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ACADEMIC CAPITALISM: DEVELOPMENT TRENDS IN UKRAINE AND EUROPEAN PRACTICE

The article outlines the trends in the formation of academic capitalism in Ukraine. There Also have been described the trends of development of business environment in the field of high technology in Ukraine and abroad, particularly in universities, as well as patterns of commercialization of results research activities in the context of strengthening the importance of knowledge. The obtained results will allow forming the principles for the formation of a new methodological paradigm for managing the technology transfer process, taking into account the peculiarities of the development of domestic science, economy, entrepreneurship and the market of high technologies.

Keywords: academic capitalism, innovation, knowledge-intensive business, commercialization, technology transfer center, scientific and technical products, patents, eurointegration.

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Introduction. Market relations predominant in the majority of world countries have laid down the rules based on entrepreneurship and competition in all economic sectors without exception. Global challenges and fight for the capital have consumed social institutions as well. Today, education and science have also become the economic agents, since due to critical lack of resources, even the world's leading universities faced the need to look for the ways to survive over the last few decades. Social and economic changes resulted in a situation where modern universities are intended to meet the market demands, rather than social ones. Within the context of the science-based economy concept development, the universities have gained extensive autonomy rights, along with the chance to push on to the next development level as a result of academic entrepreneurship. Subsequently, famous education and research institutions overseas have ended up becoming centers for innovative activities. In light of this, the role of researchers and academic research has increased considerably, since the deliverables of scientific research have become the subject of commodity-money relations, while the most commercially appealing intellectual property items have turned into valuable products. Understanding the importance of the innovation processes evolution in Ukraine generates the need for identification of the trends in academic capitalism formation.

Aim of the article is to analyze the process of science-based business environment development in Ukraine and around the globe, particularly in the universities, as well as to define the patterns of scientific research deliverables' commercialization within the context of strengthening the knowledge relevance.

Literature review. The market launch of innovative products has been the focus of research papers by many well-known foreign authors, in particular H. Etzkowitz [1], D. Mawson [2; 3], B. Clarke [4], E. Rogers [5], T. Hockaday [6; 3], Sh. Harrison [3], G. Chesbro [7], and others. In his popular monograph "The Triple Helix: University - Industry - Government Innovation In Action", Henry Etzkowitz claims that universities should play the key role in shaping and implementing new ideas and technologies, since

they form the very core of country's scientific and economic potential [1]. In turn, Everett M. Rogers in his book "Diffusion of Innovation" points out that implementation of innovations in the companies depends on the adopted individual decisions [5]. Various aspects of innovations and ways to commercialize them have been examined in publications by distinguished domestic scientists G.Androshchuk [8], L. Antoniuk [9], V.Bazylevych [10], V.Geyets [11; 19], N.Grazhevskaya [12], A.Danylenko [13; 19], O. Zhylynska [14], V.Ilyina [10], Yu.Kapitsy [18-19], as well as young researchers V.Virchenko [15], A. Vitrenko [16], A. Vikulova [17] etc. The key mechanisms and methods of innovation commercialization have been investigated by Chih-Hung Shai [20], T. Chekulina [21], O.I. Derengovsky [22] and others.

However, notwithstanding the fact that the issue concerning sale of innovations in the market is not radically new, there are still many uninvestigated aspects of this essential economic field both in science and practice.

The concepts of modern macro and microeconomic theory, as well as innovation management have laid the theoretical and methodological foundation of this research. The studies and developments by domestic and foreign researchers engaged in examining the matters associated with technological advances, innovation development and commercialization of scientific research deliverables, legal documents of Ukraine and the EU, data books and Internet resources have been used in the paper. Comparative approach, the methods of analysis, synthesis and theoretical generalization, as well as economic and statistical methods of actual data analysis have been applied in the course of research. Through the application of comparative approach, the institutional forms of science-to-business technology transfer in the EU countries and Ukraine have been identified. The regulatory framework in the field of academic knowledge commercialization has been analyzed using the methods of analysis and synthesis. The analog approach has been applied in order to identify the differences between the global and domestic trends in commercialization of technologies, particularly, in terms of intensity of invention patenting and the benefit from the sale of high-tech products. Using the generalization method, the issues arising in the course of development of Ukraine's science-based business environment have been outlined. The theoretical conclusions have been drawn based on processed statistical and analytical data retrieved from the official foreign and domestic sources, as well as analysis of own factual materials and findings.

