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## SPIN-OUT COMPANIES AS A MODERN FORM OF TRANSFER OF TECHNOLOGIES FROM UNIVERSITIES TO THE BUSINESS ENVIRONMENT

**MRYKHINA Oleksandra,**

*Ph. D. in Economics, Associate Professor,  
Doctoral Student at the Institute of Economics and Management  
Lviv Polytechnic National University  
e-mail: oleksandramrykhina@gmail.com*

**ANDRUSHCHAK Nazariy,**

*Ph. D. in Economics, Assistant Professor Department of Computer Aided Systems  
Institute of Computer Sciences and Information Technologies  
Lviv Polytechnic National University*

**POBURKO Oleksiy,**

*Associate Professor, Ph. D. in Economics,  
Associate Professor of the Department of Finance  
Institute of Economics and Management  
Lviv Polytechnic National University*

**Annotation.** *The article analyzes prospects of development of spin-out companies as a modern form of technology transfer from universities to the business environment. In the conditions of development of academic entrepreneurship in Ukraine, a spin-out company is one of the first drivers of the symbiosis of commercial, educational and scientific spaces designed to form culture of academic entrepreneurship.*

*The authors have considered the essence and value of spin-out companies, characterized spinoffs and spinouts created by universities and analyzed their attributes in the context of transfer of technologies from universities to the business environment.*

*Hence, the authors have substantiated usefulness and inherent features of functioning of spin-out companies in Ukraine.*

**Key words:** *spin-out company, spinoff, spinout, university, commercialization, technology transfer, intellectual property object.*

**Problem statement and its connection with important scientific and practical tasks.** The experience of the technologically advanced countries shows that higher education institutions (HEI) generate a majority of innovative technologies. Estab-

**Аннотация.** *Проанализированы перспективы развития спин-компаний как современной формы трансфера технологий из университетов в бизнес-среду. Установлено, что спин-компания в условиях развития академического предпринимательства в Украине является одним из первоочередных двигателей симбиоза коммерческого, образовательного и научного пространства, призванная формировать культуру академического предпринимательства. Рассмотрены сущность и значение спин-компаний, охарактеризованы спин-оффы и спин-ауты, создаваемые университетами, проанализированы их атрибуты в контексте трансфера технологий из университетов в бизнес-среду. На основании этого обоснована целесообразность и характерные особенности функционирования спин-компаний в Украине.*

**Ключевые слова:** *спин-компания, спин-офф, спин-аут, университет, коммерциализация, трансфер технологий, объект права интеллектуальной собственности.*

lishing links with research and development departments of universities is the key factor of success of industrial enterprises in the market. Academic entrepreneurship is becoming an increasingly important source of development of the triple helix system

"University — Governmental authority — Business". One of the most common forms of interaction between science and production is organizing spin-out companies — spinoffs or spinouts.

Spreading spin-out companies is a reaction of business entities to challenges of the 4<sup>th</sup> Industrial Revolution, when a time lag from generation of an idea to its implementation in the finished product is significantly reduced. The delay in transfer of the latter in most cases leads to loss of market competitiveness of the involved business entities. Spin-out companies are called to respond promptly to market requests and be flexible with financial, economic, marketing and other positions. The main characteristics of the spin-out companies: isolation from the parent structure (university), small size, mainly a single-product purpose, etc. Due to these characteristics, spin-out companies become an optimal form of business organization based on innovative technologies.

In developed countries, spin-out companies contribute to development of ecosystems in order to generate and transfer technologies (in particular, the Silicon Valley in the USA, the Irish and Israeli innovative ecosystems, the City of Science (China, Hefei), etc.). In Ukraine, spin-out companies are at the stage of their formation. In general, Ukrainian universities support the vision of a "business university". Adoption of the Law "On Higher Education" [14] in 2016, which underlies implementation of academic entrepreneurship by higher education institutions, was an important step towards this direction. However, there are still a number of unresolved issues regarding the functioning of spin-out companies. These issues include the imperfection of the legislative environment of spinoffs and spinouts, a low level of venture capital funding, the complexity of evaluating technologies developed at universities, as well as the allocation of intangible assets in technology as a contribution to the charter capital of spin-out companies created by universities, etc.

