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SOME PERSPECTIVES OF THE INNOVATION DEVELOPMENT IN UKRAINE: NEEDS IN NEW TECHNOLOGIES AND MATERIALS¹

The main aim of the article is to show what kind of technologies and materials Ukraine needs, if the country starts the innovation type of its economic growth. Particularly, the author paid attention to the idea, that all direction of industry in Ukraine are in need not only of new equipment, but of using totally new technologies, of implementing new materials. There is a lot of information about modern structure of the industry of Ukraine, about R & D that Ukrainian enterprises booked from universities or independent laboratories. Also the author has showed the mechanism of cooperation between plants in the sphere of R & D and processes of technological transfer between them.

Keywords: new materials, new technologies, innovation development, innovation activities, transfer of technologies.

Problem statement. Problem of innovation development of economy in Ukraine is one of the priorities of national economic research. There is no other alternative to Ukrainian enterprises, that actively implement product and production innovations. We can say about all Ukrainian economic workers, that they could hold their position in the markets only if they increase their levels of competitiveness. This statement concerns especially manufacturing companies. Moreover, in the context of recent events (in the year 2014), all economic operators have faced a fundamental problem of increasing of their energy efficiency. It means that the question of Ukrainian enterprises innovation has become a national problem. Moreover: the problem how to increase the competitiveness of the national economy in the nearest future is the question how to avoid the economic collapse.

So this theme – innovation development in Ukraine – is enough actual, because that way (to implement innovation and know-how in industry and in another directions of activity) is only one, which will bring possibilities to the country to take the place in world market of high-tech production and to provide conditions of welfare of society. It goes without saying, that this type of development shall find the decisions of wide list of different national problems. And this is why it's reasonably to write the article about some aspects of innovation development in Ukraine and Ukrainian industry.

Analysis of the recent researches and publications. Innovation development is the theme, which is quite popular in Ukrainian scientific works. There are a lot of authors who provide researches to these problems. The reason of that interest is national policy of Ukraine in economic sphere. During last years Ukrainian government have been proclaiming as general aim of economic policy to support innovation activity. So now there are a lot of authors, who research problems of innovation activity. Also we can state, that there is a significant influence of foreign scientist and their ideas.

Some Ukrainian authors, like Haustov V.K. [11], Lyashenko O.M. [6], Androsova O.F. [2]

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or Dydkivsky M.I. [3], pay attention to the problems of transfer of technologies. They claim, that one of the most important problems of innovation development in Ukraine is the problem of interaction between economic workers who are involved to that kind of economic activity. There are authors, Fedulova L.I. [10], Agarkov C.A. [1], who research role of government policy in innovation sphere. Another important direction of researching of innovation activity in Ukraine is analysis of infrastructure of innovation processes, Jilinska O.I., Chebercus D.V. [4]. There is opinion, that the main reason of unsuccessful innovation policy in Ukraine is absence of infrastructure of innovation. Some researchers – Pylasov A.N. [8] pay attention to different forms of innovation activity, – innovation clusters, innovation networks, centers of support of innovation, etc. Freeman C. [12] made analysis of national economic systems and investigated the problem which is the most perspective one. He proved that strong industry is not enough for the country to support an innovation activity. It is too important for the national government to make deep transformation in society and economy. In the context of innovation it is much more important to have successful education system that a steel industry or something of such a kind. Lounsbury M., Crumley E. [13] investigated the mechanism of the appearance of new knowledge, and the conversion of new idea into innovation, searching for an investor and returning the money in the future. Olsona E.M., Walker O.C., Ruckertz R.W., Bonner J.M. [14] confirmed, that now it is too difficult for one company to support an innovation alone. So the major part of all R&D and innovation projects are based on several workers at the same time. In perspective, there will be no independent companies in innovation sphere, but only associations and networks.

Unsolved parts of general problems. Despite the fact that the theme (innovation development) is so popular, there are a lot of aspects, which are not totally clear for researchers. Moreover, that theme is too wide and changes quite quickly. So there is an objective necessity to make analysis of the most important problems of innovation activity. Especially there is the sense to analyze situation in Ukraine, because this country have started their way in innovation development, and there are a lot of questions, than have no answers now.

The aim of the article is to show the necessity of Ukrainian national economy and industry in new technology and new materials in the context of their innovative development.

Main material. Situation with R&D in Ukraine doesn't look quite well. The amount of R&D projects have been decreasing since 2005 (Table 1). Moreover, there is a lack of research in new technologies. In the year 2012 the part of designing of new substances and materials was only 2,5% of all amount of R&D projects. All other projects create the new types of technologies and equipment. We can affirm, that today Ukraine has no possibility to supply in international market with some types of new materials.