Against the backdrop of the evolution of environment of innovation in the world's leading countries, recent global trends consist in transition from the "linear model" of innovation cycle management to "cooperative model" based on so-called "entrepreneurial university" [19, p. 163]. It is a cutting-edge education and research institution that effectively brings together education and science with commercial subtext. The acquired knowledge is then immediately used in research with a focus on further commercialization of its deliverables. Today, the processes linked to commercialization of scientific and research inventions and developments depend largely on operation efficiency of the modern academic structural departments professionally engaged in science-to-business technology transfer. In view of this, the key factors of scientific research deliverables' commercialization are the principles and terms of implementation of scientific ideas and developments, as well as the form of their transfer and degree of ultimate profitability.

Currently, the majority of the world's scientific and educational research institutions use 11 most common institutional forms of technology transfer: division, department, innovation division, own business, stake in business, division operating on subcontract terms, regional technology transfer subdivision, Satt program, own incubators, incubators affiliated with the universities, and independent incubators [3, p. 25-31]. Virtually, all of them have different legal status, but nonetheless work on the main innovation generator, i.e. the university, which has full authority to enter the market and secure profits.

Given that the commercialization of the scientific research deliverables has not gained any true

relevance in Ukrainian practice yet, complex and multifunctional models of technology transfer have not been developed in domestic scientific research environment in the years following independence. The most standard model of technology transfer is a *division* that directly handles the know-how transfer to the business entities, as well as distribution of application-oriented scientific and technological knowledge, and operates on the premises of the university. Its activities are complex, and the model of operation may vary based on the type of university. The most common and traditional type of technology transfer division is the *department* which is often set up on the premises of the medium-level research universities with several people being employed. Typically, such universities are short-staffed, so the specialists working in these structural units are under-qualified. In the majority of cases, this type of departments is invisible, for the most part operates at a loss and is unable to fulfill its direct functional purpose. The advantage of this institutional form of technology transfer is explained by the simplicity of its establishment - based on internal order of the university's administration - and relative inexpensiveness of its operation. In particular, these departments are arranged on the premises of Vadym Hetman Kyiv National Economic University [23], the Odesa National Polytechnic University [24], the Kyiv National University of Technology and Design [25], the National Transport University of Ukraine [26], and some other higher education institutions, the official websites of which make no mention of them, as in case of the Lutsk National Technical University [27], or if there is some type of information about them, their activities are not listed, as in Dneprodzerzhinsk State Technical University [28].

In contrast, the universities overseas have relevant *departments* i.e. integrated divisions which are larger in size (the number of employees in some of the biggest universities such as Harvard or Stanford reaches up to 60-70 people) and provides a wider range of services within the framework of academic research market promotion. In broad terms, it is a much better organized structure with an increased relevance and accountability, since their heads often report directly to the Rector or Vice Rector for Research who is in charge of research activities, and, in some cases, concurrently holds both positions and/or fulfills either duties. This contributes to sufficient integration of this division into university's research ecosystem and offers greater freedom of maneuver. However, the major drawback of these activities includes lack of complete independence, which in some cases slows down the process of technology transfer. In Ukraine universities and research institutes often have the problem of excessive and contradictory dependence on the process of implementation of promising innovative projects. This is the main reason for the fact that the most interesting projects usually those that have support of international organizations can be implemented only outside the jurisdiction of universities in Ukraine, and therefore cannot provide proper economic and investment returns to the national alma mater.

Innovation divisions that generate innovative proposals associated with other programs are sometimes established on the premises of foreign universities. Such offices operate separately from purely research areas of work and community groups, while at the same time enabling the university and external organizations to conduct their activities in a single-window mode. Commonly, they have their own financial departments, implement professional technology transfer, supervise student venture companies, train employees and offer wide-ranging business support. Their major advantage lies in provision of a full package of innovative services. For instance, Cambridge Enterprise, the subsidiary owned by the University of Cambridge is engaged in research commercialization. It works with university members throughout all stages of commercialization process ranging from legal support of received applications for research project funding and advising to facilitation of patent and license acquisition, as well as incorporation of new companies based on research developments of the university.

However, today's latest model for commercialization of academic technologies is the business fully owned by the university with the key focus on comprehensive technology transfer management, advisory activities, and provision of innovation management services to the customers worldwide. The shining

example of this is Oxford University Innovation, a subsidiary owned by the University of Oxford [30]. This versatility in the style of activities implies a certain level of autonomy from the parent university and the ability to follow a more liberal commercial strategy, unlike other institutional forms in technology transfer field which are mostly bound by business relations with "their" universities. In such a case, the advantages of making the best use of the university's brand, namely the ability to attract a bigger number of customers, partners and investors, remain.

In this context, the obvious *pattern* can be observed: the more attention the university devotes to the infrastructure development in the field of technology creation and transfer, the more economic return it can expect as a result of commercialization of research and development deliverables produced under its brand name.

