

Oleksandra B. Mrykhina<sup>1</sup>

## CONCEPTUAL FRAMEWORK FOR THE FORMATION OF INFORMATION AND ANALYTICAL SUPPORT SYSTEM FOR TECHNOLOGY TRANSFER

*The article develops the conceptual framework for the formation of information and analytical support in the field of technology transfer (TT) based on the system approach. The loads of the data used for information and analytical support of TT are systematized in structural units, in particular: theoretical and practical support for TT; social provision for TT. The research on the components of information and analytical support for TT enabled the determination of a range of problems in Ukraine's technology transfer; the ways to solve them are grounded.*

*Keywords: information and analytical support; technology transfer; innovation; system approach.*

Олександра Б. Мрихіна

## КОНЦЕПТУАЛЬНІ ЗАСАДИ ФОРМУВАННЯ СИСТЕМИ ІНФОРМАЦІЙНО-АНАЛІТИЧНОГО ЗАБЕЗПЕЧЕННЯ ТРАНСФЕРУ ТЕХНОЛОГІЙ

*У статті розроблено концептуальні положення щодо формування інформаційно-аналітичного забезпечення трансферу технологій (ТТ) на засадах використання системного підходу. Множину даних, які використовуються для інформаційно-аналітичного забезпечення ТТ, систематизовано у структурні блоки: теоретичне та прикладне забезпечення ТТ; законодавче і нормативне забезпечення ТТ; фінансове забезпечення ТТ; соціальне забезпечення ТТ. Дослідження компонент, які складають концепцію інформаційно-аналітичного забезпечення ТТ, дало змогу виявити низку проблем вітчизняного ТТ, обґрунтувати шляхи їх розв'язання.*

*Ключові слова: інформаційно-аналітичне забезпечення; трансфер технологій; інновація; системний підхід.*

*Табл. 3. Літ. 15.*

Александра Б. Мрыхина

## КОНЦЕПТУАЛЬНЫЕ ОСНОВЫ ФОРМИРОВАНИЯ СИСТЕМЫ ИНФОРМАЦИОННО-АНАЛИТИЧЕСКОГО ОБЕСПЕЧЕНИЯ ТРАНСФЕРА ТЕХНОЛОГИЙ

*В статье разработаны концептуальные положения формирования информационно-аналитического обеспечения трансфера технологий (ТТ) на основе использования системного подхода. Множество данных, которые используются для информационно-аналитического обеспечения ТТ, систематизированы в структурные блоки: теоретическое и прикладное обеспечение ТТ; законодательное и нормативное обеспечение ТТ, финансовое обеспечение ТТ; социальное обеспечение ТТ. Исследования компонент, составляющих концепцию информационно-аналитического обеспечения ТТ, дало возможность вывести ряд проблем отечественного ТТ, обосновать пути их решения.*

*Ключевые слова: информационно-аналитическое обеспечение; трансфер технологий; инновация; системный подход.*

**Problem setting.** Merely countries of the world are now on their evolutionary way to the new form of economy – that is knowledge economy which requires a brand new toolkit for achieving and maintaining competitive positions for all sectors and fields of activities. Ukraine is officially declaring its innovational type of further

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<sup>1</sup> National University "Lviv Polytechnics", Ukraine.

development based on the principles of knowledge economy, the key element of which must be the enhancement of the so-called high technologies. According to the Law of Ukraine (Law 143-V, 14.09.2006), high technologies are those which are produced on the basis of the most novel scientific knowledge, thus technologically outperforming best national and international counterparts in terms of competitiveness at national or global markets. The whole process of such high technologies creation and implementation is followed by a range of supplemental tasks, known as technology transfer (TT). For Ukraine one of the reasons for TT hindering is insufficient quantity and quality of information and analytical support for this process.

Information and analytical support for TT includes rich and various knowledge database aimed at promoting the most efficient transfer of technologies at all stages of development. For example, a database consisting of national and foreign research reports can serve as a range of best practices and analogues for further development (of a model, mechanism etc.) It can also be presented as a database of information on individual researchers and research institutions working on specific technologies and/or innovations in various fields of knowledge. Moreover, legislation and normative background should also be mentioned here. Important features of information and analytical support for TT are timeliness and completeness of information for those, who need it. And this in its turn requires an efficient form of cooperation between national and international networks.