In the Global Competitiveness Index [24], the indicator of "innovation" equals 52 in 2016—2017. It is significantly higher than the position of this indicator in previous periods because of improvement of positions of almost all components of this indicator, except one — "cooperation between universities and business in the field of research and development" (82). However, according to materials of the studies of the Ukrainian Statistics Service [3; 10; 11], this indicator in Ukraine has the most significant potential for development. The cross-comparison of the indices of the scientific and educational spheres,

innovations and technologies indicates their divergence and, consequently, different effectiveness and influence on the Global Competitiveness Index. According to the level of coverage of higher education in 2016-2017, Ukraine ranked 11<sup>th</sup> — a rather high position, with the presence of state-of-the-art technologies — 98<sup>th</sup> place that is a low position. One of reasons for such situation is the disruption of the interaction between business structures and universities. There is an urgent need to revise the established approaches to organizing business in Ukraine on the basis of university innovation technologies.

**An analysis of the latest research and publications that initiated the solution to this problem.** The works of such domestic scientists as Tsybuliov P. M. and Chebotariov V. P. [15, 16], Chukhray N. I. [17] and others are dedicated to problems of spin-out companies. Agarwal R., Echambadi R., et al. [18], Algieri, B., Aquino, A. [19], Clarysse B., Wright M., et al. [20], Druilhe C. D., Garnsey E. [21], Harrison R. T., Leitch C. [23], Kroll H., Liefner I. [25], Müller K. [26], Rasmussen E. [27], Shane S. [28], Siegel D. S., Wright M. [29], Visintin F., Pittino D. [30], Żebrowski P. [31] are among foreign scientists who devoted their works to a matter of development of spin-out companies.

Illiashenko S. M. [4], Pererva P. G. [12], Kosenko O. P. [8; 12] address in their works to issues of organizational and methodological support for technology transfer and the role of universities in this process. The authors considered some aspects of this problem in the works [6; 9].

Scientists and practitioners confirm that due to the introduction of innovative technologies into the market, fundamental changes often occur not only in related industries, but also in related sectors of the economy. Therefore, the study of spin-out companies as binding forms of science and production is of scientific and practical importance.

**Separation of previously unsolved parts of the general problem, to which this article is dedicated.** Despite the existing work of scientists and practitioners within the framework of the above-mentioned topics, development of spin-out companies as a form of technology transfer from universities to the business environment in Ukraine has not been significantly researched. Generally, spinoffs and spinouts are considered as subsidiaries of enterprises. However, spin-out companies are one of the main drivers for modern universities that promote entrepreneurial activity. At present, there is no necessary number of methodological grounds for spin-out companies that can be created by universities.

Scientists and practitioners have not developed methodical tools being sufficient for ensuring of the activity of spin-out companies. In view of the above-mentioned facts, this study is dedicated to one of the most important theoretical and applied questions — the study of spin-out companies as a form of technology transfer from universities to the business environment. Development of this issue will be a fundamental element for further study of other issues of spin-out companies.

**The purpose of the article** is to analyze prospects of development of spin-out companies as a modern form of technology transfer from universities to the business environment in Ukraine. To achieve this purpose, the authors have set and solved the following tasks: 1) to consider the essence and value of the spin-out companies; 2) to characterize and analyze features of spinoffs and spinouts as a modern form of technology transfer from universities to the business environment; 3) to substantiate prospects of spin-out companies in Ukraine.