Thus, the number of the best innovative profile developments given in the European Enterprises Network (EEN) database offers illuminating insights into the best performance of the countries, where a complex of linked servicing facilities providing the foundation for the innovation system operation in the universities is sufficiently developed and meets the demands of today's market (Table 1). In Ukrainian state education, science and research institutions, the innovation and investment management is at conception stage, and currently even those universities that have already recognized the need for its implementation have yet to fully realize the importance and relevance of introducing adequate mechanisms and processes.

Table 1 – Profiles of innovative developments given in the EEN database* [31]

	Great Britain	Poland	Germany	France	Romania	Ukraine
Total last year	482	539	361	308	348	118
Business offer last year	390	476	188	219	329	87
Technology offer last year	92	63	173	89	19	31

*as of March 25, 2018

In the process of commercializing research and development deliverables, the key objective of the universities and relevant divisions engaged in science-to-business technology transfer is the maximum value capture, and so the modern higher education institutions are interested in implementing the projects involving incorporation of the new companies based on in-house developments, ideas and know-hows. Therefore, hundreds and thousands of small but profit-generating innovation companies are set up every year on the premises of the world's top universities or jointly with them. For instance, at the University of California, USA which is the economic powerhouse of the region, five new inventions, the commercialization of which starts from the lab, emerge daily [32]. We can clearly see the *pattern* here: the way the science-production system is arranged does not depend on the forms of ownership, since the profits can be generated both through implementation of licenses to use inventions patented by the university and by holding the share in the company based on the principle of venture capital investment. However, the majority of research and development activities in Ukraine are commissioned by the state agencies, which are in charge of that and have relevant powers associated with funding allocation. Meanwhile, hundreds of successfully implemented research activities have not been commercialized. The following *pattern* must be emphasized here: the one who gains the most advantageous market position is not the one who develops some of the best solutions and products, but the one who is able to ensure maximum synergetic effect resulting from the synthesis of local technologies when creating the market product, as well as the cooperation between the customer, the seller and the external environment.

In Ukraine, the entrepreneurial passiveness in the science-based field is one of the key roadblocks

to development of an efficient market for academic knowledge and technologies. This situation is explained by the fact that commercialization of scientific breakthroughs is somewhat new in our country, since during the Soviet era all research developments were used for the sole benefit of the state, and so there was no need to search for any other potential customers for this product. On the flip side, the officials of different levels do not fully realize the actual social benefits of investing into science projects, since our society has a somewhat distorted idea of their socio-economic impact.

For this reason, the need to improve the state innovation policy is being formed in Ukraine. In particular, this can be achieved through development of mechanisms for meaningful cooperation between the universities, the business and the state which have been successfully operating as a "triple helix model of innovation" in the Western world for quite some time now [1; 19]. The implementation of principles for management of scientific research deliverables will encourage further emergence of high-tech innovations, since it will accommodate the interests and accumulate resources of all parties involved.

However, in a civilized world, the process of intellectual property commercialization is regulated through other means as well, in particular by creating the conditions, under which innovation activities become an actual key factor in development of the national economy. This complex of linked actions requires creation of innovation infrastructure, development of mechanisms to encourage innovation activities, identification of priority directions for building the economic strength of a developed state, along with development and adoption of relevant laws and regulations.

Currently, the main law allowing to regulate transactions associated with technology transfer to other recipients is the Law of Ukraine "On State Regulation of Activities in the Field of Technology Transfer" passed in 2006 [33] and outlining legal, economic, organizational and financial principles of activities in this field. Operation of this law became a turning point in the context of scientific and research developments commercialization process, since as of the time of law passage, just like today, the country had practically no competent experts who would be able to get the transfer of the new technologies or innovations for commercial use up and running. In addition, this norm-setting document has plenty of drawbacks and contradictions, considerably complicating the commercialization of science-based technologies and innovations.

The crucial aspect in encouragement of technology transfer as a key factor in innovation process intensification in the national economy is efficient stimulating tools of operation of all parties involved in technology transfer, and mainly the employees directly engaged in the market promotion of technologies. In fact, the idea of receiving profits from the use of technologies in the course of business activities is aimed not only at expanding the scale and speeding up the pace of industry modernization on an innovative basis, but also creating additional remunerative incentives for the scientists who are the key players directly generating valuable research deliverables which are the very evolutionary foundation of the mankind. Thus, another *pattern* proves that the commercial success of innovation depends both on exogenous (technological, social, psychological and economic) and endogenous (creativity of the individual) factors, namely 5% of the economic factor, 5% of the psychological factor, 10% of the social factor, 25% of technological development level, and 55% of the quality of creative thinking [22, p.16]. The basis of the creative (author) component in the science-based innovation business is evidenced by yet another *pattern*. Nearly until the mid-60's of the 20th century, the success of the final innovative product depended greatly on the contribution of the author who put major personal effort into its market promotion, thus acting as an inventor and entrepreneur at the same time. Almost 40% of all commercially-viable inventions back then became profitable family businesses owned by those who created them.