Besides the factors already mentioned above, the current stage of Ukrainian economy's development requires a significant state support for the information and analytical support development for TT. According to the official statistics (State of development..., 2012), in 2012 the expenditures on the establishment and development of innovative infrastructure (which, inter alia, includes the support system for TT) amounted for only 0.1% of the total budget expenditures. Same situation and amount are observed for new technologies purchase – again 0.1% in the total expenditures. At the same time the volume of budget spending on other innovation-related directions were much higher: purchasing machines, equipment and software – 26.8%; marketing and advertising – 4.3%; other innovation-related expenditures (which are mostly payments for R&D works) amounted for 68.7%. The situation can be called a dead-end one, since the structural units which are supposed to be producing knowledge-intensive and high-technological products experience the absence of information and analytical support for it, in the field of TT in particular, due to extremely low state spending (0.1%).

Marketing, advertising and other related expenditures are only partially involved in TT support and are treated as rather independent directions of work.

Besides, if to consider those directions that are financed as being innovative in order to check for the presence of any particularly new production, it turns out that none of them is bearing innovativeness at all.

The problem of developing information and analytical support systems for technology transfers is closely related to both science and business. On one hand, for its solution it is vital to formulate certain organizational and methodological procedures for TT maintenance. On the other, it is expedient to develop certain software products for the most efficient information and analytical support for TT practice. Today there is quite a variety of software for databases and data warehouses developed by such companies as *Hewlett-Packard*, *IBM*, *Platinum Technology*, *Microsoft*, *Oracle*,

*SAS Institute, Software AG* etc. However, Ukrainian analogues of such software that would take into consideration the local features of TT in our country, are not yet present at the market.

Considering the importance of this problem, in this article we present the theoretical and methodological framework of information and analytical support for TT.

**Recent research and publications analysis.** Technology transfer problems and in particular its information and analytical support have been considered in the works by T. Yevtukhova (2005), O. Kamianska (2008), R. Koval (2008), O. Kuzmin and N. Georgiadi (2006), L. Kurbetdinova (2012), K. Ivanova (2013), O. Parkhomenko (2006), M. Plechawska-Wojcik and J. Rubka (2013), O. Solovyov (2005), V. Smirnova (2006), S. Petrenko et al. (2013), A. Yamchuk (2012) etc.

Most often the mentioned above and other authors consider information and analytical support in the context of studying the technology transfer concept itself. In particular, A. Yamchuk (2012), studying this issue in more detail, grounds that information and analytical support for TT must include a set of interrelated methods, activities and tools (of scientific, methodological, social & political, economic, technical, organizational and legal nature) that would enable the realization and functioning of such information and analytical support. For efficient technology transfer the most important issues are collecting, sending, processing, analyzing, saving and finally presentation of information.

O. Kamyanska's (2008) work is dedicated to the systematization of theoretical grounds in this field and further development of scientific, methodological and practical recommendations on TT management. The author demonstrates the most widely spread bottlenecks in the support for technology transfers, also showing that efficient TT is hardly possible at all without its preliminary information and analytical support. This is quite reasonable since any management process, TT-related or not, needs a background, that is a set of methods for its realization.

Wider access to the Internet these days and rapid growth of Internet resources in general has led to a new problem (and a new skill at the same time) – finding necessary information. Low relevance of the information found and provided would not increase the efficiency of information and analytical support for TT. In this context scientifically and practically valuable is the approach of T. Yevtukhova (2005), who was the first to apply the methods of expert evaluation within the fuzzy set theory to solve the problem of structuring the information-analytical support for TT. Within the framework of TT aspects practical application an interesting approach is suggested by M. Plechawska-Wojcik and J. Rybka (2013) who investigated a range of tools used in commercial promotion of scientific achievements basing on information technologies. In this context a significant practical contribution is also presented by O. Parkhomenko (2006) who studied the correlation between patent statistics and the actual scientific potential usage of the database of Ukrainian Institute of Technical and Economic Information for certain sectors of the economy. The process of constructing the system of information-analytical support should be accompanied by the analysis of the conditions under which these new products are developed, understanding also all the key stages in the support needed.

