UDC 658:005.3:621(477.8)+631.16:330.142

METHOD OF ASSESSING THE LEVEL OF DEVELOPMENT OF INDIVIDUAL COMPONENTS OF THE INTELLECTUAL CAPITAL OF ENGINEERING COMPANIES

I.V. Prokopenko

Department of management and international business National University "Lviv Polytechnic", Lviv, Ukraine

Прокопенко І.В. Метод оцінювання розвитку окремих складових інтелектуального капіталу машинобудівних підприємств.

У статті подано результати дослідження середовища функціонування машинобудівних підприємств України. На основі аналізу статистичних даних виявлено взаємозв'язки забезпечувальних характеристик інтелектуального капіталу, показників його економічного оцінювання та результатів роботи машинобудівних підприємств. Розроблено систему якісних вимірників рівня розвитку людського, організаційного та споживчого капіталу підприємств машинобудування. На прикладі машинобудівних підприємств Західної України розраховано зведені показники оцінювання рівня розвитку окремих складових інтелектуального капіталу. Розроблено і апробовано метод оцінювання складових інтелектуального капіталу на основі зв'язків якісних оцінок та економічних показників діяльності машинобудівних підприємств. Запропоновано спосіб нівелювання нетипових відхилень окремих оцінок.

Ключові слова: інтелектуальний капітал, людський капітал, організаційний капітал, споживчий капітал, машинобудівні підприємства, показники оцінювання, зведені оцінки

Прокопенко И.В. Метод оценки развития отдельных составляющих интеллектуального капитала машиностроительных предприятий.

В статье представлены результаты исследования среды функционирования машиностроительных предприятий Украины. На основе анализа статистических данных выявлены взаимосвязи обеспечительных характеристик интеллектуального капитала, показателей его экономической оценки и результатов работы машиностроительных предприятий. Разработана система качественных измерителей уровня развития человеческого, организационного и потребительского капитала предприятий машиностроения. На примере машиностроительных предприятий Западной Украины рассчитаны сводные показатели оценки уровня развития отдельных составляющих интеллектуального капитала. Разработан и апробирован метод оценки составляющих интеллектуального капитала на основе связей качественных оценок и экономических показателей деятельности машиностроительных предприятий. Предложен способ нивелирования нетипичных отклонений отдельных оценок.

Ключевые слова: интеллектуальный капитал, человеческий капитал, организационный капитал, потребительский капитал, машиностроительные предприятия, показатели оценки, сведенные оценки

Prokopenko I.V. Method of assessing the level of development of individual components of the intellectual capital of engineering companies.

The article presents the results study environmental engineering companies functioning in Ukraine. Based on statistical analysis revealed the relationship of security features of intellectual capital, its economic performance evaluation and performance engineering companies. A system for measuring the quality of the development of human, institutional and consumer businesses capital engineering. For example, engineering companies in Western Ukraine calculated pooled evaluation of individual components of intellectual capital. Developed and tested method of evaluation components of intellectual capital-based communications quality standards and economic performance engineering companies. A method of leveling atypical deviations of individual valuations.

Keywords: intellectual capital, human capital, organizational capital, consumer capital, engineering enterprises, performance evaluation summary evaluation

The industrial potential of any economy is based on machine-building enterprises, and economic growth is impossible without the development of their intellectual capital (IC). Mechanical engineering in Ukraine is in decline through objective and subjective reasons. The level of development of machine-building enterprises depends on resource base, demand structure, competition, related and supporting industries public policies and international environment. A lot weighs the supply of factors of production, their distribution between enterprises of different ownership, geographic location, infrastructure. The experience of industrialized countries suggests that the benefits of a large engineering enterprise that is integrated with the producers of materials, spare parts and accessories with its own research base and have the support of the state in global markets. The level of competition in engineering is constantly growing, and without tangible measures of protectionism to stay on the market very difficult. One of the key elements of international competitiveness of engineering products, the level of development of the IC companies and the industry as a whole. However, measuring the value of IC domestic enterprises is difficult due to the weak development of the stock market. Therefore is important to develop the qualitative method of individual aspects of IC, namely human, customer and organizational capital. This method should enable comparisons summary ratings of individual components of IC among enterprises of different types, sizes, life cycle stages, regions, and countries. In addition, this method of evaluation can be an effective tool for the regulation of IC and its components and to promote the recovery and development of heavy mechanical engineering of Ukraine.

Analysis of recent researches and publications

The problem of estimating the IC and its constituent elements arose simultaneously with the identification of this concept and identify its role in the formation of the value of the business in the late 1980s, well-Known researchers who introduced a typology of evaluation methods IC was K.-E. Sveiby (Sveiby K.-E., 2011) [1], D. Lucy (David H. Luthy, 2006) [2], L. Edvinsson (L. Edvinsson, 2000) [3]. In their works they founded the division of evaluation

methods of IC into four groups: 1) methods of direct measurement of IC (Direct Intellectual Capital methods – DIC). 2) the methods of market capitalization (Market Capitalization Methods – MCM); 3) methods of return on assets (Return on Assets methods – ROA); 4) methods of scoring (Scorecard Methods – SC). Although this typology was created 20 years ago, still all new methods of evaluation of IC or modifications of existing methods can still be attributed to one or two of these groups. The researchers determined that the universal method of assessing IC, and moreover, different evaluation objectives of the IC and its components may cause a conflict between quantitative (monetary) and qualitative measures of elements of IC. It is impossible to simultaneously measure the monetary value of the capitalization of IC as a whole and the potential of its components and elements to create cash flow in the future. The question of assessing the IC and its components are devoted to the work of D. Andriessen (Andriessen D., 2004) [4], E. Flamholtz (Eric G. Flamholtz, 2012) [5], B. Kuosa, D. Dama, M. Palmacci, G. Lombardi (B. Cuozzo, J. Dumay, At M., R. Lombardi, 2017) [6] and many others.

