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ANALYSIS OF THE INNOVATIVE ACTIVITY AT THE UKRAINIAN MACHINE-BUILDING ENTERPRISES

Bodenchyuk Lilia Borysivna
lecturer
Danube filial branch of IAPM MES of Ukraine, Ukraine

The article deals with the peculiarities of machine-building enterprises. Innovation and highlights patterns and current trends of innovative activity of machine-building enterprises are analyzed. It was established, that the domestic machine-building enterprises have a very low level of innovation activity, compared with the European. The reason for this situation is the financial insolvency of enterprises, the lack of support from the state, not the effectiveness of incentive mechanisms to improve the innovative activity of the enterprises of machine-building industry. In general, the structure of the machine-building enterprises of expenditure is characterized by sharp disparities between different types of innovation. The share of the costs of the external and internal research projects by enterprises of machine-building industry of Ukraine in the total expenditure on innovation in the industry was the highest among the other industrial activities. However, the company clearly did not pay enough attention to education and training of personnel, that during the analyzed period it was accounted for small amount of innovation expenditures. Based on the identified gaps and challenges we offered basic directions of innovative activity of machine-building enterprises of Ukraine.

Keywords*: machine-building enterprises, innovation, innovation activity, innovation potential of development, financing of innovation activity.*

Introduction. Vector of the innovative development is only one possible variant to change the present situation concerning Ukrainian industry. According to experts' estimations, technologies of the third and fourth technological modes in the native production dominate in production, which can't be competitive, at the same time the leading world technologies have been already related to the sixth technological mode. Taking into account the raw direction of the Ukrainian export, one has to point out weak innovativeness of the native production. It is caused by the low level of innovative activity at the industrial enterprises. In order to develop economy, special attention must be paid to machine building, development of which is able to provide gradual moving to the

innovative technologies in all economic branches. It is important to solve problems concerning support of the machine building production high scientific and technical level and its competitiveness, to what the innovative activity and events concerning innovative activity growth at the enterprises in this area have to contribute.

Analysis of the recent research and publications. Problems of the innovative activity at the machine building enterprises are presented in studies of such scientists as V. M. Heyets [4], V. M. Hrynyova [1], S. M. Illyashenko [3], S. V. Knyaz [6], Ye. O. Korzhov [7], O. Ye. Kuzmin [6, 8], O. V. Sobkevych [5], A. I. Sukhorukov [5], V. H. Fedorenko [11], A. V. Shevchenko [5], S. Butsifal [12], Z. Devis [13].

Distinguishing of the unsolved issues, which are part of the general problem. Although the innovative activity of machine building enterprises attracts great interest, today the innovative sphere, particularly innovative activity providing, is one of the least developed areas in national economic system. Numerous studies show that the main problem of the negative innovative development in machine building sphere includes the financial resources deficit to provide scientific studies and to bring into use the innovative investigations. The problem on the innovative development financing effective mechanism took leading places at all stages of the Ukrainian innovative legislation development, however in fact it is not still sloved. The essential disadvantage in the system of innovative sphere national development consists in the fact that unlike legislation in more countries all over the world, it assits not only innovative development sources financing extension, but also contracts involving of non-budgetary costs and excludes possibility to form special and famous funds for the innovative projects and programs financing. Owing to lack of financing, there is a staffing problem, and thus also the motivative mechanism concerning the innovative activity growth at the machine building enterprises. I.e., the problem to provide innovative activity of the machine building enterprises, has complex character, requires proper actions at all levels of the innovative system, that's why all mentioned problems must be solved complexly.

Formation of an object in the article. The object of an article is to reveal modern tendencies in the innovative activity, based on machine building enterprises analysis in Ukraine.

Results and discussions. The native industrial enterprises typically have low level of the innovative development, in comparison with EU countries. Although machine building enterprises are the most innovatively active in Ukraine, in comparison with other branches, this factor is very low. So, the level of innovative activity at the native machine building enterprises is 17,4% (in pre-crisis 2012), in comparison with EU countries – about 53-55% of the total number of enterprises – is admission of the fact that under such conditions, Ukraine will become raw-material appendage of Europe very soon.