**Presentation of the main material of the study with full substantiation of the received scientific results.** 345 higher education institutions of Ukraine, 229 of which are in charge of the Ministry of Education and Science of Ukraine, have the right to carry out research and development (R&D). Such amount of HEIs relative to the population and a number of socio-economic indicators of Ukraine confirms the high scientific-technical and scientific-technological potential of the domestic sector of higher education and the ability to carry out R&D and to produce technologies that can be transferred to business. Almost two-thirds of funds spent on innovation activity in Ukraine in 2017 were for the purchase of equipment [2], while expenses on obtaining rights for new objects of intellectual property (IP) or realization of R&D are significantly lower. Growth of GDP due to the introduction of new technologies in Ukraine is estimated at only 0.7—1% [2; 3]. The state of R&D in Ukraine has a negative impact on foreign trade of science-intensive products. An attempt to break the crisis by the way of increase of the export of traditional goods and raw materials makes the crisis permanent.

In the world, spin-out companies are considered to be optimal forms of combining the interests of science and production. This form implies further possession of IP by a university and, with proper output of product to the market, the long-term revenue from sales.

Although large enterprises are able to carry out R&D on their own, in present-day conditions trans-

fer of scientific research on outsourcing by external actors of technology generation with a view to its transfer has shown higher efficiency. Such enterprises open their offices on the basis of universities that are engaged in innovation activities (or organize branches of university departments). Thus, they reduce the time between scientific discoveries and their implementation. Chukhray N. I. et al. in [17] note that usually potential customers — industrial enterprises are not interested in supporting university projects because of a high risk and long payback periods. Enterprises are ready to implement only fully completed projects with minimal investment and a short payback period. Universities do not have working capital to make their development ready for implementation. Hence, in some cases, developers unreasonably overprice. Consequently, each of the participants of the process is trying to maximize cost advantages of their activity on the market and minimize their risks [17, p. 100]. Therefore, the creation of spin-out companies by universities is a way to get out of this situation and to strengthen their competitive position.

Traditionally, the concept of spinoff is widely used both in business and in other spheres of life, since its understanding has broad interpretation and application. In the economy, the concept of a spin-out company is in fact a definition of an economic entity created by separating from a parent organization for implementation of activities that otherwise are difficult or impossible to implement. It is the formation of a new company, mostly not from scratch. The content of "spinoff" can be interpreted as "by-product", "additional advantage" and "extra revenue". In other words, a spinoff provides some of the added advantages that arose during implementation of the primary activity. The spinoffs are organized by the separation of the employees of the unit from the parent structure (university), using its material (in particular, legal services, accounting, auditing and marketing services, use of the distribution channels of the parent company, etc.) and intellectual potential. Spinoffs are often created by turning the parent company into the independent structure.

In fact, the spinoffs are "companies-successors" that are separated from the structure of a university in order to develop independently and introduce the innovative product or technology into the market. A spinoff is a company founded by at least one employee of a research organization with a degree in science. The main reason for the separation from a university is the fact that independent spinoff activity will be more successful than within a university.

From the standpoint of the estimated value, a spinoff will cost on the market more than as a component in the form of a university. It happens due to the expectations of higher revenues from a spinoff being an independent. In the case of such separation, a university may retain a large proportion of a commercial enterprise for a certain period. Then, it can distribute or sell the rest of his shares if a spinoff is successful. Otherwise, a spinoff again joins a university. A parent institution plays the decisive role because its capital determines the competitive positions of a spinoff. A typical spinoff is a company that produces products based on the innovative technology developed at a university from which a spinoff was created. Basically, a scientist (scientists) from a university has a share of stock, as well as the university itself through a separate legal entity. Spinoffs and spinouts are often considered to be the commercial activities which use university's intellectual capital, unique equipment, etc. Transparency of procedures with IP and compliance with the rules of commercial activity established by law play the key role in the functioning of spinoffs.

The European Trend Chart on Innovation [22] proposes such definition of spinoff: it is an enterprise created on the basis of research results coming from the public sector of research and development. This also applies to enterprises created for students, graduates, scientists and other employees for the commercial use of ideas developed at state universities or scientific institutions.