Problems of industrial development is the subject of much debate among scientists, who mostly tend to think that only innovation and government support can restore the international competitiveness of domestic engineering products. In turn, innovations are based on technological development and scientific potential, require investment in training and retraining workers, require improved management systems and communications, and the like. In the works of A.A. Bosak [7], V.M. Grineva [8], P.M. Ilyashenko [9], A.V. Kendyukhov [10], A.There. Kuzmin [11], L.I. Luccia [12] A.G. Miller [13] A.To. Mnich [14].P. Moiseenko [15] A.V. Skorupi [16] etc. proved that recovery of the industrial potential of Ukraine requires the development of intellectual capital, not in particular industry and the economy as a whole. The opinions of scholars vary regarding the priorities of the state policy of support of engineering, sources of financing of development of engineering enterprises and of the priority of regulation of various elements of IC, but all agree that without a coordinated assessment system to restore the capacity of the industry is impossible.

Unsolved aspects of the problem

Analysis of works devoted to the evaluation of IC, showed a lack of scholarly attention to the specifics of individual groups of enterprises in the sector of mechanical engineering. Procedures for the formation, regulation, development and commercialization of IC enterprises of heavy industry are very different from those procedures smaller engineering companies which produce machines and mechanisms for further intra-industry consumption. There is a significant difference in the perception of innovations by employees of foreign and domestic enterprises, different level of personnel resistance to organizational changes, different technologies work with consumers and build a common business infrastructure. All this should be reflected in the valuation method of the individual components IR, by taking into account estimates of production managers and functional departments.

The aim of the article is the formalization of the method of evaluation of individual components of the IC on the basis of qualitative assessments. To achieve this goal are to implement the following: 1) define the key macroeconomic indicators of development of industry of Ukraine and to examine their trends in the long term; 2) identify factors in the formation of IC at the macro level and to identify trends in indicators that reflect these factors; 3) to link the security features of the IC, its economic assessment and the results of the work of machine-building enterprises; 4) create a technology survey of managers of machine-building enterprises with the purpose of gathering data about the quality of the gauges the individual components of IC; 5) to calculate the summary assessment of quality measures and to identify the most problematic elements of the management system of the IC at the enterprise level.

The main part

The results of the work of engineering enterprises can obtain from public statistics and compare them with the results of other process industries. However, the problem of comparability of statistics from different years, because constantly being improved static reporting and often the same data belong to different statistical groups for various years. In addition, the results of the work of engineering enterprises and of the level of development of their IC associated with the work of other sectors: metallurgy, energy, construction, communications, education, and the like. Indirectly, trends in the development of engineering reflected in the statistics of foreign trade, innovation and research, labour market statistics, management and information services.

Intellectual capital individual companies depends on investment all economic entities in their intellectual development, but also depends on the General state of Affairs in the state. The level of development of education, research, innovation, labor relations, information environment and infrastructure formed a state policy and is in a long time. These processes are interconnected macro- and micro-level: on the one hand the available factors of production determine the results, but on the other – the cumulative results increase the productivity of existing factors of production. This is especially true of labor and technology: in contrast to capital or natural resources they cannot be moved quickly between countries, and their underlying distribution dictates the terms of their development, and thus the strategy of accumulation of IC and its further commercialization.

The formal separation of IC into components is arbitrary and does not allow to highlight the characteristics of these components, which would not interfere with each other in different processes

forming the internal environment of the enterprise or at different stages of its life cycle. Therefore I want to ask situational criteria for selection of indicators for assessing IC and the formation of integrated indicators that are relevant at a particular time to a particular group of elements of IC.

Based on this analyze tendencies of development of machine-building enterprises and their IC since General data on the development of industry of Ukraine. The study period 2000-2016., in some cases, 2003-2015 the sales Volume of industry grew at an average rate 16.29% and in 2016 to over $ 2 trillion. UAH. Such growth of the basic tools of the industry (was 18.93% per year) and average monthly wages (by 20.52% annually). However, over the past 3 years the industry has increased the losses that are in 2016 exceeded 200 bln. [17, 18].

In terms of inflation and devaluation of the national currency are more informative relative performance. Indexes of industrial production in 2000-2007 grew (103.1-only 114.2%), followed by the recession of 2008-2009 (78.1, 94.8%), the rise of 2010-2011 (108-112%) and a sharp drop in 2012-2016 (85.5-99.5%). Similar trends in the engineering industry in General: increase by 2008, then a disastrous 2009, (55.1%), alignment in 2010-2011 (115.9-141.3%) and continuous decline 2012-2016 (84.2-96.7%). If we analyze the indices of production machinery by types, then the average rate of reduction of the production of machinery and equipment for HS 2000-2016 amounted to 0.98%, electric, electronic and optical equipment – 2.27%, and vehicles and equipment by 2.89% [17, 18].