Special attention should be paid to the works of the scientists who have developed the methodological approaches to formation of the system of information-analytical support for TT, and these would be: R. Koval (2008), O. Kuzmin and

N. Georgiadi (2006), L. Kurbetdinova (2012), O. Parkhomenko (2006), O. Soloviyov (2005) and V. Smirnova (2006).

And finally, K. Ivanova (2013) and S. Petrenko et al. (2013) consider the issue of the contractual grounds for TT procedures, highlighting at this all legislative drawbacks and bottlenecks. They also state that information-analytical support for TT maintenance must be based on the reconsidered and also brand new legislative acts because without them TT procedures would be of low efficiency.

**Unresolved issues.** A significant research interest to the topic under study proves that the issue is topical indeed and important for many. All the authors mentioned above have been studying the TT issue from the viewpoint of a particular system (sub-system) within information-analytical support in general. An open issue remains here, and that is the formation of the general system as such, which assumes grouping and systematization of the already existing science-based solutions which would altogether build a joint system and help see the gaps in the existing information and analytical support mechanism for TT, thus enabling any further corrections needed.

**Research objectives.** The current work is aimed at developing the conceptual framework for the formation of information and analytical support for TT maintenance based on the system approach.

For the achievement of the aim formulated above the following tasks are put forward:

1. To group the existing theoretical and methodological approaches to components formation within the information and analytical support for TT basing on the system approach.
2. To determine the bottlenecks in the development and application of the components within the system of information and analytical support for TT.
3. To ground the ways and instruments of improving the components belonging to the system of information support for TT.
4. To develop the conceptual framework for the formation of the system of information and analytical support of TT.

**Key research findings.** Grouping the existing theoretical and methodological approaches to improvement of the information-analytical support system for TT enables us to define the top-priority ones (Table 1). For the table from the variety of components we have chosen those that may be treated as fundamental from the viewpoint of the system and concept formation for the information and analytical support for TT.

Analyzing the presented components of the information and analytical support system for TT we can define a range of problems adherent to national TT.

First of all, it is important to pay attention to the complexity of getting information about the existing and potential innovations. This kind of information is first of all needed for R&D staff for timely evaluation of their position and status at the market and in their search for comparable technologies for further transfer. The solution of this problem would lead to reconsideration of the existing databases and the creation of the new ones (in particular, on the basis of national computer and information networks) which would contain information on local and international innovations at various stages of their life cycle along with the details on various patents and information on access to them. It is worth noting here that in Ukraine there exist the

National network for technology transfer (NNTT), however, this network and similar ones are oriented mostly on professional participants while individual researchers and inventors are left out, though they feel the biggest need in information access on world innovations. Besides that, data banks must be maintained in the mode on constant update, while the existing databases are often outdated and late with that.

**Table 1. Theoretical and methodical approaches to development and improvement of the components within the information and analytical support system for TT, authors' development**