A peculiarity of spinoffs, in contrast to spinouts, is that these companies are independent from a parent organization. They do not depend on capital and other circumstances related to current activities. They can work in other areas of the market or compete directly with the parent organization.

In the literature, there is no agreed acceptable classification of spinoffs for institutions and researchers. The term "spinoff" is often used in mutually exclusive contexts. There is a discussion about which of the names — "spinoff" or "spinout" should be applied to a planned process of forming a company by an academic institution and which — to an unplanned.

R. Agarwal et al. in the work [18] use the term "spinout", emphasizing that it primarily relates to the creation of industrial companies without interference of higher education institutions.

Sometimes the terms "spinoff" and "spinout" are used as synonyms. K. Drulhe and I. Garnsey in [21], analyzing various aspects of the establishment and functioning of spinoffs, use these terms as interchangeable concepts.

University spinoffs or academic spinoffs are an important form of technology transfer from universities to the business environment. As the analysis of literary sources shows, an approach to understanding the phenomenon of companies like "spin" is different, depending on the purpose of a particular study. However, the considerable latitude in defining the concept of university spinoff can cause disputes. For example, S. Shane [28] argues in favor of the narrow definition of spinoff. The researcher points out that the spread of the above-mentioned understanding of a spinoff among the enterprises founded by the individuals who have ever studied or worked at universities or research institutions will lead to the group being so large that it will not be different from the vast majority of companies in the market of companies. The authors draw attention to a need to track the origin of objects of the right of intellectual property, on the basis of which the spinoffs are created. The main difference between the university spinoffs and spinoffs created by the business consists in the very motives for the foundation of the company. In addition to the main motive, spinoffs are also the way to generate revenue from an untapped resource-technology/ rights to IP, which are produced during R&D. It is advisable to specify those that do not refer to the spinoffs created by the business:

- formalization of the use of entrepreneurial potential of workers, which is designed, in particular, to limit the threat of the shadow economy in the sphere of the use of intellectual property;
- an opportunity to increase the university's rating, which is a result of the existence of a number of systems that assess higher education institutions.

The relations between university spinoffs and an institution, from which they originate, may be of the following types:

- lack of formal links, often combined with informal use of decisions taken at universities;
- a spinoff was founded on the basis of a license agreement for the use of scientific and technical developments;
- participation in capital that provides the university in exchange for granting the rights to IP.

As practice shows, the relations of the second and third types are the most popular.

A group of scientists [20] has developed the typology of university spinoffs according to the support they get from the parent institution. There are three main support models:

- model of a low selecting level is focused on creating as many spinoffs as possible;

- supporting model is associated with the provision (on the basis of commercial and non-commercial relations) of certain types of resources to the spinoff;

- an incubator corresponds to the concept of a technology incubator with a large selection at the entry to the program and, also, a long period of support at various stages and spheres of spinoff's activities.

In the narrow sense, a spinoff is a new enterprise created by an employee of a HEI, who had used intellectual resources of the institution to accomplish this goal.

Outlining boundaries of university spinoffs, it is worth noting that they must meet the following basic criteria:

- to be a new company that is an independent legal entity;

- to not contain an organizational unit created within existing business;

- to acquire strategic advantages by using the scientific and technological capital obtained from the university;

- people who worked in a parent organization should play the key role.

From the practical point of view, spinoffs are considered as certain channels of technology transfer, as a link between R&D and the market. Acting at the intersection of science and business, they are particularly sensitive to demands and trends in the market of innovative technologies. Spinoffs take on risks of commercial activity that arise during implementation of research projects.

Spin-out companies are the "buds" of the university and retain close ties with it, unlike spin-off companies. Spin-off companies have greater liberty of action, an ability to develop innovative products independently or to organize production. Spin-out companies keep dependence on a parent organization for financial and operational relations.

A spin-out company is a company created with the help of resources of an institution (university, research center, etc.), or a company that initiates the creation of technologies. HEI usually serves as a base for supporting the work of a spinout at least until the first tranche of venture capital investments is received. Staff employees of an institution or company are often transferred to a new company on a permanent and temporary basis until the final set-

tlement of company's status. The spin-out company, as a rule, is autonomous with respect to a university and has independent sources of financing.