The second block of statistics is devoted to trends in the volumes of scientific research and innovation. The average rate of growth of scientific and technical works, performed by own forces of the enterprises made up 13.14% over the period 2000-2016., were the fastest growing volume of fundamental research (average of 15.98% annually), the slowest – applied research (average increase of 11.62%). The greatest share of these volumes make up the scientific and technical development (average of 50.2%), while other works are much more modest (21.0% for fundamental research, 17.0% – applied and 11.8% – scientific-technical services) [17, 18].

Peaks of innovation activity was observed in 2002 and 2012 (1506 and 1371 enterprises implemented innovations), and since 2013 have a sharp decline (in 2016, only 689 of enterprises implemented innovations). The share of these enterprises in the total volume of the low – an average of 8.5% and has a steady tendency to decrease (from 14.6% in 2002 to 6.6% in 2016) [17, 18].

From the point of view of IC research, we are interested in what proportion of capital investment was directed at intangible assets. Investment in intangible assets grew with an average rate of 11.98% a year and reached in 2016 the level of 20.6 billion UAH. this is an average of 3.92% of the total capital investment. Of which 1.32% software and databases, and the remaining 2.1 percent – the lens of intellectual property of various kinds. Activity in the sphere of Informatization reached the level of UAH 1.4 billion. in 2016 with an average growth rate of 26.54% and an average share in the total investments will amount to 0.21%. On research and development accounted for almost 0.6 billion UAH. (average growth rate was 14.27%, the average share of 0.23%) and professional services 4.1 billion UAH. (according to the accounting period by 25.97% and 1.81%). In General, the growth of investment in intangible assets ahead of General trends in industry [17, 18].

Important group of indicators to measure the development of machine-building enterprises are the indicators of their external economic activity. Exports of machines, equipment and mechanisms, together with electrical equipment made in 2012 of 7.02 billion. and from that time steadily declined, on average by 4.51% each year, and at the end of 2016, barely reached $ 4 billion. But the import in this group of goods grew at an average rate of 53.04% annually (for the period 2000-2016), however, in recent years (2012-2016) decreased from 13.2 to 6.6 billion. From the point of view of foreign investors, engineering has lost its appeal: if in 2012, foreign direct investment in machine-building enterprises have invested 1.22 billion dollars, then in 2016 – only $ 0.88 billion. Much of the money invested by foreign investors in construction (1.4 billion dollars), transport and communications (4.2 billion dollars), professional services (7 billion dollars), although in these sectors there is a significant reduction compared to 2012 [19].

Human labor is the key production factor and takes part in the formation of the IC. The number of employed people is decreasing in Ukraine as a whole (from 20.18 million persons in 2000 to 16.22 million persons in 2016). In the industry 2000-2016 years the number of employed decreased from 4.33 to 2.79 million in the construction from 0.9 to 0.63 million individuals in the industry transport and communication – from 1.36 to 1.27 million people, and in education from 1.7 to 1.5 million. Proportional changes are observed in the structure of employees by economic activities: the overall decrease on average by 3.43% per year, and in industry – by 4.7% annually in construction – 7.7%, transport and communication industry of 1.97%, in professional services – 0.39%, in education – 0.56%. Even faster, it reduces the number of full-time employees, which means a shift of employers from permanent to temporary workers. In industry the number of full-time employees has decreased over the 17 years from 4.06 to 2.21 million individuals (-3.73% annually), in engineering – from 1.06 to 0.38 million persons (-6.27% annually) [17, 18].

Important are the data on the protection of intellectual property (IP). The number of patent applications from national applicants decreased by 1.09% annually, and foreign – by 3.84% annually. Accordingly, in the engineering -11.94% -4.66% per year. A similar trend in the number of patents: in General, the number of patents obtained by national

owners declined for 2011-2016 from 1902 until 1432 (-24.7%), and foreign owners 2159 to 1367 (-36.7%). In engineering, the reduction in the number of patents 493 to 381 (-22.8%), and 430 to 217 (-49%), respectively. Interesting is the distribution of applications and patents for utility models. In General, the number of applications declined for 2011-2016 with 10437 to 8213 (-21.3%), and patent 10291 to 7692 (-25.2%). The share of unsatisfied applications was relatively stable (average 3%). The reduction in applications and received patents for utility models in engineering is more rapid than in the whole industry (-11.23% on applications and -6.41% of patents annually). Registration of industrial designs for 2014-2016. increased by 2.31% in the whole economy, but in engineering there was a reduction in: manufacture of transport and lifting equipment by 28.6%; machines of other classes -18.46%, equipment for distribution of liquids and gases, sanitary heating, ventilation -22.15%, equipment for recording, communications or information transfer -70.37% [20].

Statistics are the basis for building a diagram of the relationship of the security characteristics of the IC, indicators of its economic assessment and results of the work of machine-building enterprises at the micro and the macro level (fig. 1).