Dynamics of the innovative activity and the innovative activity level at the machine building enterprises in Ukraine is shown in the table 1.

Due to the data from table 1, some enterprises, which introduced innovations, in the total number of enterprises was increased from 20,4 % in 2007 to 23 % in 2014. Therefore the enterprises part, which mastered producing of the innovative goods, during the studied period, was in average 13,2 % of the total number of enterprises in the branch.

In 2014 16,1% of inspected industrial enterprises were engaged in the innovative activity, part of the innovatively active enterprises in the machine building branch was 26,9 % of the total number of enterprises in the branch, that 10,8 в.п. times more than in average in industry.

Ukraine greately cedes the developed countries, concerning enterprises, which dealt with innovations. In 2010 13,8 % of the total number of the industrial enterprises (in 2009 – 12,8 %) dealt with innovative activity in industry. It proves the gradual recovery of the innovative activity in

the post-crisis era, however one couldn't achieve pre-crisis indexes (in 2007 – 14,2 %). Since 2012, the number of innovatively active machine building enterprises has been extremely shortened (for 19%, in comparison 2014 with 2011), number of enterprises, which introduced innovations (for 13%) and number of enterprises, which realized innovative production (for 12,8%). I.e., one can observe great reduction of the machine buidling production part in the industrial manufacture, decrease of the producers' innovative and investment activity.

Table 1. **Dynamics of the innovative activity at the machine building enterprises in Ukraine [2]**

Indexes	2007	2008	2009	2010	2011	2012	2013	2014
Number of the innovatively active enterprises, *un. / % to the total number of enterprises in the branch*	421/ 23,3	400/ 21,2	406/ 21,1	417/ 22,2	443/ 24,5	426/ 25,0	397/ 28,8	359/ 26,9
Number of enterprises, which introduced innovations, *un./ % to the total number of enterprises in the branch*	369/ 20,4	354/ 18,8	358/ 18,6	373/ 19,8	389/ 21,5	426/ 21,2	499/ 24,5	338/ 23,0
Number of enterprises, Which realized innovative production, *oд. / % to the total number of enterprises in the branch*	345/ 19,1	327/ 17,3	323/ 16,8	331/ 17,6	351/ 19,4	317/ 18,3	338/ 21,3	306/ 19,2
Amounts of the realized innovative production, *mln hrn / % to the total amount of the realized production in the branch*	13386,7/ 15,6	17811,0/ 16,8	9738,3/ 13,0	10780,4/ 10,5	11280,3/ 8,2	13105,2/ 9,1	13367,8/ 11,8	6904,5/ 10,4
Amounts of the realized innovative production out of Ukraine, *mln hrn / % to the total amount of the realized innovative production in the branch*	5623,1/ 42,0	8169,7/ 45,9	6464,1/ 66,4	8054,2/ 74,7	8434,3/ 74,8	10001,9/ 76,3	8715,4/ 66,8	5068,4/ 69,5

Machine building is characterized with high part of the innovative production, realized out of Ukraine (58,7 % in average for 2007-2014). During the period 2007-2011 one could see growth of innovative production export amounts while producing pumps, compressors and hydraulic systems 1,9 time, machines for metallurgy – 2,2 times, household appliences – 5,2 times, electric machines and facilities – 2,2 times, flying machines – 4,3 times. There is a negative tendency concerning realized innovative production out of Ukraine, since 2012 – reduction was 40%. The decrease of realized innovative production share in the total amount became the result of the several systematic external and internal factors actions, and factors, which were formed during the global financing crisis, and continued their negative impact in postcrisis period.