Important results of the activity of spin-type companies are additional revenue for the parent company's budget, as well as the increase of the innovative activity of the founding company aimed at innovative development that is especially important for universities and research organizations. In addition to implementation of scientific developments, university spin-out companies are capable of creating jobs and expanding research activities. Both forms of organizing spin-out companies are based on a joint-stock mechanism of investment in a new company. A founding company possesses the controlling interest of a newly created firm. If the firm works successfully, the company can either introduce the firm into its structure or sell it profitably [31].

Spinoffs and spinouts are the demonstration of academic entrepreneurship. They are forms of the practical use of results of R&D mainly by universities (researchers, postgraduate students, students, graduates, etc.) in business, their commercialization; business projects created by the academic environment are based on innovation. The main task of spinoffs is to bring the results of R&D of a scientific institution to the state in which they can be used in the industry. Today, spinoffs and spinouts are considered to be one of the most active tools for the transfer and commercialization of technologies.

As a result, there are the Anglo-Saxon approach to the activities of universities, the so-called "ivory tower". It reflects criticism of the elitism of academic institutions and their separation from everyday activities. It points to the scientists of a certain "elite" group that deals only with issues created by themselves. They are not interested in commercializing results of their R&D.

On the other hand, the creation of university spinoffs denies the phenomenon of "tower ivory", since their main component are scientists involved in practical implementation of their research and the result of the spinoffs' activity are not only patents, but also real products brought to the market. In fact, university spinoffs are tools for implementing entrepreneurial activities of scientists.

The recent study has allowed defining the main characteristics of the spin-out companies (*Table 1*).

The main characteristics of the spin-out companies

Positions of characteristics	Type of company/ characteristics	
	Spinoff	Spinout
Advantages	<ul style="list-style-type: none"> <li>– The idea of creation is fulfilment of specific needs of the market;</li> <li>– subjects that meet market demands are selected among university's R&amp;D;</li> <li>– flexibility of the spinoff's organizational structure and efficiency of implementation of business processes in comparison with a university;</li> <li>– transparency of financial flows associated with the absence or a minimum number of intermediaries in the spinoff activity;</li> <li>– reducing a level of risks for a university, since specialists are involved in a spinoff</li> </ul>	<ul style="list-style-type: none"> <li>– A spinout is created for long-term fulfilment of certain market needs;</li> <li>– the gradual transfer of IP and other parts of university's scientific and technological capital to a legal entity that stimulates investment of a given spinout and its accelerated development;</li> <li>– obtaining all the necessary resources in the short term with simultaneous independence of doing business allow to achieve efficiency and flexibility of business processes of a spinout</li> </ul>
Motives for setting up companies	<ul style="list-style-type: none"> <li>– Commercialization of technologies (results of R&amp;D, inventions, innovative solutions, etc.), meeting needs of the market;</li> <li>– application of the scientific and technological potential of a university;</li> <li>– the lack of prospects for introduction of technology in the market by a university caused by bureaucracy;</li> <li>– the lack of time to continue R&amp;D on certain subjects at a university;</li> <li>– the increase in the market value of the company outside a university compared with its value within a university;</li> <li>– developing the corresponding technology by a market niche</li> </ul>	
Prerequisites for setting up companies	<ul style="list-style-type: none"> <li>– Market inquiries, the urgency of commercialization of relevant R&amp;D at a university;</li> <li>– skills and willingness of scientists and developers to be engaged in academic entrepreneurship;</li> <li>– participants take responsibility for risks in the activity of a spinoff;</li> <li>– protection of IP rights</li> </ul>	
Legal form of organization	All types of business entities	
Restrictions	<ul style="list-style-type: none"> <li>– Predominance of the teaching work of participants of spin-out companies;</li> <li>– the inconsiderable interest of a university in stimulating the creation of spinoffs;</li> <li>– "ostracism of the environment" of a scientific community around scientific personnel, which contact with entrepreneurial structures;</li> <li>– a relatively low level of scientists' entrepreneurial knowledge and competencies and, consequently, the lack of skills in business management;</li> <li>– the lack of or insufficient funding;</li> <li>– problems with IP rights;</li> <li>– participants' ignorance of regulatory and legal aspects of technology transfer;</li> <li>– results of university R&amp;D are not always technological solutions being suitable for direct commercialization</li> </ul>	

Note. Systematized by the authors.