Later on, the privately-owned innovative businesses have been squeezed out by the corporate ones. Because of this, large innovation-oriented transnational corporations, such as Boeing, Intel, Google, and

Microsoft guided by the strategy of accumulation of the world's best intellectual assets have now become the owners of intellectual property and the source of innovations [34]. However, it is evident that the scientists keep playing a leading role in organization of successful science-intensive business, and therefore should receive adequate royalties.

From this perspective, Part 5, Art. 22 of the Law of Ukraine "On State Regulation of Activities in the Field of Technology Transfer" emphasizes the need to set minimum rates of royalties for creators of technologies and those who carry out their transfer. In addition, the Decree "On Approval of Minimum Rates of Royalties for Technology Creators and Individuals Carrying Out Their Transfer" passed by the Cabinet of Ministers of Ukraine in 2008 explicitly outlines them; however, on a practical level these rules are hardly applied [35].

The Law "On Higher Education in Ukraine", 2016 has had a direct impact on evolution of Ukraine's scientific and research developments market as well. According to this law, domestic higher education institutions were granted new rights and opportunities [36]. However, it has also had substantial controversies concerning the investment and commercialization processes in the field of science. In particular these are the contradictions which touch the autonomy and opportunities of the universities to create new models proceedings research activities (in accordance with Article 30 of this Law). Taras Shevchenko National University of Kyiv, according to Article 70 of this Law, has the right to carry out independently financial and economic activities, including receive profit. In particular, it has the right to form innovative structures of different types (scientific and technological parks, business incubators, small companies etc.) on their premises by bringing together interests of high-tech companies, science, education, business and the state for the purpose of implementing other innovative projects. It also has the right to open current and deposit bank accounts within the framework of financial freedom etc. However, outdated algorithms and artificial barriers in the budgeting process continue to hinder essential the implementation of innovative processes in public universities.

Thus, on the one hand, our country technically continues to declare the high-priority social nature of the activities carried out by domestic higher education institutions, the key tasks of which are to promote the increase and spread of scientific knowledge, as well as to carry out cultural and educational activities based on the principles of patriotism, morality, responsibility etc. [36] Yet it is developing not yet quite visible institutional instruments to implement the proven foreign formula of academic capitalism, which implies combination of commercial interests of the public authorities, market/businesses and the academic community. In modern sense there are several theories regarding the definition of the term "academic capitalism". However the main, according to the authors, thing it is that this is the process of transforming universities or research institutes from non-profit socially-oriented organizations into commercial enterprises, which leads to the need for direct market activities patents, licenses, etc.) for profits (, as well as increased competition for the opportunity to attract investment funds and profitable commercial contracts with other academic enterprises. The role of researchers also changes substantially. They become scientific managers.

In Europe, the activities linked to knowledge transfer and research and technology commercialization are governed by specific legislative instruments, in particular the European Commission Recommendations on the Management of Intellectual Property in Knowledge Transfer Activities, and the Code of Practice for universities and other public research organizations [37]. Over the recent years, open innovation models of the form of partnership between the universities, the private industry and the state administrations of different level have become increasingly widespread within the framework of the Europe 2020 strategy. This speeds up the spread of knowledge, stimulates innovation activities, and enables to create an environment that has a favorable investment climate.

In addition, innovation activities are affected by global macroeconomic factors, such as geopolitical challenges, macroeconomic policy of the country, socio-economic stability, efficiency of reforms in

business activities, income level and standard of living of the population, including innovators etc. Thus, economic and political turmoil results in a sharp deterioration of the financial and economic climate of the country, which, in turn, triggers macroeconomic equilibrium disturbances, termination of close and long-term economic relations, slump of production, complication of monetary-and-credit relations between market players, inflation, bankruptcies of the companies and banking institutions, rising unemployment rate and subsequently a significant impoverishment of the citizens.