The innovative activity of the enterprise is directly connected with the investment activity level both of branch and enterprise. It means that innovative activity is determined with intensity to involve investment resources into the main capital to develop, produce and sale principally new production on the principally new equipment. However, analysis shows that the innovative activity financing at the machine building enterprises is carried out in most cases by own funds, part of which in average during the analyzed period was from 70,9% to 91,9 % (table 2).

Part of credits in the innovative activity total amount in 2007-2014 was in average from 0,4% to 10,8 % per period, and in 2014 it was decreased to 0,9 %. Most credits, given to the machine building enterprises, are short- and mid-term (accordingly 43,5 % and 42,9 % in the credits structure, given by banks to the machine building enterprises) [2]. It proves that creadits are

oriented to fill stocks of the enterprises.

Table 2. **Distribution of the innovative activity financing total amount in the machine building industry (mln hrn)** [2]

Indexes, mln. hrn./%	2007	2008	2009	2010	2011	2012	2013	2014
Total, mln. hrn.	2573,5	3000,5	2006,0	2541,6	2731,7	3079,1	3590,0	2267,1
including owing to:								
own funds	2001,7/ 77,8	2301,3/ 76,6	1618,0/ 80,7	2334,7/ 91,9	2376,5/ 87,0	2183,4/ 70,9	3150/ 87,7	1755,9/ 77,5
state budget	78,1/ 3,0	120,2/ 4,0	80,6/ 4,0	14,8/ 0,6	86,4/ 3,2	47,4/ 1,5	15,3/ 0,4	337,8/ 14,9
local budgets	2,2/	5,9/ 0,2	0,0	0,0	0,0	0,1/ < 0,1	10,7/ 0,3	0,1/ < 0,1
Non-budget funds	0,1/ < 0,1	0,0	0,0	0,0	0,0	< 0,1	2,2/ < 0,1	2,1/ < 0,1
Native investors	5,8/ 0,2	168,6/ 5,6	22,9/ 0,1	14,5/ 0,6	6,8/ 0,3	62,8/ 2,0	10,5/ 0,3	7,6/ 0,3
Foreign investors	29,9/ 1,2	60,7/ 2,0	102,2/ 5,1	63,8/ 2,5	13,9/ 0,4	384,3/ 12,5	1054,5/ 2,9	117,8/ 0,5
Credits	125,1/ 4,9	324,4/ 10,8	27,5/ 0,4	10,2/ 0,4	31,6/ 1,2	214,4/ 6,9	69,7/ 1,94	19,9/ 0,9
Other sources	330,6/ 12,8	19,3/ 0,6	154,9/ 7,7	103,6/ 4,1	216,5/ 7,9	186,6/ 6,1	153,1/ 4,26	7,3/ 0,3

The innovative activity financing in machine building industry is low, funded by State budget, which provided the highest amount per analyzed period 120,2 mln. hrn. (4%) in 2008 and 337,8 mln. hrn. (14,9%) in 2014. Some costs from the local budgets in the general financing structure of the innovative activity in machine building industry made in average less than 0,1 % per period, and in 2009 - 2011 there was no any financing from that source.

The global experience shows that state part in the innovative and scientific-technical works financing in economy take a significant place and cedes only private sector. The national security bound is considered to be innovating activity investing from state budget equal to 25% of GDP. In 2010 state part in financing of scientific and research works in economy was 39,7 % in France, in Great Britain – 32,1 %, Czech Republic – 39,9 %. In Poland and Lithuania this index was accordingly 60,9 % and 47,5 % and exceeded the part of such works financing by private sector [14]. In the developed countries in the world great amounts of state financing (particularly, grants and subsidies) are oriented to support innovative and scientific-technical activity of machine building industry. E.g., corporation “Boeing” received 5,3 billion US dollars in subsidies and grants from the USA government during 1989-2006, “Airbus” received 18 billion US dollars in subsidies from European Union [16]. Other producers received great support in the innovative activity, e.g., the world leader on production of electric equipment “General Electric Company” got 2,5 billion US dollars for scientific studies and investigations (particularly from the USA government) during 2010-2012 [15].