According to the world experience, in the long term, spinoffs and spinouts are the best options for commercialization of R&D, because the cost of the developed technology, which is the basis for the creation of a company, is often substantially larger than the cost of licenses sold for it.

According to the research on development of spinoffs and spinouts in Ukraine, in the 1990s

and early 2000s, Ukrainian scientific-research organizations had experience in the formation of small innovative enterprises (spin-type companies). However, after the adoption of the Law of Ukraine "On Management of Objects of State-Owned Property" in 2006 and the restriction of rights of budget institutions that created such companies, this activity has been practically stopped since

2006 (until the adoption of the Law of Ukraine "On Higher Education").

Today, despite a large number of programs and initiatives designed to promote academic entrepreneurship in Ukraine, a number of created spinoffs and spinouts is still insignificant. The study of reasons for this situation has shown that during 2012-2017 the main barriers of commercialization of technologies encompassed:

- insufficient knowledge of scientists about the realities and mechanisms of the market; the neglect of the study of marketing tools, a gap between subjects of R&D and market demands;

- the lack of practical experience in commercialization of university technologies, as well as normative-methodical knowledge;

- excessive workload of developers with educational and research work, the lack of specialists in the transfer of academic technology;

- sluggishness and low motivation of scientists to start and run a business.

At the same time, the lack of funds for the purchase of necessary equipment slows down the academic entrepreneurship of domestic universities.

Generalized features of university spinoffs are shown in *Figure 1*, spinouts — in *Figure 2*.