In this context, the well-known domestic professors Reshetnikova I.L. and Sagaydack M.P. prove that the “shock therapy” that was introduced in the Ukrainian economy following the Revolution of Dignity in 2014, delayed reforms and overall political instability resulted in harsh austerity measures, for which reason costly innovation projects became “deferred expenses” [38]. Due to this, the number of industrial enterprises engaged in innovation activities has decreased dramatically. Thus, only 824 or 17.3% of industrial enterprises with 50 or more employees were formally engaged in innovative activities in 2015 (see Table 2), as compared to 1,609 in 2014. According to official statistical data, they have spent UAH 13.8 billion or USD 510.3 million (0.7% of GDP) on innovations, in particular UAH 11.1 billion on the purchase of machinery, hardware and software, UAH 2.0 billion on internal and external scientific and research developments, and UAH 0.1 billion on the purchase of the new pieces of technology. As in previous years, own funds of the enterprises amounting to UAH 13.4 billion were the primary source used to cover innovation expenses. The volume of the attracted state budget funding totaled UAH 55.1 million, UAH 58.6 million of foreign investments, and UAH 273.0 million of funds from other sources. That said, they have sold innovative products worth only UAH 23.1 billion, with only UAH 10.8 billion outside Ukraine. [39]. According to the current exchange rate UAH 27/USD 1, this is about USD 4 billion which is 8.4% of the total volume of goods and services exported by our country in 2015. Thus, it is evident that implementation of promising long-term innovative projects needs stable operation of the key institutions of science-based business, as well as macroeconomic equilibrium, clear and stable state policy in this field, firm rights of the intellectual property holders and business entities actually bringing the know-hows into their activities, reasonable cost estimate of the commercially-viable deliverables of the creators etc. This *pattern* is essential for development of efficient science-based business environment.

Low innovative activities impede competitive growth of Ukraine globally, hinder innovative economy development process, significantly reduce defense potential and slow down the pace of the European vector of development. According to the Global Economy ranking, out of 140 countries Ukraine was ranked 41th in the export of high-technology products in 2014; in 2015, Ukraine did not even make it into the list of 65 countries [42], whereas the World Bank figures show that the global volume of high technology export reached over \$2 trillion in 2014. The maximum innovation and export volumes were operated by China with \$558.6 billion. Germany was ranked second with \$199.7 billion, the US was ranked third with \$155.6 billion, followed by Singapore with \$137.3 billion, South Korea with \$133.4 billion, France with \$114.7 billion, and Japan with \$123.4 billion. The share of Ukraine is only \$1.9 billion. [43].

Currently, the world's key technological sectors, where high technologies are traded, are biotechnologies, medicine, computer technologies and telecommunication, aerospace, nuclear field and optoelectronics, while Ukraine is a supplier of basic metals and products (\$9 billion), grain crops (about \$8 billion), machinery and equipment (\$4 billion), fats and oils (\$3 billion), mineral products, such as ore, slag, ashes (\$3 billion), as well as chemical industry products, including inorganic chemicals, pharmaceuticals products, fertilizers, essential oils etc. (\$2 billion) [39].

Whereas the world's leading countries make profit off of the export of high-tech products, Ukraine remains to be mostly a raw material supplier. However, in the context of building our country's security and defense, there is a chance to increase the commercial returns from scientific and technological

activities. Against the backdrop of Russia's aggression towards Ukraine, creating conditions for increase in production output and facilities of the Ukraine's defense industry complex is a significant factor for launching own production of weapon, military and special equipment [44]. To do so, it is planned to boost innovative development of the domestic defense industry complex, in particular, to take relevant measures on development of efficient means for protection of military facilities, as well as other military developments in the future.

Table 2 – Distribution of the total funding of industrial enterprises' innovative activities according to 2010 and 2015 sources (prepared by the authors using own calculation and official statistical data sources [39-41])

Funding sources	2010					2015					The change in funding in dollars, 2015 to 2010, %	Growth rate, 2015 to 2010, %	
	Number of enterprises that had expenses associated with innovative activities from relevant sources	In % of total number of innovatively active enterprises	Mln UAH	Mln USD*	In% to the total number of innovative enterprises	Number of enterprises that had expenses associated with innovative activities from relevant sources	In % of total number of innovatively active enterprises	Mln UAH	Mln USD**	In % to the total number of innovative enterprises		Quantities of innovative enterprises from relevant sources	Investment per 1 enterprise (USD)
Own budget	1043	71.3	4775.2	592.4	59.4	611	74.2	13427.0	496.0	851.4	+43.7	-41.4	+143.9
The state budget	23	1.6	87.0	10.9	1.1	11	1.3	55.1	2.0	3.5	-67.9	-52.2	-32.3
Local budgets	17	1.2	5.7	0.7	0.1	15	1.8	38.4	1.4	2.4	+242.9	-11.8	+300.0
Extra-budgetary funds	2	0.1	0.9	0.1	0.0	1	0.1	1.4	0.1	0.1	0	-50.0	+100.0
Domestic investors	12	0.8	31.0	3.9	0.4	9	1.1	74.3	2.7	4.7	+20.5	-25.0	+60.7
Overseas investors	11	0.8	2411.4	301.0	30.0	6	0.7	58.6	2.2	3.7	-98.8	-45.5	-97.7
Lending resources	36	2.5	626.1	78.2	7.8	11	1.3	113.7	4.2	7.2	-90.8	-69.4	-69.8
Other sources	8	0.5	108.1	13.5	1.3	9	1.1	45.1	1.7	2.9	-78.5	+12.5	-53.1