Table 1 – Numbers of R&D projects which were implemented in Ukraine, their types and directions, (developed on the basis of [7])

Type of R&D projects (amount)	2000	2005	2010	2012	2013
In total	38000	63900	52000	53200	47900
Designing of new types of devices	–	6300	6200	6400	5600
Designing of new types of equipment	3900	3800	2300	2100	2100
Designing of new types of technologies	3600	5400	5700	5000	5000
Designing of new types of materials	1100	1200	1400	1300	1200
Others	27000	45000	30300	32300	27800

Distribution of the number of projects for research areas is not equable (Table 2). Data in this table shows, that Ukraine is out of the world scientific main stream. It is considered, that biological researches and pharmaceuticals researches are the most perspectives ways of all another directions of further innovative and scientific development. This is global tendency, and Ukraine in that context seems to be incorrect, because Ukrainian national researches institutions spend the most part of their resources to chemical science and physical science. But there is one fact: Ukrainian national researches institutions (universities, laboratories) have had strong positions in those directions since the Soviet time. So Ukraine did nothing but saved this potential. This is not enough for modern innovation development. Ukrainian industry needs other types of technologies.

Table 2 – Numbers of R&D projects, which were implemented in Ukraine in the context of research areas, 2013, (developed on the basis of [7])

Research area	Total amount of projects	New devices	New technologies	New materials
Physical and mathematical science	1938	250	221	167
Chemical science	1374	290	259	199
Biological science	2438	326	324	19
Agricultural science	5066	311	773	49
Medical science	2574	199	199	2
Pharmaceutical science	971	102	2	3
Technical science	28853	3299	2109	563

Structure of R&D projects in the context of customer type (it means that a lot of types of economic workers could play this role, – state organization, private companies, etc.) looks much more balanced that in another sphere. In the year 2012, in Ukraine, state organizations booked more than 41% of all amount of the R&D project. At the same time private companies shared 37%, and universities booked 21% of all amount of that types of projects. We should say, that there is the one unnatural tendency: Ukraine has quite a slack tendency – society organization do not take a part in this process – their share is less then 1% (Table 3).

Table 3 – Numbers of R&D projects, which were implemented in Ukraine in the context of customer type, 2011-2013, (developed on the basis of [7])

Customer types	Total amount of projects	New devices	New technologies	New materials
2011				
In total	52354	6475	5331	1553
State customers	14190	1593	1826	579
Private customers	28361	3896	1256	642
Universities	9784	986	1408	332
Public sector	19	–	–	–
National Academies	11574	1074	1546	645
National Academy of Science of Ukraine	7385	699	750	513
2013				
In total	48857	6397	5012	1342
State customers	14581	1306	1765	555
Private customers	28440	4041	1979	497
Universities	10154	1050	1268	290
Public sector	15	–	–	–
National Academies	10718	920	1610	537
National Academy of science of Ukraine	6674	664	890	463

We can state, that structure of financing of R&D projects (it means outlay on science, R&D) is unbalancing (Table 4).

Table 4 – Structure of financing of R&D projects, which were implemented in Ukraine; in the context of research areas, millions of dollars USA, (developed on the basis of [7])

Research areas	2005	2010	2012	2013
In total	645,1	1120,1	1319,7	1395,1
Chemical science	12,7	33,3	63,7	50,9
Biological science	21,6	49,5	67,7	84,1
Technical science	428,5	50,7	59,7	80,4
Medical science	20,8	40,7	59,8	55,0
Pharmaceutical science	3,4	2,2	3,3	11,6

Especially there is a huge difference between many researching areas. Formally, funding of R&D has been increased during last ten years. In the year 2013 funding of R&D in total was more than 1,1 milliards \$. But in the case, if we take into account inflation in the country, we can affirm that during this period Ukrainian government has spent the same amount of money for R&D every year. The part of researches of new materials and technologies in this sum of money amounts only 3%. The tiny part of all direction of research is the part of pharmacy. It amounts only 0,2% of all sum. The reason of this situation is that the Ukrainian companies don't want to invest money into new technologies, especially in new materials. These directions of investment are not perspective, because they have too long terms of refund and a lot of risks. Moreover, in Ukraine credits for local companies are too expensive. It is because of the policy of National Bank of Ukraine when lending rates are 25% per year or more. Because of that all local investors prefer to support new projects in another sphere (retail, commercial estate), but not to support R&D. In Ukraine it is much easier to organize import operation with some new equipment and know-how, than to organize new laboratories, or to invent some new machines. For example: the hugest Ukrainian healthcare companies are not pharmacy production companies ones. They are trade companies which organize importation of medicine into local market. On the other hand, the hugest Ukrainian companies are metallurgical and agricultures holdings, which don't wish to develop their local enterprises: it is much more profitable to save the profit and to reinvest all money in another sphere of economic activities (into retail, for example). Ukrainian banks also do not support R&D projects: this is much more profitable for them to lend money to private persons or to take part in operations with currency.

