering Works Sumy"	78779	136.41	24.97	2263	0.565	2901
32.	PJSC Kherson Shipyard	43112	110.64	84.07	1876	0.827	1915
33.	OJSC "Donetskgormach"	41798	208.54	79.00	1377	0.978	2530
34.	Kharkiv Tractor Plant n.a. Ordzhonikidze Public JSC	71366	108.93	118.78	2992	0.610	1988
35.	Zaporizhia Electric Locomotive Repair Plant,***JSC***	75728	115.29	86.26	2444	0.986	2582
36.	The Kharkov Frunze Plant JSC	13275	666.49	123.16	356	0.877	3107
37.	AB machinery plant "Astra"	440	1174.83	31.46	179	0.994	205
38.	WebsiOJSC «Lviv Locomotive Repair Plant»	42395	124.93	130.99	1428	1.000	2474
39.	Kharkov State Aircraft Manufacturing Company	122879	38.78	37.89	5226	0.967	1959
40.	PJSC «ZAVOD «LTAVA»	39454	76.52	42.40	1083	0.997	3036
41.	***Wadan Yards Okean OJSC***	4165750	94.33	2.32	1754	1.000	2375
42.	Dniepropetrovsk Diesel ***Locomotive Works*** PLC	40079	88.11	53.17	1607	0.515	2078
43.	PJSC «Elektrodvyhun (Elecrical Motors)»	5233	398.84	28.44	185	0.808	2357
44.	OJSC NVK Kyiv G.I. Petrovsky Automatics Plant	22046	47.58	60.31	742	0.970	2476
45.	JSC "***Kramatorsk Heavy Machine*** Tool Building Works"	16235	48.68	73688.86	629	0.974	2151
46.	Dniprovsky machine-building plant, PJSC	6570	77.94	286.45	334	0.480	1639