*in accordance with exchange rate as of January 1, 2010 (UAH 8.01 /USD 1);

**in accordance with exchange rate as January 1, 2015 (UAH 15.77 /USD 1);

*** innovative active industrial enterprises with the number of employees 50 and more persons

Another roadblock to promotion of scientific and research developments is the chronic underfunding of "science" in domestic universities and research institutions. The scientists are now faced with the issues of survival. These include preservation of the schools of science and intellectual potential, maintaining high international scientific level of research, nurturing the next generation of scientists, ensuring access to the latest equipment and information resources that are an essential prerequisite for the effective performance of work and achievement of the research objectives, rather than enhancing the innovation potential and commercializing their inventions. Over the recent years, funding from the overall

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budget allocated to the science and innovation has gone down dramatically (see Table 3). In contrast, the findings of our research show that the level of state expenditures on science has increased taking into account the hryvnia equivalent. For instance, the Ministry of Education and Science of Ukraine in 2018 for research and development received more than 2 times funds from the general budget than in 2013. At the same time, in dollar terms, the level of science funding decreased by 60% on average as a result of rapid depreciation of the national currency in 2014-2018, which is unacceptable for creation of effective institutional, socio-economic, legal and information system for managing commercialization of scientific and research developments in higher education and research institutions.

Table 3 – Actual state of funding allocated to the science from the State Budget of Ukraine (prepared by the authors using own calculations and official statistical data sources [45])

	2013		2017		2018		Change in the size of funding in UAH, %		Change in the size of funding in USD, %	
	mln. UAH	mln. USD*	mln. UAH	mln. USD**	mln. UAH	mln. USD***	2018/2013	2018/2017	2018/2013	2018/2017
The Ministry of Education and Science	318.2	39.8	621.5	22.9	698.1	24.9	+119.4%	+12.3%	-37.4%	+8.7%
Research, scientific and technical developments, scientific events hosted by the Taras Shevchenko National University of Kyiv	67.0	8.4	98.5	3.6	108.4	3.9	+61.8%	+10.1%	-53.6%	+8.3%
The National Academy of Sciences of Ukraine	2511.6	314.3	2526.8	92.9	2806.8	100.0	+11.8%	+11.1%	-68.1%	+7.6%
The National Academy of Educational Sciences of Ukraine	118.0	14.8	123.3	4.5	144.5	5.1	+22.5%	+17.2%	-65.5%	+13.3%
The National Academy of Medical Sciences of Ukraine	219.5	27.5	177.9	6.5	199.6	7.1	-9.0%	+12.2%	-74.2%	+9.2%
The National Academy of Arts of Ukraine	8.9	1.1	15.0	0.6	11.0	0.4	+23.6%	-26.7%	-63.6%	-33.3%
The National Academy of Legal Sciences of Ukraine	22.8	2.9	17.9	0.7	26.1	0.9	+14.5%	+45.8%	-67.0%	+28.6%
The National Academy of Agrarian Sciences of Ukraine	404.4	50.6	353.3	13.0	393.3	14.0	-2.7%	+11.3%	-72.3%	+7.7%

*in accordance with exchange rate as of January 1, 2013 (UAH 7.99 / USD 1);

**in accordance with exchange rate as January 1, 2017 (UAH 27.19 / USD 1);

***in accordance with exchange rate as January 1, 2018 (UAH 28.07 / USD 1)

Legislative uncertainty and critical lack of funding intended for research, development and commercialization of the deliverables of innovative activities in Ukraine is the main culprit of passive behavior shown by domestic developers, when it comes to creating commercially attractive R&D deliverables and intellectual property protection. To overcome this “empty-pocket” situation,

O.I. Zhylynska suggests developing and implementing purpose-oriented programs in order to boost technology transfer, granting credits on easy terms to encourage scientific and technical cooperation with small and medium-sized enterprises which will stimulate the climate for entrepreneurship, and spreading information about commercially-viable research and development projects among potential investors etc. [14].