Expenses for innovative activity in the machine building industry in 2007-2014 in average were equal to 2,6 billion hrn. per year (table 3), or 23,8 % of the total expenses for innovative activity in industry. It is the highest index among other types of the industrial activity (15,9 % – in metallurgy industry, 14,5 % – in chemical and petrochemical industry, 10,5 % – food industry).

Analyzing the innovatively active enterprises distinguish by directions of performed innovations, it was determined that high sgare of enterprises (30 – 40 %) preferred purchasing and introducing of machines, equipment and software. It proves that enterprises wish to direct their

funds to the technical reequipment of production. Some expenses to carry out external and internal scientific and research works by machine building enterprises in Ukraine were equal to 51 % in the total expenses amount for innovative activity in 2014 and were the highest among other industrial activities. During this period, on the one hand, one can observe innovative activity stepping up at the large enterprises, which have financial abilities to carry out research and investigations, to involve trained specialists on technologies, to perform marketing activity and advertisement to promote production to the markets.

Table 3. **Amounts of expenses for the innovative activity in the machine building sector in Ukraine, mln hrn** [2]

Types of expenses	2007	2008	2009	2010	2011	2012	2013	2014
Internal SRW	519,5	408,0	472,4	632,9	656,9	627,2	1034,5	755,7
External SRW	95,4	133,9	102,7	58,5	96,8	129,2	178,1	401,1
Machines purchasing, equipment and software	888,9	1264,1	815,9	1008,0	1248,6	1243,5	1015,7	899,6
Other internal knowledge	28,8	38,8	16,2	34,2	42,2	26,4	27,3	8,0
Others	1040,8	1155,7	598,8	808,0	687,1	1052,4	1334,4	202,7
Total	2573,4	3000,5	2006,0	2541,6	2731,6	3079,1	3411,9	2267,1

On the other hand – number of enterprises, which oriented funds to purchase know-how and technologies, and conducted technological preparation in production, was decreased.

In general great disproportions between separate types of the innovative activity are particular for machine building enterprises expenses structure. The enterprises do not pay necessary attention to staff teaching and training, for what not many innovative expenses were given per the studied period.

Although there are high indexes of the innovative activity at the machine building enterprises in Ukraine (in comparison with other types of industrial activity), this branch has several disadvantages, barriers and unsolved problems, which stop its development at the innovative base, particularly [1, 3, 11]:

– insufficient realization of the goods common production potential with foreign partners;
– lack of development at large machine building centers with full range of works: researching, research and constructive, probational, innovative, producing, following of machines and systems in exploitation, their renovation etc [9];
– destruction of ties with enterprises and machine building enterprises in the CIS countries, where most leading design bureaues and scientific institutions, especially high technological, took place;
– persistent staff shortage, absence of generations change, worsening of the workers' age structure;
– inefficient performing of some target programs in machine building development, insufficient amounts of their financing from state budget;
– low effective demand for the innovative machine building production, which in some degree is caused by the insufficient rates of the modern and great innovative production market establishment in Ukraine, and also by inability of most native commodity producers to be equal partners at the international market of the innovative goods and service [10].

Conclusions and further research areas. For the foregoing reasons, the main problem in innovative sphere is low assistance to business sector to innovations, which limits labor efficiency growth, production power intensity decrease, does not create base to modernize and structurally to reconstruct economy, does not provide its qualitative renewing. The economic growth dynamics

change without new high technologies introduction into industrial production leads to production energy- and resourcespending growing, decrease of the economic competitiveness, transformation of Ukraine into outsider in the global economic development. That's why the innovative activity growth at the machine building enterprises in Ukraine has to take place in the following ways:

– extension of interstate cooperating to increase and to use productive, innovative and scientific-technological potential of the machine building industry;

– Search of the investment possibilities to renew and to modernize main means of the machine building industry by modern equipment and tools;

– Creation of the available investment climate to increase investments incomes to perform technical modernization, to extend production of the new innovative goods, to carry out SRRCW;

– Creation of the acting integrated national scientific and productive unions, which are able to provide high efficiency of resources use and which are able to be integrated into the world branches on innovative goods production and distribution;

– Active creation (stimulation of the acting ones) of technoparks, technological incubators, based on the leading educational and scientific-research institutions [10];

– Creation of appropriate conditions to provide active mechanism of educational service market interconnection with labor market, to deepen integration process at the level of business-industry-education-state.