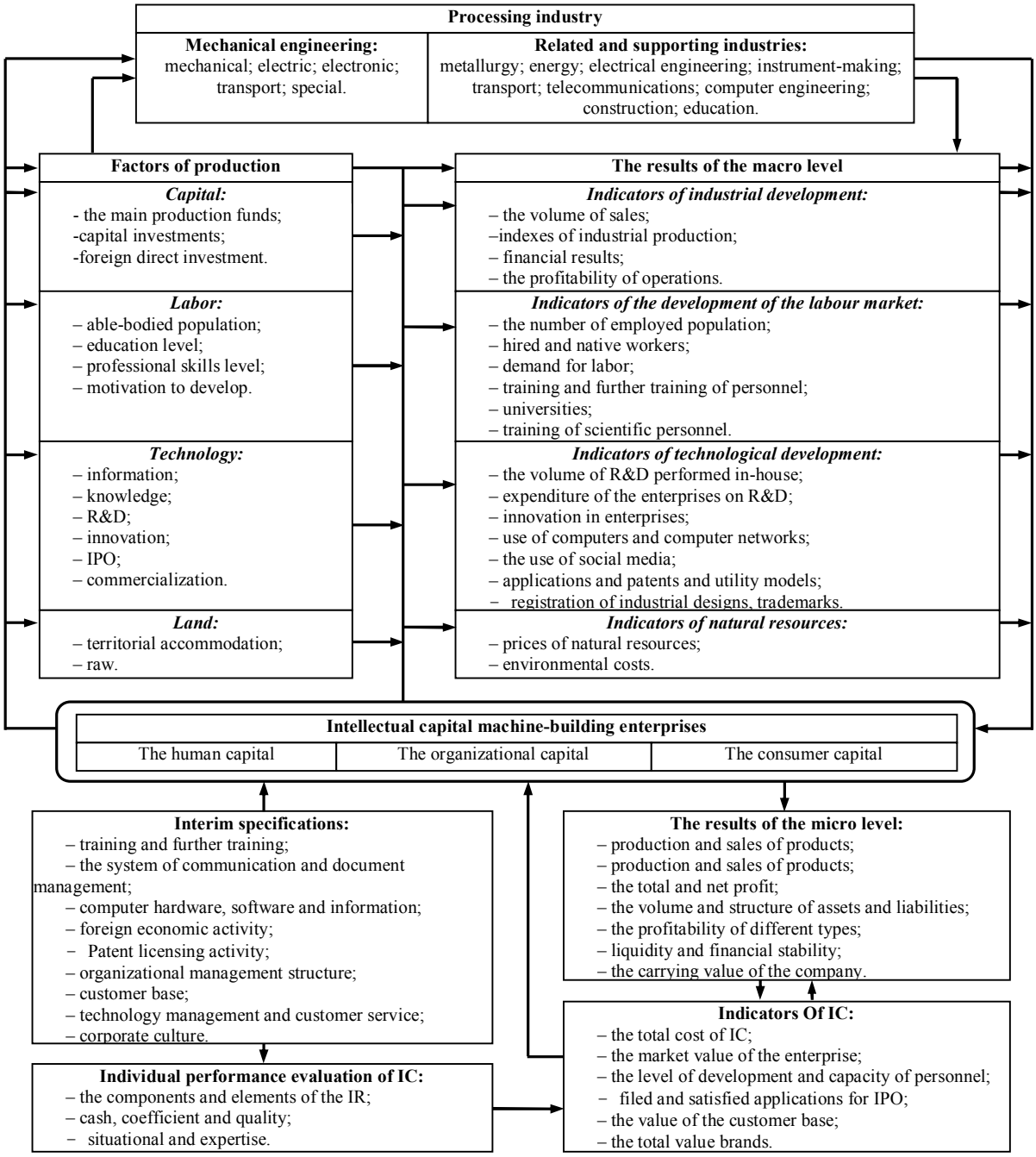

Fig. 1. the scheme of interconnection of security characteristics of IC, indicators of its economic evaluation and the results of the machine-building enterprises
Source: Own elaboration

Development trends of mechanical engineering and the factors shaping them IC give us a General idea of the direction of change but not about individual aspects of the effectiveness of human, organizational and consumer capital. We are limited in our analysis by two factors: first, the domestic stock market is poorly developed, it traded shares of a very small number of engineering companies and therefore we cannot compare their cost and market values to determine the total level of IC in monetary terms; second, the monetary measure of financial results, productivity or even efficiency from commercialized ITNs do not provide information about the structure, processes, and quality control elements IC, which later form the following financial results and cash meters. These limitations we snowmo using your own method of assessing the level of development of individual components of the IC-based quality indicators.

To assess quality indicators of the individual components IC, we have developed a questionnaire, which contains four set of questions for diagnosing levels: 1) human capital (staffing and workforce); 2) organizational capital (management system, innovation, R&d); 3) consumer capital (customers, suppliers, external infrastructure); 4) economic, production and financial-economic activities. Each block contains 10 questions aimed at assessing individual parameters of the IC – we have deliberately limited the number of parameters in order not to accumulate secondary characteristics whose weight in the overall integrated assessment is clearly less than 2%.

During the first quarter of 2017 surveyed 214 managers at different levels control 33 of machine-building enterprises. Part of the questionnaires was not included in the final sample due to incompleteness of the estimates, or their bias or inconsistency. In general, the base further study were 196 questionnaires, and to improve the reliability of the obtained results and the possible extrapolation of their results to the average of the industry, we tried from each company to interview at least 10% of the managers who are involved in key business processes and the formation of the strategy of an enterprise. Summary results of parameter estimates of IC and its components are presented in table 1-4.

Among the respondents, it was ensured that approximately equal representation of heads of various levels of government (65 senior management level, 67-64 middle and bottom). Such alignment we needed in order to identify trends in different evaluation of the same phenomena from the point of view of managers at different levels. With the same purpose, we have allocated approximately the same number of groups of heads of functional and production divisions of middle and lower management levels. Distribution of the respondents with leadership experience reflects the General trend in the industry: 29.8% of managers with experience up to 3 years, 34.18% – with experience of 3-5 years and 36.73% – more than 5 years. Regarding the level of education among respondents of 20.92% of them have scientific degrees, 63.78% – complete higher education, and only 15.31% – persons with secondary special or incomplete higher education. Most of the latter are the managers of lower level management and currently continue their education.