As we see (Table 5) the part of the government budget in Ukraine in funding of R&D is 67%. It means that private companies are not active economic workers in this sphere. In other countries private sector money doesn't have less than 50% in funding of R&D, and they take a more efficient part in innovation activity than government actors do [9]. At the same time in Ukraine parts of money of foreign investors are much less. In the year 2012 in Ukraine part of foreign investors in funding of R&D was 10%. Also there are a lot of different projects between Ukrainian and foreign science institutions, and we should state that there are perspectives of Ukraine in international scientific sphere.

We can also affirm that the hugest part of costs is for purchasing of a new equipment and new machines [7]. Ukrainian enterprises don't spend money to new technologies, especially they don't pay attention to the most perspectives direction of innovation development. If the sum of all costs of Ukrainian enterprises for innovation activity is 100%, the part of buying of new knowledge is 0,4%, the part of buying of new equipment and machines is 71,0%, and the part of R&D is only 10,4%. So we can state, that Ukrainian enterprises spend to R&D less

than 10,0% of all amount of investments to innovation activity. If they save this proportion during next years, they stay at the same position of the market: Ukraine will be a recipient of new materials and technologies. But we can say, that all countries and all companies, which had a success in innovation policy and innovation activity, also had possibilities to support original R&D programs and to invent new original products.

Table 5 – Structure of financing of R&D projects, which were implemented in Ukraine; in the context of sources and types of economic activity in the year 2012, millions of dollars USA, (developed on the basis of [7])

Type of economic activity	In total	Sources of funding if R&D			
		Government budget	Private money	Investor's money	Foreign investors
All types of economic activity	1319,8	588,6	140,2	307,3	25,6
Agriculture industry	33,1	25,4	5,2	2,0	0,0
Extracting industry	41,5	1,2	0,6	10,1	28,8
Food industry	1,0	0,2	–	0,7	0,1
Oil industry	2,0	0,0	0,1	1,9	0,0
Chemical industry	11,4	0,7	1,2	4,5	5,0
Metallurgy	28,5	2,3	0,3	14,7	11,1
Mechanical engineering	41,8	5,0	12,0	18,2	65,6
Automobile production	1,8	–	1,8	42,3	88,6
Government management	174,3	113,6	39,0	10,1	4,4

There are other risks for Ukraine. In the case, if Ukraine doesn't have high levels of competitiveness and innovation activity, in the nearest future country will not have possibility to support normal level of salary. We can say, that only country which have a lot of innovation enterprises and high level of innovation activity can support high productivity, and as result high level of citizen's life.

So as we have seen in some sources [7; 13; 14] Ukrainian economy needs the new technological and materials. Especially the national economy needs the materials that can help it with modernization. We are sure, that the most perspective materials are the next: materials for energetic, catalysts, materials for rechargeable batteries of high power; new structural materials, especially which are made from recycled raw materials.

Conclusions. We can say that Ukraine has some positions in the sphere of R&D, in particular in the direction of new materials. But at the same time we can notice, that these positions are not so stronger as the basis for the economic growths. The reason is that the most of Ukrainian new technologies are not completely new: country have had these technologies since the Soviet time. Also there is one more detail: there is a difference between Ukraine scientific sphere and scientific sphere of Western countries. In the Western countries (members of EU, for example) universities are leaders in R&D, while in Ukraine the institutes of National academy of science of Ukraine play that role.

At that period in Ukraine the major parts of all R&D projects were provided in the spheres of chemical science, technical science and biological science. The most important direction of scientific research is the metal science. At the same time main stream of international scientific sphere includes the directions such as nanotechnology, biotechnology, chemistry. So we can conclude that Ukraine in the nearest future will not satisfy its own needs in new technologies. At least during the next ten years Ukraine should build its innovation policy like

the country, which imports the major part of new technologies and know-how. There are not possibilities for Ukraine to create totally new and totally independent infrastructure of scientific researches. In other words, during at least next ten years Ukraine will be the recipient of new technologies, and not the donor of them. There is only one chance to create some internal R&D projects in the country: it is to combine the most successful national labs in one society (or association), and to concentrate all government resources in a few directions, where Ukraine has already got some success. Also there is a necessity in the country to organize reforms of all national sphere of research, and to find new organizational model of innovation end researches of infrastructure.