In addition, innovation experts note that only 8-10% of the launched projects manage to achieve commercial success. For example, in the aforementioned University of California, the effectiveness of investment in own patents in 2009 was presented as the Pyramid of Disappointment: out of 400 inventions patented that year, only 50 were implemented in the form of licenses, of which 16 generated some profit, and only one license gave profit exceeding \$1 million. [32]. This *pattern* is identification of relationship between the quantitative and qualitative side of science-based business. The measure for efficiency of R&D deliverables commercialization is the number of patents, since they protect inventions and stimulate their emergence. According to 2015 data of the World Intellectual Property Organization, all countries of the world filed 2.9 million (!) patent applications [46], of which only 4,497 (!) were submitted by Ukraine [47]. The biggest number of patent applications was filed by Chinese inventors, namely 1,101,864. The US was ranked 2nd with 589,410 submitted applications (see Table 4). However, Chinese innovators focus largely on the practical application of their inventions in their own country, and therefore submitted only 42,154 patent applications outside China, whereas the US innovators are more geared towards the outside world, having filed as many as 237,961 patent applications abroad, which, in turn, makes them the leader.

Table 4 – Impact of research and development funding level on commercialization of intellectual activity deliverables, 2015 (prepared by the authors using own calculation and official statistical data sources [39-40; 46-54],)

Countries	Number of submitted patent applications and obtained patents, 2015				Number of submitted patents in the EU per 1 mln residents, as of early 2015	Number of researchers including those having scientific degree, as of early 2015	Total amount of funds allocated to scientific and research field in 2015, % of GDP	
	WIPO	EPO		US PTO			Total	Of which state investment
	Patents	Applications	Patents	Patents				
China	1 101 864	31 504	5 721	9814	4.2	1 524 280	2.1	0.57
USA	589 410	65 754	42 692	155 982	115.74	1 247 125	2.77	2.06
Japan	318 721	50 597	21 426	54 422	169.02	682 935	3.47	1.78
South Korea	213 694	18 215	6 411	20 201	127.37	345 463	4.15	3.75
Germany	66 893	31 670	24 820	17 752	256.97	357 538	2.87	1.95
Switzerland	-	8 354	7 088	2 841	398.67	35 950*	2.96	2.63
Sweden	-	5 075	3 839	2 862	350.41	68 670	3.16	1.58
Great Britain	22 801	7 095	5 037	7 167	83.58	289 330	1.7	1.27
Singapore	10 814	1 029	391	1 048	68.9	42 542	2.2	0.8
Russian Federation	45 517	788	230	483	2.67	449 180	1.66	1.19
Poland	4 815	842	568	223	16.02	96 692	0.94	0.74
Ukraine	4 497	137	19	64	-	90 249	0.62	0.21
World	2 888 800	279 000	160 028	325 979	-	7 358 900	-	-

*provided data are for the year of 2012

Patents are the key profitable sale of intellectual property, since what they do is protect the exclusive rights of their holders. For this reason, conditions for commercializing scientific and research developments must first and foremost be created within the regulatory framework based on the principles of patent law, namely creative freedom, exclusive rights of the patent holder(s), innovativeness of items protected by the patents, their mandatory recognition by the state; respect for the interests of the patent holder(s) and society, protection of the deliverables of purely creative activities (product or process), moral and material incentives for the authors etc. [55].

Management of intellectual property asset (hereinafter referred to IPA) commercialization process dictates the need for unbiased evaluation of IPA as a new item of market relations. On a practical level, the evaluation of the commercial potential of intellectual property (hereinafter referred to as the IP) assets is determined by the cost-benefit evaluation method, consisting in contrasting the expenses with expected benefits for those using this IP, although other evaluation methods directly linked to IP ownership rights have been stipulated by the law [56, 57]. However, in order to evaluate innovative products to the maximum extent, it is critical to prepare an intellectual property portfolio, i.e. entire package of copyright protection documents intended to protect scientific and technological developments, including in other countries worldwide. This is a rather costly procedure which domestic higher education institutions are currently unable to afford.

Thus, even though the public officials explicitly declare that one of the country's top priorities is intensive use and fulfillment of scientific and technical potential, the actual state of technology transfer and mechanism for its implementation in scientific, educational and entrepreneurial activities points to the fact that the country has no market for science-based products. So far, the primary funding source for innovation activities of the universities has been poor budgetary funds that can only maintain the heat, but fail to ignite the fire.

Suggestions. Generally, the authors strongly believe that real changes within the context of arranging commercialization of scientific and research developments will take place, once the country starts following recommendations of the European Union [58] and using instruments in order to unite the scientific and research sector and business entities for stimulating the research and scientific work. In particular this means its financing at a sufficient level for effective innovative development, i.e. not less than 3% of GDP (according to international standards) [59] or at least 1.7% of GDP to reach the norms of financial providing the scientific and research work according to Article 48 of the current Law of Ukraine "On Scientific and Technical Activities". To boost innovative activities of the business it is necessary to provide grant credits on easy terms to companies and organizations able to generate innovations and commercialize them; to develop innovative infrastructure in the regions; to implement various programs; to place state orders for making scientific and technical research and developments in the form of contracts; to create scientific and technical areas having special regime of innovation and investment activities; to establish tax credits for investments involved in the field of innovation; to develop and to approve regulations intended to encourage development of research activities; to stimulate cooperation between academic research and business, as well as the work of the experts engaged in the field of innovation and technology transfer.