The distribution of estimates of the level of development of human capital of enterprises shows that the most critical are the managers of the middle management level (164 of 396 the lowest estimates). At the same time, these leaders and are the most objective assessments of personnel work, since first, work closely with the real performers, and secondly, have an effect on their selection, promotion and training. There is a subjectivity in the assessments of senior level management of the system of personnel work – their share of positive ratings are much lower (average of 9.23%) than the corresponding estimates from the managers (11.64%) and lower (to 12.19%) levels of control.

Somewhat different between managers of different management levels distribution estimates of organizational (structural) capital of enterprises. Here are the most critical mid-level management (144 of 314 with the lowest ratings), and the most loyal members of the middle management level. Senior management is the worst estimates such parameters as the system communications requirements of its growth (of 16.92% of negative evaluations) and the needs of staff in the self (18.46% of negative assessments). But the leaders of the lower level management low evaluate the development of internal regulations (29.69% ratings of "1" level), the level of innovation in production (32.25%) and development of R&D (34.38%).

The distribution of the estimates of consumer capital of machine building enterprises it is necessary to take account of the fact that the leaders of different levels and services have different touch points with consumers, and sometimes do not have accurate information regarding their preferences. It is obvious that the most relevant estimates will be heads of functional divisions mid-level management. However, negative assessments by managers at different levels have put about the same (21.08 per cent of senior management level, 26.57% – and average of 27.81% lower). The same precision and to the highest estimate (of 8.62%, of 7.31% 7.66% respectively). Senior officials underestimate the presence of their own brands that may be commercialized (47.69% the lowest ratings), e middle management and lower level management – production of unique goods (37.31% 40.63%, respectively).

Production and business activities and financial condition of their companies, managers of various levels of management grade like, but with a substantial deviation of the estimates of the individual parameters. Strongly negative assessment to the activities and finances of 13.85% top-level managers, 21.34% – medium and 20.31% – lower levels of management. And only the 11.02% of all executives to evaluate the business at the highest level. It is not about the absolute evaluation of financial indicators

and qualitative parameters that reflect the level of development of the system of financial management and its potential. Leaders at all levels, mainly negatively assess the availability of modern technologies and the newest equipment (32.31%, 38.81% and 37.5% of senior, middle and lower management levels). The greatest variation in estimates of efficiency of use of working hours in production units (negative estimate of 12.31% top-level managers, 22.39% – medium and 28.13% – lower levels of management).

In order to neutralize atypical deviations of the estimates, we have for each parameter, we derive a summary rating by the formula:

$$O_Z = \frac{\sum_{i=1}^{4}(n_i \times w_i)}{\sum_{i=1}^{4} n_i \times w_{max}} \times 100\%, \qquad (1)$$

where ni = the number of assessments of i level;

w_i – weight estimates;

w_{max} – the maximum score (0.4).

O_z can take a value from 25% to 100%. Thus, if some questions all managers responded unequivocally negative ("1" is a pleasant, w_i = 0.1), O_Z = 25%. Conversely, respondents estimated that unanimity continues with "4" is excellent, (w_i = 0.1) indicates that the Oz = 100%.

Evaluation of managers of different levels of management at the enterprises of different size have very large deviation, which among other things explains the different roles these executives and their "distance" in the centers of making real decisions. For example, the master in the shop will always be more sceptical about the quality of the selection of management personnel and be able to say about the system of financial planning of the whole enterprise. However, the evaluation of the same wizard to organize industrial processes, technology, quality or productivity of the major workers are more objective than the judgement of executives of the functional divisions of the middle level, and the more senior levels of management.

Summary estimates variances negate and give an idea of the degree of development of the IC component or factor of influence on its formation and development. Among the qualitative parameters of evaluation of the level of development of the human capital of enterprises (table 1) lowest scores have a level of intellectual activity (52.68%), impact programs professional development staff (54.34%) and the effectiveness of the recruiting managers (54.85%). Although the average scores for these options are similar, however the most negative ratings (30.1%) has the impact of the program, training of the personnel. If the average level of our method is pivot score 62.5% (average between boundary values of 25% and 100%), then to her "dragged as far as" only two parameters: the productivity of workers (63.78%) and personal quality and physiological characteristics of workers (exactly 62.5%); All other options have scores below average. The averaged score from the level of development of the human capital of the investigated companies is 58.98%. By itself, this assessment indicates a low level of development of human capital, but it's worth it compared with other groups of enterprises and time periods.