We can speak about the position of Ukraine in international markets of high-tech productions like about the position of the country which proposes (to sell) only a few names of goods, and which buys all needed things to support innovation activity inside the country. Now Ukraine buys all products: know-how, new technologies, equipment, machines, etc. But we can affirm, that at this time only countries, which provide innovation activity, have a chance to stay in the market as providers of difficult productions. It means that if Ukraine does not change its innovation policy, it will stay middle-development country with agricultural economy and will not propose to the international market complex and expensive goods but only some simple metals products.

There is a different situation in international market of high-tech services and intellectual products. Here Ukraine keeps a strong position in the market of software. The Ukrainian market of software has a lack of demand, so the major part of Ukrainian software companies work with outsourcing. The problem is that the most part of economic workers in this sphere work illegally: firms officially show to tax office minimally indicators, and work unofficially. They use cash for such case. At the same time the most part of programmers work also unofficially, like freelancers.

The important question for all Ukrainian enterprises is the question of modernization. At first this is important because the country consumes much more energetic resources than European countries do. And this is the reason why local actors have less level of competitiveness. Secondly, Ukrainian enterprises use equipment with high level of deterioration, and they can improve it only by using technologies from the international market.

There is an idea, that Ukraine will have significant economic growth only if it has got powerful innovation activity. That means the national government has spent recourses in this direction (for innovation development) much more intensively, then it spends for the other directions. If Ukrainian government has a plan that national economy should rise by 5% each year, they have to increase cost for innovation activity in the country in 10% each year. At the same time it's important to save balance in the budget: the government has to spend to R&D in the country the same sum, as the private sector does. Now we can say about proportion 60% (from government) to 40% (from private sector).

It's quite important for Ukraine to save those national labs and the most important universities, which have already noticeable R&D. But even these structures will have no future, if they are not integrated in the international scientific sphere. Ukrainian industries during next 5-8 year will have necessity in implementation of new technology from the international market. After that period the national industry will have necessity in totally new technologies, and at this moment the country should have quite powerful national researching sphere. There are some levers to support national science infrastructure. At first, Ukraine has to reform their scientific institution – Academies of Science, universities. At second, the national government has possibility to use international experience in this kind of activity: to create innovation and scientific networks, innovation centers, new researchers organization.

There are several ideas in the article, which are of scientific novelty. Firstly, the author showed actual structure of costs for science in Ukraine and main economic workers of scientific activity, and their role in the national economy. Secondly, there are found out the directions of scientific research of Ukrainian scientists, which have been the most successful. Thirdly, the author proved that Ukrainian enterprises have necessity in the principally new technologies so much as they need upgrading their production processes. Fourthly, the author showed what kind of new materials and technologies Ukrainian enterprises really need.

We can point out the following theses about the **prospects of further research** of the theme of new materials and technologies (in particular, their implementation in Ukrainian economy). So the most promising areas are: potential of the economy of Ukraine into development and implementation of new technologies and materials; searching for “breakthrough technologies” for Ukraine (“breakthrough technologies” means the technologies, which will create competitive advantage of Ukraine in the future).

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К.О. Січкаренко. Деякі перспективи інноваційного розвитку в Україні: потреби в нових технологіях і матеріалах

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Деякі перспективи інноваційного розвитку в Україні: потреби в нових технологіях і матеріалах

У статті проаналізовано потреби національної економіки України в нових технологіях і матеріалах у контексті пожвавлення інноваційної діяльності. Автором зосереджено увагу на тому, що найбільша потреба в технологічному оновленні існує в сфері промисловості, де в найближчій перспективі будуть необхідні принципово нові (проривні) технології.

Ключові слова: нові матеріали, нові технології, інноваційний розвиток, інноваційна активність, трансфер технологій.

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Некоторые перспективы инновационного развития в Украине: потребность в новых технологиях и материалах

В статье проанализированы потребности национальной экономики Украины в новых технологиях и материалах в контексте оживления инновационной деятельности. Автором сосредоточено внимание на том, что наибольшая потребность в технологическом обновлении существует в сфере промышленности, где в ближайшей перспективе будут необходимы принципиально новые (прорывные) технологии.

Ключевые слова: новые материалы, новые технологии, инновационное развитие, инновационная активность, трансфер технологий.

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