Thus, it is impossible to increase innovative activity of the machine buisling enterprises without state target programs concerning strategic innovative development.

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АНАЛІЗ ІННОВАЦІЙНОЇ АКТИВНОСТІ МАШИНОБУДІВНИХ ПІДПРИЄМСТВ УКРАЇНИ

Боденчук Лілія Борисівна
викладач
Придунайська філія МАУП МОН України, Україна

У статті розглянуті особливості функціонування підприємств машинобудування. Проаналізовано інноваційна діяльність та виділені закономірності і сучасні тенденції інноваційної активності машинобудівних підприємств. Установлено, що вітчизняні машинобудівні підприємства мають дуже низький рівень інноваційної активності, у порівнянні з європейськими. Причиною такого становища є фінансова неспроможність підприємств, відсутність підтримки з боку держави, не дієвість мотиваційних механізмів щодо підвищення інноваційної активності підприємств машинобувної галузі. В цілому для структури витрат машинобудівних підприємств характерні різкі диспропорції між окремими видами інноваційної діяльності. Частка витрат на здійснення зовнішніх та внутрішніх науково-дослідних робіт підприємствами машинобудівної промисловості України у загальному обсязі витрат на інноваційну діяльність у галузі була найвищою серед інших видів промислової діяльності. Проте, підприємства явно не приділяють необхідної уваги навчанню і підготовці персоналу, на що за досліджуваний період припадала не значна сума інноваційних витрат. На основі виявлених недоліків і проблем пропонуються основні напрямки підвищення інноваційної активності машинобудівних підприємств України.

Ключові слова: *машинобудівні підприємства, інноваційна діяльність, інноваційна активність, інноваційний потенціал розвитку, фінансування інноваційної діяльності.*

АНАЛИЗ ИННОВАЦИОННОЙ АКТИВНОСТИ МАШИНОСТРОИТЕЛЬНЫХ ПРЕДПРИЯТИЙ УКРАИНЫ

Боденчук Лилия Борисовна
преподаватель
Придунайський филиал МАУП МОН Украины, Украина

В статье рассмотрены особенности функционирования предприятий машиностроения. Проанализированы инновационная деятельность и выделены закономерности и современные тенденции инновационной активности машиностроительных предприятий. Установлено, что отечественные машиностроительные предприятия имеют очень низкий уровень инновационной активности, по сравнению с европейскими. Причиной такого положения является финансовая несостоятельность предприятий, отсутствие поддержки со стороны государства, не действенность мотивационных механизмов по повышению инновационной активности предприятий машиностроительной отрасли. В целом для структуры расходов машиностроительных предприятий характерны резкие диспропорции между отдельными видами инновационной деятельности. Доля расходов на осуществление внешних и внутренних научно-исследовательских работ предприятиями машиностроительной промышленности Украины в общем объеме расходов на инновационную деятельность в отрасли была самой высокой среди других видов промышленной деятельности. Однако, предприятия явно не уделяют должного внимания обучению и подготовке персонала, на что за исследуемый период приходилась незначительная сумма инновационных затрат. На основе выявленных недостатков и проблем предлагаются основные направления повышения инновационной активности машиностроительных предприятий Украины.

Ключевые слова: *машиностроительные предприятия, инновационная деятельность, инновационная активность, инновационный потенциал развития, финансирования инновационной деятельности.*