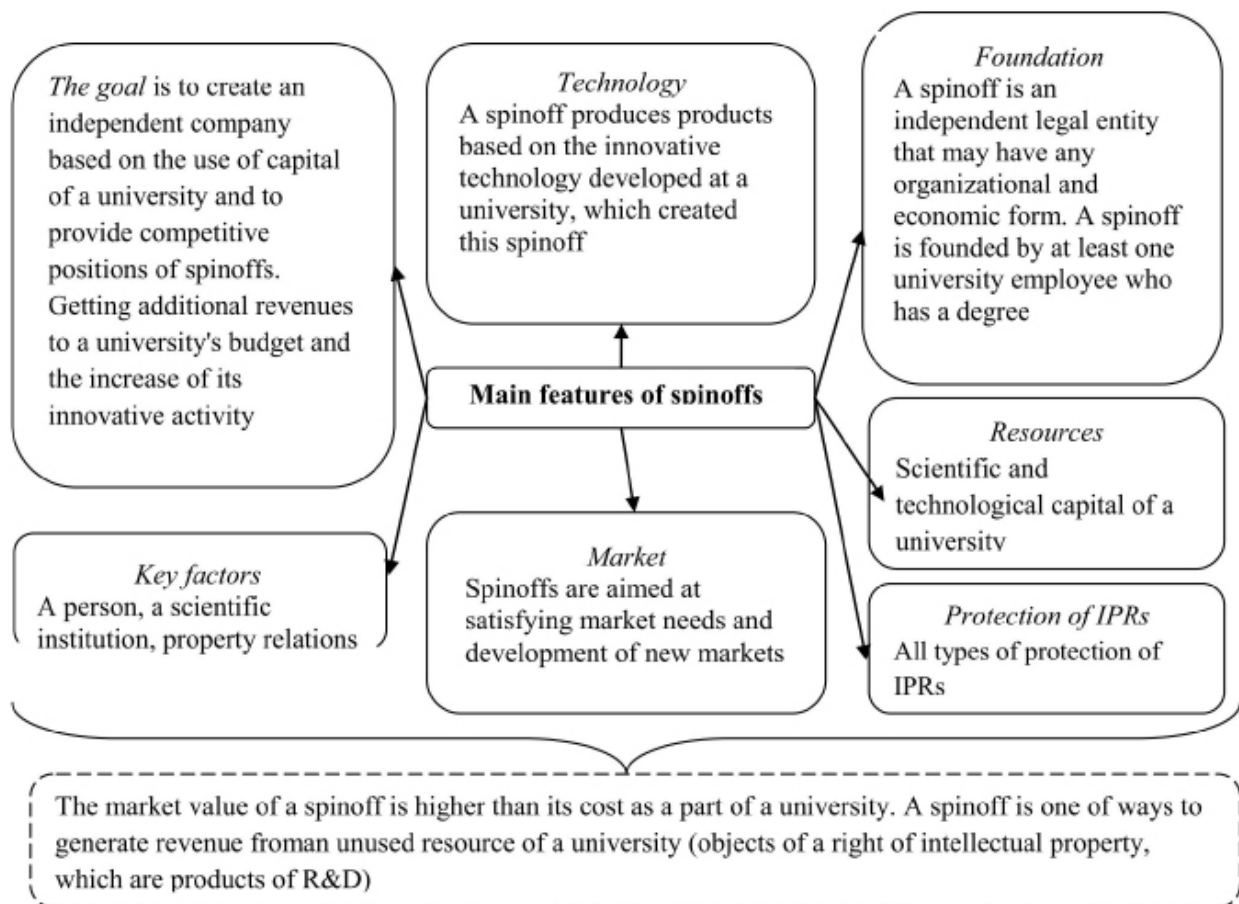


Figure 1. Main features of university spinoffs

Note. Formulated by the authors.

The contemporary economic science does not pay enough attention to development of conceptual models of functioning of spin-out companies. The solution to this problem should not be of a local format, in the context of a particular university, but of a global one. Models of spinoffs and spinouts should be integrated into the modern system of triple helix

of interaction "University — Governmental authority — Business".

This will contribute to the formation of a successful innovative ecosystem where a university will occupy the proper place and the transfer of technology will become a function of the effectiveness of this ecosystem.