Table 1. The results of the evaluation of the level of development of the human capital of enterprises

The parameters of the evaluation of the level of development of human capital (high quality)	The distribution of ratings of leaders								Summary of evaluation
	1 (disappointing)		2 (satisfactory)		3 (good)		4 (excellent)		
	unit	%	unit	%	unit	%	unit	%	
1. Improving the quality of human resources	31	15.82	63	32.14	81	41.33	21	10.71	61.73
2. The system of workforce planning	40	20.41	72	36.73	59	30.10	25	12.76	58.80
3. Compliance with the structure and qualification of workers of the enterprise challenge	39	19.90	64	32.65	67	34.18	26	13.27	60.20
4. The effectiveness of the selection of the main production staff	35	17.86	60	30.61	83	42.35	18	9.18	60.71
5.The effectiveness of the recruiting managers	46	23.47	80	40.82	56	28.57	14	7.14	54.85
6. The impact of the program of excellence staff	59	30.10	73	37.24	35	17.86	29	14.80	54.34
7. The productivity of workers	33	16.84	46	23.47	93	47.45	24	12.24	63.78
8. The level of intellectual activity staff	51	26.02	89	45.41	40	20.41	16	8.16	52.68
9. Personal qualities and physiological characteristics of employees	34	17.35	56	28.57	80	40.82	26	13.27	62.50
10. Motivation to perform tasks and the implementation of the development strategy	28	14.29	77	39.29	74	37.76	17	8.67	60.20
The averaged score	39.6	20.20	68	34.69	66.8	34.08	21.6	11.02	58.98

Source: Own elaboration

Assess the level of development of organizational capital enterprises (tab. 2) on average are much higher. To some extent this is unexpectedly, because traditionally it was believed that the footage we have quality, and the organization of manufacture lagging. It seems that once was, until many of the skilled workers not broken free of the machine-building enterprises. Therefore, the highest aggregate score has matching design schedule for the company stated purposes (68.49%), it is followed by the efficiency of the internal workflow and production meetings (66.71%) enterprise communications systems and compliance with the requirements of its growth (64.54%) higher than the average level is also assessing the level of innovation of production (63.52%) and development of the internal regulations of the company (62.76%). The remaining parameters have scores below average levels and the worst of them is the level of development of R&D in the enterprise (55.99%) and the level of innovation management system (59.57%).

Table 2. The results of the evaluation of the level of development of organizational capital of enterprises

Options evaluation of organisational (structure) (high quality)	The distribution of ratings of leaders								Summary of evaluation
	1 (disappointing)		2 (satisfactory)		3 (good)		4 (excellent)		
	unit	%	unit	%	unit	%	unit	%	
1 The structure of the business processes of the enterprise	28	14.29	83	42.35	62	31.63	23	11.73	60.20
2. The organizational structure of the enterprise management	30	15.31	77	39.29	66	33.67	23	11.73	60.46
3. Compliance with the design schedule for our company goals	18	9.18	49	25.00	95	48.47	34	17.35	68.49
4. Elaboration of internal regulations of the company	35	17.86	49	25.00	89	45.41	23	11.73	62.76
5. Compliance with the requirements of the enterprise communications system of its growth	27	13.78	57	29.08	83	42.35	29	14.80	64.54
6. The effectiveness of the internal workflow and production meetings	19	9.69	62	31.63	80	40.82	35	17.86	66.71
7. Taking into account the needs of personnel in self-realization	37	18.88	57	29.08	86	43.88	16	8.16	60.33
8. The level of innovation of management system	38	19.39	53	27.04	97	49.49	8	4.08	59.57
9. The level of innovation of the production	32	16.33	51	26.02	88	44.90	25	12.76	63.52
10. The level of R&D in the enterprise	50	25.51	64	32.65	67	34.18	15	7.65	55.99
The averaged score	31.4	16.02	60.2	30.71	81.3	41.48	23.1	11.79	62.26

Source: Own elaboration

The level of development of consumer capital, the lowest compared with other components of IC (table 3). This result and just was anticipated because engineering does not and branch, where advanced marketing research, market, target consumers, etc. Therefore, only one option has a score higher on average, it is the relationship with external infrastructure contractors (65.18%). All other scores are lower on average and vary in range from 50.13% (release unique products and own brands that can bits commercialised) to 60.2% (efficiency of the system supply company) low evaluation options such as security developments of the enterprise from unauthorized copying (52.17%) and the market share of the enterprise and its dynamics (52.3%) clearly indicate a weakly developed system of work with clients.

Table 3. The results of the evaluation of the level of development of consumer capital enterprises

Options evaluation of consumer capital (high quality)	The distribution of ratings of leaders								Summary of evaluation
	1 (disappointing)		2 (satisfactory)		3 (good)		4 (excellent)		
	unit	%	unit	%	unit	%	unit	%	
1	2	3	4	5	6	7	8	9	10
1. Meet the expectations of consumers on the prices and quality of products	42	21.43	65	33.16	74	37.76	15	7.65	57.91
2. Dependence of the distribution of enterprise from large consumers	42	21.43	67	34.18	80	40.82	7	3.57	56.63
3. Release unique products	66	33.67	70	35.71	53	27.04	7	3.57	50.13
4. Protection of the development of the enterprise from unauthorized copying	61	31.12	69	35.20	54	27.55	12	6.12	52.17
5. The market share of the enterprise and its dynamics	47	23.98	95	48.47	43	21.94	11	5.61	52.30

Continuation of table 2

1	2	3	4	5	6	7	8	9	10
6. Sensitivity of the enterprise to the price competition	46	23.47	54	27.55	75	38.27	21	10.71	59.06
7. Presence of own brands that can be commercialised	69	35.20	67	34.18	50	25.51	10	5.10	50.13
8.The effectiveness of supply systems of the enterprise	46	23.47	56	28.57	62	31.63	32	16.33	60.20
9. The impact of the urgent (large) orders for regular supply and production	49	25.00	54	27.55	71	36.22	22	11.22	58.42
10. Relations with external infrastructure contractors	25	12.76	44	22.45	110	56.12	17	8.67	65.18
The averaged score	49.3	25.15	64.1	32.70	67.2	34.29	15.4	7.86	56.21

Source: Own elaboration

In addition to traditional components of IC we were wondering who those same executives estimate the quality parameters of the production economic and financial-economic activity of their enterprises (table 4). Despite the fact that the averaged score of selected parameters of the lower to middle level (61.25%) We have several options, which are evaluated by the relatively high. A system analysis of costs (70.41%), the structure of assets and liabilities of enterprises (69.52%), the level of organization of production (66.45%), accounting system and analysis of the operation of the enterprises (64.8%) Instead of critically low appreciated the availability of modern technologies and modern equipment (49.74%) and the very low level of development of financial planning (56.51%), compliance with the production capacity of the enterprise needs of its development (57.02%) and efficiency of working time in the production units (57.78%).