Author	Developed or improved components within the system of information and analytical support for TT
L. Kurbetdinova (2012: 9)	The author developed the methodical approaches to the formation of accounting & information support for the management of innovative activities basing on application of accounting records and special accounts and considering the stages in the life cycle of innovations and the features of economic operations while performing the innovative activity by the enterprises of the food industry.
O. Solovyov (2005)	The author considers the information and analytical support as an element within the general improvement of the mechanism for innovative processes regulation.
O. Kamyanska (2008)	The author develops the conceptual grounds for TT management basing on the process approach, formulating the aim and the tasks of management and defining the principles of TT processes organization along with its integration into the system of strategic management which enables the comprehensive, consumer-oriented management of TT at national machine-building enterprises.
O. Kuzmin and N. Georgiadi (2006)	The authors develop the theoretical grounds along with practical recommendations on the formation and application of integrated information system for managing economic development of an enterprise basing on the cumulative target approach. This approach forms the basis for the mechanism of system identification and target usage for clarifying static and dynamic features of an object under study (information systems for managing the economic development of enterprises) in its relation to other objects.
A. Yamchuk (2012)	The researcher proves that the methodological grounds for TT and its information and analytical support can be presented as a chain of processes of technological audit, system analysis, strategic and tactical management along with prospects forecast.
V. Smirnova (2006)	The author presents a particular order of forming the information managerial system for an enterprise which enables the construction of a hierarchy of access to managerial information in order to optimize the process of enterprise management and the structure of its information flows. The author also updates the forms and the directions of information support for enterprise activity with application of an original system of decision-making based on the formed database and a complex of simulation models of enterprise functioning.
O. Parkhomenko (2006)	Basing on the general theory of systems the authors develops a comprehensive approach to developing the information grounds for research activities. The very technology of information and analytical support for middle-level management within the system of scientific and technical information is improved with parallel determination of managerial hierarchy and the types of information resources base. The process of analytical and synthetic processing of information is presented with the determination of stages in information resources formation for various managerial levels.
R. Koval (2008)	The author suggests to use for information and analytical support of state authorities and local self-governments the technology of developing and implementing expert systems which would enable the solution of semistructured and poorly formalized tasks of state administration.

In parallel with dissemination of information on innovations, it is necessary to solve one more important problem – more widely spread Internet access among Ukraine's population, since all databases and data bank nowadays are operating online. Statistical data on Internet access in Ukraine was first gathered in 1990, however, first more or less significant growth rate (more than 1%) was recorded in 2001, and that was 1.24% only. According to the World Bank, in 2012 33.7% of Ukraine's population were using Internet. To compare, in 2010 this indicator was 23.3% only, in 2008 – 11%, and 2006 – 4.5%. This means that during the last 12 years the rate of Internet usage growth was 27 times and it keeps growing. However, this is still not enough for data banks development in the field of innovations and the related Internet networking. Therefore, there is a to promote further the geographical spread of Internet access in Ukraine's regions. Considering the current global trends in this area, data banks creation would be possible when the indicator under study would reach the level of 50%. And this is very much possible in the nearest two years already.

In this context it would be further expedient to create a data bank on expert services and information-analytical support for TT.

The constant update of a national database by new innovations' information in Ukraine and abroad is the guarantee of the efficient patenting mechanism for national new discoveries and inventions. Today applications for patents are usually considering during 1.5–3.5 years, thus causing the moral aging of innovations. This is why in many cases domestic inventors apply to abroad patent organizations from the very beginning. Shortening the term of patents' documents consideration is a necessary prerequisite for innovative development of any country.

Additional problem is the determination of licensing costs which are always correlated with patent protection. On average, non-patented licenses are 10–20% cheaper as compared to patented inventions, besides, exclusive licenses are more expensive than regular ones.

It is worth mentioning here that there exists no common comprehensive methodology for cost estimation of non-material assets, and the existing documents (Law of Ukraine "On scientific and technical activities" dated 13.12.1991 with the amendments as of 05.12.2012; Regulation on the order of statistical reporting #1-science "Report about the performance of scientific and technical works" by State Committee of Statistics # 290 as of 09.09.2003, Accounting Standard #8 "Non-material assets") can be described as segmentary only.

At the same time the procedures of information-analytical support for technology transfer are complicated due to the existence of a large variety of methods for non-materials assets evaluation (and none of them is officially approved). This situation leads to legislation collisions. For example, consideration the existing regulations and legislation, it is nearly impossible to calculate the financial equivalent of damage for intellectual property rights violation. Besides that, the current Criminal Code of Ukraine does not mention any criminal responsibility for illegal technology transfers.