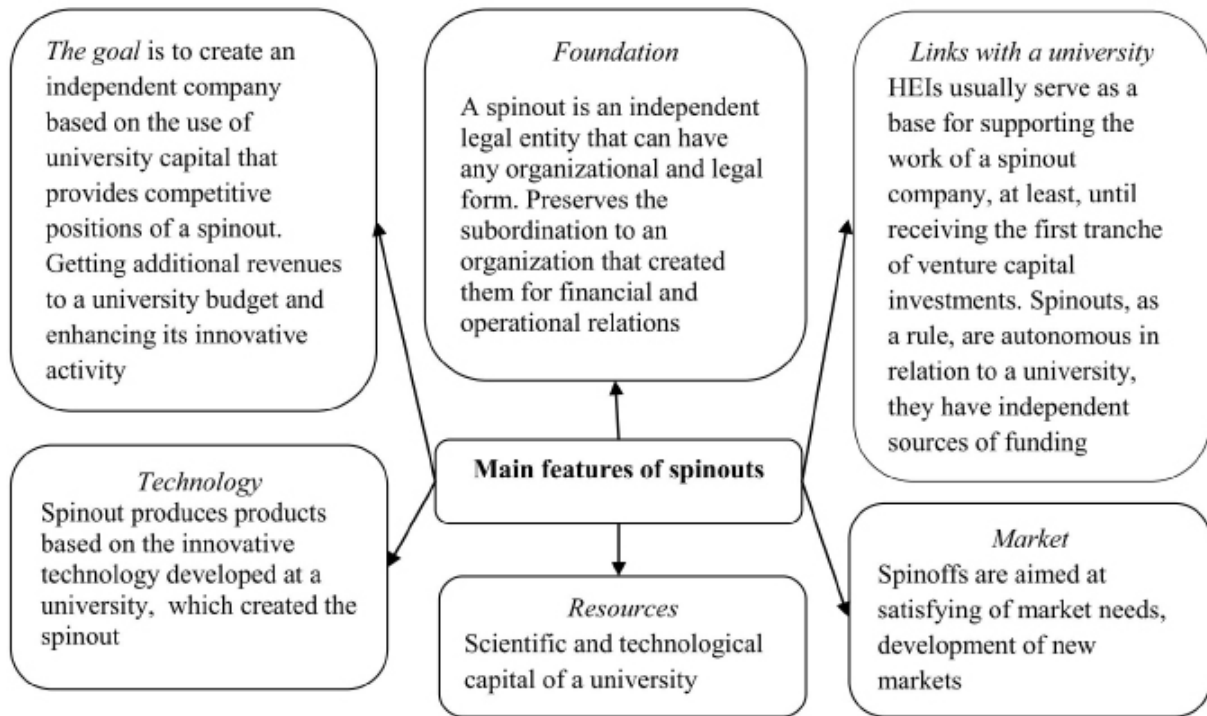


Figure 2. Main features of university spinouts

Note. Formulated by the authors.

Using the SWOT analysis, we summarized advantages and disadvantages of creating a spin-off company by universities (Figure 3).

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>– participation of universities in development of a product they generate;</li> <li>– carrying out further research with financing from income of a spin-out company, etc.</li> </ul>	<ul style="list-style-type: none"> <li>– a loss of intellectual property rights to an object of a spin-out company by a university;</li> <li>– a problem with share contributions being a result of a frequent lack of funds from a university, etc.</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>– product development in the market and development of new markets;</li> <li>– high probability of market success, ensured by a desire of spin-out company to make profit;</li> <li>– a possibility of spin-out company to become a research center (important from the point of view of further obtaining tax benefits);</li> <li>– a possibility of creating strategic alliances with other firms;</li> <li>– access to foreign markets;</li> <li>– development of business with capital coming from credit and banking institutions, etc.</li> </ul>	<ul style="list-style-type: none"> <li>– a risk of loss of deposits in case of bankruptcy of a firm;</li> <li>– unresolved legal issues of intellectual property rights in universities;</li> <li>– ineffective management of a spin-out company may lead to the failure in income generation, etc.</li> </ul>

Figure 3. SWOT-analysis of the creation of spin-out companies by universities

Note. Formulated by the authors.

**Conclusions of the study and prospects for further development in this direction.** In Ukraine, traditional entrepreneurship is more developed than innovative one. At the same time, the innovative progress occurs with development of interac-

tion between the industry and universities. Scientific and technological development of a university is one of the most important factors of successful innovative development of the country. Universities make a significant contribution to development of



the knowledge economy and form an intellectual society. Thus, a spin-out company as a form of business organization is intended to provide a symbiosis of commercial, educational and scientific spaces. On the one hand, encouraging organizing spin-out companies will contribute to the rapid and effective technology transfer from universities to the business environment. On the other hand, it will form culture of academic entrepreneurship.

The study of the problems of spin-out companies has confirmed a high level of relevance and viability of this form of business for Ukrainian business entities. Simultaneously, new issues (methodological, regulatory, financial and other bases for main-

tenance of university spinoffs) require elaboration. The integrated approach to these issues will help to turn the technology transfer from universities to the business environment into a functional component integrated into a pro-active strategy of university development.

This will make it possible not only to respond to market requests, generating new materials, technologies, etc., but also to meet them in a comprehensive and long-term manner. Thus, the spinoffs and spinouts will contribute to a qualitative increase of a level of activity of all participants in the innovation process and improve economic welfare of the country.

#### ПОДЯКА

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