Thus, inference should be drawn that the key trends in commercialization of research deliverables are developed based on the principles and terms for materialization of scientific ideas and developments, as well as the forms of their transfer and the extent of eventual profitability. In Ukraine, the process of creating science-based business environment is reflected by the following:

- the scale and level of development of scientific and research developments' commercialization process in Ukraine, as well as the competitiveness of domestic products do not cater to the modern needs of the national innovation system's development or relevant indices and trends in developed countries of the world;

- in the years following independence, no complex and multifunctional models for technology transfer have been not fully developed in the Ukrainian scientific academic and research environment;
- the major problem when arranging an efficient process of technology commercialization is the lack of skilled personnel to be employed in the technology transfer departments, the key task of which is to encourage development of innovation activities in the country, since the management of the centers for technology transfer often has neither theoretical knowledge nor practical experience in managing innovative projects;
- switching to a commercial basis for development of the Ukrainian science becomes more complicated due to a passive mentality of the scientific community, which the Soviet era with its state-controlled economy took a toll on;
- essentially, the state, governing bodies of the universities, and research institutions do not use any moral or material incentives designed to encourage the scientists to engage in efficient innovative activities;
- the imperfect regulatory framework ignores i.e. does not stipulate the activities of the entities handling technology purchase and sale: centers for technology transfer, technology transfer networks, innovation centers, expert consulting firms etc.
- due to the lack of own funds, domestic research universities and institution are unable to set up own science-based business;
- insufficient amount of own financial resources used for the genesis and expansion of innovation processes is another factor contributing to low innovation activity and industrial enterprises in Ukraine;
- the businesses showing scanty demand for the know-hows, including academic developments and inventions that allow entering the market with the new competitive products;
- too high a percentage of commercial credits also does not facilitate the process of scientific and research developments' commercialization in Ukraine;
- large long-term investment projects impede the planning of economic and political turmoil's which often occur in the country.

Discussion. The development of schools of science and preparation of highly-skilled professionals in various areas of expertise in Ukraine requires creation of a transparent funding and innovation management mechanisms. Nowadays the efficiency of transfer of newly created technologies for commercial use is unfortunately extremely low. In some universities such as the Taras Shevchenko National University of Kyiv, the scientific community makes every effort to get the process of knowledge management up and running on its own, while taking into account available resources. However, the question concerning increase in commercial impact of the deliverables obtained by researchers of the university as a result of their activities needs to be worked on further, since virtually the global trends are hardly taken into account.

Prospects for further research. The stated conclusions will afford a solid foundation for finding effective strategies to commercialize deliverables of scientific and technological activities in Ukrainian research institutions.

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Академічний капіталізм: українські тенденції формування та європейська практика

У статті визначено тенденції формування академічного капіталізму в Україні, а саме розкрито основи становлення наукоємного бізнес-середовища в Україні та світі, зокрема в університетах, а також виокремлено закономірності комерціалізації результатів науково-дослідної діяльності у контексті посилення значимості знань. Здійснено порівняльний огляд найбільш поширених інституційних форм передачі технологій в Україні та за кордоном. Одержані результати дозволять сформулювати принципи для формування нової методичної парадигми керування процесом трансферу технологій з урахуванням особливостей розвитку вітчизняної науки, економіки, підприємництва та ринку високих технологій.

Ключові слова: академічний капіталізм, інновації, наукоємний бізнес, комерціалізація, центр трансферу технологій, науково-технічна продукція, патенти, євроінтеграція.

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В статье определены тенденции формирования академического капитализма в Украине. В частности, раскрыто основы становления наукоемкого бизнес-среды в Украине и мире, в частности в университетах, а также выделены закономерности коммерциализации результатов научно-исследовательской деятельности в контексте усиления значимости знаний. Осуществлен сравнительный обзор наиболее распространенных институциональных форм передачи технологий в Украине и за рубежом. Полученные результаты позволят сформировать фундаментальную базу для формирования новой методической парадигмы управления процессом трансфера технологий с учетом особенностей развития отечественной науки, экономики, предпринимательства, рынка высоких технологий.

Ключевые слова: академический капитализм, инновации, наукоемкий бизнес, коммерциализация, центр трансфера технологий, научно-техническая продукция, патенты, евроинтеграция.

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