Separate grounding would be also needed for income distribution from TT which are to go into state budget of Ukraine, and this needs to be indicated in the Law of Ukraine "On state regulation of activities in the field of technology transfer". As of today we can observe the dysregulation in the field of purchasing and distributing property rights for non-material assets created with the participation of state budget

funds. It is worth noting here that current Ukrainian legislation does not forbid transferring to the territory of our country of the technologies which do not satisfy the requirement of state technological restructuring programmes. Besides that, there are no legal means of restraining the process of researchers' applying for patents abroad (without the preliminary trial in Ukraine). Altogether, the abovementioned factors contribute to the process of innovations leaving Ukraine.

The Law of Ukraine "On the protection of rights for inventions and utility models" should, *inter alia*, cover the order and the volume of state premiums to inventors.

Several significant drawbacks in the antimonopoly legislation often lead to the situation when patenting is used for market monopolization. This issue has to be reconsidered as well for further development of the system of information and legal support for TT.

Another important issue is the formation of efficient information and analytical support for TT is risk insurance; it has to be solved by means of developing the information risks subsystem within the system of information-analytical support for TT. Methodological recommendations developed by O. Kamianska (2008) treat the integral risk indicator for TT as a combination of sociopolitical, marketing, technological, production, investment & finance, contractual and court arbitrage factors, and at the same time – as a good example to follow in developing the same integral indicators for other sectors.

Based on the carried out here analysis of scientific and methodological approaches and their transformation into practice such directions for further improvement of separate components within the system of information support for TT are suggested (Table 2) along with the way (tools) for their realization.

**Table 2. Approaches to the development of components within the system of information-analytical support for TT, developed by the author**

Directions in the improvement of components within the information-analytical support system for TT	Ways and instruments for the improvement of components within the system of information-analytical support for TT
Information dissemination on the existing innovations and innovations under development	<ul style="list-style-type: none"> <li>- "inventory" of the existing databases and establishment of new ones (in particular, within national networks) containing information on foreign and local innovations (at all stages – idea, development and a readymade product) along with the already existing patents which are in free access (not confidential);</li> <li>- creating a bank of propositions by experts and professionals in general in the field of information and analytical support for TT;</li> <li>- stimulation of the general Internet coverage development in the country.</li> </ul>
Improving the legislation in part of information-analytical support for TT	<ul style="list-style-type: none"> <li>- the Law of Ukraine "On state regulation of activities in the field of technology transfer" must include the grounding of costs distribution after TT, including state budget. It should also describe how the technologies entering Ukraine should meet the requirements of state technological restructuring programmes;</li> <li>- to the Law of Ukraine "On the protection of rights for inventions and utility models" must be added the volume and the order of premium payments to inventors;</li> <li>- improvements in the antimonopoly legislation.</li> </ul>
Improving both legislative and theoretical-methodological bases for information-analytical support for TT	<ul style="list-style-type: none"> <li>- developing and approving the universal methodology of value estimation for non-material assets;</li> <li>- developing an organizational and methodological framework for the evaluation of the technologies to be transferred;</li> <li>- developing special programmes aimed at efficient technical and economic grounding of the technologies to be transferred.</li> </ul>

Continuation of Table 2

Directions in the improvement of components within the information and analytical support system for TT	Ways and instruments for the improvement of components within the system of information and analytical support for TT
Increasing the volumes of all types of financing for the organization of information and analytical support for TT	- increasing the volumes of state financing of developing innovative infrastructure (which includes information and analytical support for TT); - enhancing the processes of private capital attraction to the development of information and analytical support for TT; - stimulation of venture financing.
Developing the subsystem of risks insurance in the process of information and analytical support for TT	- formation of the subsystem of information risks insurance within the system of information and analytical support for TT; - developing new methodologies on risks evaluation of TT in various economic sectors.

As a result of exploring the components in the system of information and analytical support for TT we can present the conceptual framework for this system formation (Table 3) which must be a stage prior to the actual implementation of information and analytical support.