Table 4. The results of the evaluation of the production economic and financial-economic activity of enterprises

Parameters estimation of production-economic and financial-economic activity (high quality)	The distribution of ratings of leaders								Summary of evaluation
	1 (disappointing)		2 (satisfactory)		3 (good)		4 (excellent)		
	unit	%	unit	%	unit	%	unit	%	
1. The level of organization of production	25	12.76	46	23.47	96	48.98	29	14.80	66.45
2. Compliance with the production capacity of the enterprise needs of its development	38	19.39	79	40.31	65	33.16	14	7.14	57.02
3. The availability of modern technologies and modern equipment	71	36.22	71	36.22	39	19.90	15	7.65	49.74
4. Quality control system	44	22.45	55	28.06	72	36.73	25	12.76	59.95
5. The efficiency of working time in the production units	41	20.92	62	31.63	84	42.86	9	4.59	57.78
6. Financial status of the company	39	19.90	62	31.63	70	35.71	25	12.76	60.33
7.The level of development of financial planning	46	23.47	71	36.22	61	31.12	18	9.18	56.51
8. The system of accounting and analysis of the work of the enterprise	33	16.84	36	18.37	105	53.57	22	11.22	64.80
9. The system cost analysis	13	6.63	38	19.39	117	59.69	28	14.29	70.41
10. The structure of assets and liabilities	13	6.63	48	24.49	104	53.06	31	15.82	69.52
The averaged score	36.3	18.52	56.8	28.98	81.3	41.48	21.6	11.02	61.25

Source: Own elaboration

The results are interesting also in terms of the future of the study of interrelations between elements of the IC and the financial performance of individual businesses and their changes as a result of carrying out of regulatory action. To this end, we have set aside the numerical indicators of evaluation of industrial and economic activity of those 33 machine-building enterprises, who have received from their open statements and calculated on the basis of relative indicators that can characterize the level of development of IC for these enterprises.

A brief overview of the data clearly demonstrates a low level IC of the machine-building enterprises, lack of effective policy development elements of the IC. Critical of the small proportion of intangible assets in the fixed assets (3.87%), while 21 of the 33 companies have a share of less than 1%, and 10 of them at all does not have intangible assets on the balance sheet. A large share of intangible assets are research institutes in the field of Engineering: "Lviv plant of electronic medical equipment" (58.56). "Karat" (26.37%), JSC "Pidvolochysk factory of plastic products" (10.7%), but they have small non-current assets and if you exclude them from consideration then the average share of intangible assets will fall from 3.87% to 1.07%.

Level of development of the IC is characterized also shares the cost of R&D and professional development and training of staff. The average share of expenditure on R&D is 4.82%, but again with

individual research structures, which actually do not have the production, and therefore the great cost of the produced products: SPE "Karat" (42.17%), JSC "Concern-electron" (25.22%), JSC "Design Institute of conveyor building" (19.92%), JSC "Drogobych truck crane plant" (10.62%). If you exclude these companies from consideration, the average share of expenditure on R&D in the structure of the full cost of production decrease from 4.88% to 2.18%.

Unrealistically low have expenses for personnel work. Their share in overall expenditures on average 2.44% and if you do not take into account the PJSC "Concern-electron" (18.58%), "Karat" (10.68%), JSC "Design Institute of conveyor building" (4%), JSC "Kolomyia plant agricultural machinery" (9.5%), this proportion dropped to 1.26%.

If we assume that work with customers is characterized by share marketing expenses, we have similar stats: average of 3.62%, but if you remove the sample "custom" (JSC "Drogobych truck crane plant" (34.84%), JSC "Iskra" (11.28%), you will have the average value of 2.37%.

Part of the machine-building enterprises has evolved in multiple or structures that are actually not engaged in industrial production. This is evidenced by their ratio of administrative expenses to cost of production: PJSC "Concern-electron" (2532.08%), "Karat" (182.78%), JSC "Lviv insulating plant" (129.6%), JSC "Mikroprilad" (97.35%), JSC "Plant press-forging equipment" (121.46%), JSC "Kolomyia plant agricultural machines" (219.58%), JSC "Kamenetz-Podilsksilmash" (85.75%). If you do not consider these enterprises, the average ratio of administrative costs to total costs will decrease from 119.27% to 21.82%, which is quite an adequate indicator for actually existing industrial enterprises.

All it reaffirms the need for the development of IC and its constituents at the enterprises of machine-building, and this in turn requires an adequate system of economic evaluation of IC and implementing regulations, which gradually will improve the situation and save the domestic machinery industry from further decline.