Table 3. Conceptual notions within the system of information and analytical support for TT, author's construction

The notion to describe the system of information and analytical support for TT	Description of the notion
Type	Information and analytical support for TT must serve as an open system.
Aim	<i>The aim of the system functioning of information and analytical support for TT is providing both theoretical and practical data concerning efficient TT processing.</i> (Under such data we mean: methodological and applied studies; legislation documents; information on existing innovations, patents, expert services etc.)
Structure	- <i>Theoretical and practical support for TT.</i> - <i>Legislative support for TT.</i> - <i>Financial support for TT.</i> - <i>Social support for TT.</i>
Balance and stability	<i>The system must be well balanced and stable.</i> External influences should not have significant effects on it. External circumstances change should not lead to conceptual changes inside the system of information-analytical support for TT. (However, at the same time improvements in external environment should increase the efficiency of internal components of information and analytical support).
Development of the system	<i>The development of information and analytical support for TT can be described as evolutionary.</i> The gradual shift of national economy to the innovative type of development stimulates the TT processes dynamics. Because various factors (in particular, the development and spread of information technologies, Internet coverage, socioeconomic and political changes) are acting separately, the development of the system can now be described as leaping one.
Adaptation of the system	The system of information-analytical support for TT should be adaptive and flexible since it has to be correlated with the TT processes development in the country.

The suggested approach to formation of the concept of information and analytical support for TT enables the systematization of achievements already available in



this area. This approach is different from the previous ones because it is based on the system theory, and the array of data used for information and analytical support of TT should be divided into the following structural units: theoretical and practical support for TT; legislation support for TT; financial support; social support. This structural division would provide the opportunities to cover the huge mass of all the information needed for information and analytical support for TT. Such systematization of materials would definitely increase the efficiency of TT introduction.

**Conclusions and prospects for further research.** The system approach application enables determining the background for information and analytical support for TT, that is the concept of its formation. Practical application of this systematized complex of scientific and practical achievements would provide opportunities to acquire new knowledge and develop professional skills for more efficient TT in the future. Collecting and systematizing data by the directions presented would also accelerate the speed of technology transfers.

Of primary importance becomes the issue of adjustments and corrections to the components system within the information and analytical support for TT while fulfilling the structure will all necessary information, in particular, by such directions as: information dissemination on the already existing innovations and innovations under development; legislation update; theoretical and methodological developments related to information and analytical support for TT; increasing the volume of all types of financing on the organization of information and analytical support for TT; improvements in the field of risks insurance within information and analytical support for TT.

The results of this research study clearly demonstrate the need for more research in the related field, in particular, concerning the subsystems of information and analytical support for TT and their filling with data. Special attention in the future should be paid to the development of an algorithm of this system application as a whole using specialized software.

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## **КНИЖКОВИЙ СВІТ**

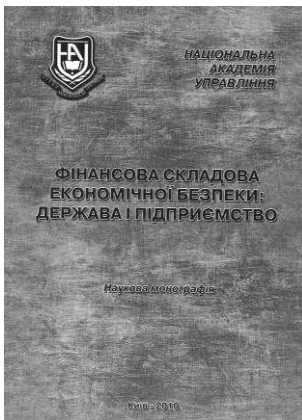


СУЧАСНА ЕКОНОМІЧНА ТА ЮРИДИЧНА ОСВІТА  
ПРЕСТИЖНИЙ ВИЩИЙ НАВЧАЛЬНИЙ ЗАКЛАД  
**НАЦІОНАЛЬНА АКАДЕМІЯ УПРАВЛІННЯ**

Україна, 01011, м. Київ, вул. Панаса Мирного, 26

E-mail: [book@nam.kiev.ua](mailto:book@nam.kiev.ua)

тел./факс 288-94-98, 280-80-56



**Фінансова складова економічної безпеки: держава і підприємство: Наук. монографія. – К.: Національна академія управління, 2010. – 232 с. Ціна без доставки – 40 грн.**

Автори: **М.М. Єрмошенко, К.С. Горячева.**

У монографії розкрито місце і засади фінансової безпеки в системі економічної безпеки на двох рівнях управління економікою країни: держави і підприємства. Розкрито роль економічної безпеки в розвитку економіки України, визначено і обґрунтовано шляхи забезпечення фінансової безпеки на рівні держави.

Викладено методологічні основи фінансової безпеки підприємства та управління нею. Визначено форми і методи удосконалення механізму управління фінансовою безпекою на рівні підприємства.