Conclusions

The results of the analysis of the development trends of mechanical engineering in Ukraine of testifying about the deterioration of the macro environment operation. International quality standards are becoming more stringent, and the domestic machine-building enterprises for the most part they do not match, so their products cannot compete on world markets, nor on the domestic market to foreign firms. The development of information and communication infrastructure requires considerable investment, and Government support and domestic investment by the owners is not enough. Effective demand from domestic consumers is falling, the proportion of imported components, and foreign exchange revenue from exports is dwindling.

There is a problem collecting statistical information, which is the base for the evaluation of IC machine-building enterprises and its components. Most businesses do not reflect in their balance sheets of real value of intangible assets (NMA), uses unlicensed software does not commercialization OMV. Performance deterioration of the NMA does not correspond to reality, the designs of industrial property, trademarks and signs, or does not appear or is an understatement. None of the investigated companies does not reflect the value of the NMA databases, client base, copyright and related rights to them. Insufficiently reflected the development of systems of communication: there is no reliable data on the use of software products, channels of communication, network technology, mass media communications, etc.

Developed by the author of the scheme of interconnection of security characteristics of IC, indicators of its economic evaluation and the results of the machine-building enterprises allows to form technology statistical analysis the data of different levels, which will be the basis for the formation of a monetary equivalent IC and its components. We propose to explore the data macro level (factors of production factors of demand, related and supporting industries), to determine their impact on the development of the industry, the labour market, and technological development and use of natural resources. These figures reflect the general economic trends, which in turn form the IC at the macro level. At the level of individual businesses need to keep track of the change in the values of the parameters of the security characteristics of the indicators of evaluation of IC and its components.

Results of a study of trends in the macro level indicators confirm a downward trend. Nominal production volume in some sectors is increasing, however, given the index of inflation and sharp devaluation in 2012-2014 real performance dramatically decreased. Enterprises of Crimea, part of the Donetsk and Lugansk regions not controlled by Ukrainian authorities, supporting and connecting with the engineering industry (metallurgy, fuel and energy complex, agriculture, transportation, etc.) also are at the stage of recession is a real product. Supporting the development of IC by the innovative production, R&D, education, retraining and improvement of professional skill in terms of reducing public funding tends to decrease.

To study trends in IC at the level of individual machine-building enterprises conducted a survey in which took part 196 managers different levels of 33 enterprises. The respondents asked the four blocks of questions to assess the level of development of the human, organizational and consumer capital, as well as the general results of the production economic activity. Evaluation of managers of different levels of management have significant deviation. Among the qualitative parameters of evaluation of the level of development of the human capital lowest scores have a level of intellectual activity (52.68%), the impact of

the program of excellence (54.34%) and the effectiveness of the recruiting managers (54.85). Evaluation of the level of development of the organizational capital in average much higher (68.49%). The level of development of consumer capital, the lowest compared with other components of IC (52.17%), due to its specific engineering and established relationships with consumers. In general, the leaders are sceptical of the needs of the development of IC, believing that in the conditions of financial crisis, you need to first take care of the financial stability of the business and to seek additional sources of funding for operational activities.

The results are the basis for forming a model of economic evaluation of IC machine-building enterprises, which respects the different methods of evaluation of integrate and quantitative and qualitative indicators. Such a model is needed to ensure the process of regulation of IC and its components in order to increase the market value of the business and ensure its long-term growth.

Abstract

The research results of the environment of the Ukrainian machine-building enterprises functioning are given in this article. Interrelation of the providing characteristics of the intellectual capital, indices of its economic estimation and the results of the machine-building enterprises are revealed on the base of the statistical data analysis.

Here is used the method of the quality estimation of the separate components of the intellectual capital and on the base of this method is worked out the system of the quality measurements of the level of development of the human, organizational and consumer capital of machine-building enterprises. Combined proofs of the estimations of the development level of the separate components of the intellectual capital are figured out on the examples of the machine-building enterprises of the Western Ukraine.

The method of evaluation components of the intellectual capital on the base of relations of quality estimations and economic indices of machine-building enterprises activity was worked out and a probated.

For the usage of the mentioned above methods were defined key macroeconomic indices of Ukraine industry development and were investigated tendencies of their changes in the long term period; here was formed the polling technology of machine-building enterprises managers with the aim to collect data concerning quality indices of the separate components of the intellectual capital; combined estimations of the quality indices were figured out and were revealed the most problematic elements of management of intellectual capital on the enterprise level.

The results of tendencies analysing of machine-building development in Ukraine testify not very high level of intellectual capital and, what is the worst, the effective polity of intellectual capital elements development is absent. Part of the machine-building enterprises have been changed into holdings, or into structures, which, in fact, have nothing to do with the industrial production. It is confirmed by correlation of their administrative expenditures to the complete prime cost of their goods. The international standards of quality become more and more strict, but the native machine-building enterprises in their priority don't correspond to them, that's why their production is not competitive neither on the world markets, not on the native markets with the foreign firms.

JEL Classification: J24, L22, M31, L64, O14, O34.

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Надано до редакційної колегії 20.04.17

Прокопенко Ірина Валеріївна / Iryna V. Prokopenko
Irena2406@gmail.com

Посилання на статтю / Reference a Journal Article:
Method of assessing the level of development of individual components of the intellectual capital of engineering companies. [Електронний ресурс] / I. V. Prokopenko // Економіка: реалії часу. Науковий журнал. – 2017. – № 2(30). – С. 85-96. – Режим доступу до журн.: http://economics.opu.ua/files/archive/2017/No2/85.pdf