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Technology Transfer in the Field of Energy Efficiency and Renewable Energy Sources

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Training for Researchers Handbook

Imprint

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Technology Transfer in the Field of Energy Efficiency and Renewable Energy Sources

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INTRODUCTION

The current training handbook is part of a larger undertaking within the competence development framework proposed within the project *NoGap – Knowledge Transfer Community to bridge the gap between research, innovation and business creation*. This FP7 INCO project address the societal challenge of "secure, clean and efficient energy" within an international consortium of 13 partners belonging to 6 countries, 3 within the European Union and 3 belonging to the Eastern Partnership. It is our belief that the issues faced by all countries in this area require a strong cooperation of all stakeholders in the field, be they public or private, in order to promote the necessary awareness and develop the proper solutions for the technical, economic, legal and cultural challenges related to this topic.

A considerable effort within this project will be directed to raising the competence level related to innovation management, technology transfer and intellectual property in this field. For this, a series of four training sessions will take place in each of the countries of Georgia, Ukraine and Belarus directed towards researchers, companies and information multiplicators. The material that you are reading is aimed at covering the most important topics of interest for researchers, in order to stimulate the approach of the academic and economic environments for producing concrete results pertaining to the generation and use of renewable energy. Without the intention of being exhaustive, the training material tries to pinpoint the main topics and discuss upon their contribution towards successful endeavors. As a consequence, subjects such as the *Use and exploitation of knowledge, Legal framework for technology transfer* or *Licensing* are discussed in a regional context, which is relevant for the participants.

It is our hope that, equipped with this knowledge, a spirit of entrepreneurship and cooperation will be created that could help the development of renewable energy related technologies, services and business in your country. Also, last but not least, the networking opportunities brought about by our meeting could contribute to the initiation of many other collaboration projects. We thank you for your participation and we are honored by your contribution to the success of NoGap.

The authors and the trainers

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Chapter 1

Knowledge management

Concepts and definitions

The concept of knowledge management is based on the notion that one of the most valuable resources of the organization is knowledge of its employees. Therefore, the success of any organization largely depends on effective management of this resource: creation, dissemination and use of knowledge. It should be noted that the object of management is not all knowledge in general, but only that which is crucial for organization, namely that which is valuable for the end user of a product or service.

Knowledge management (KM) is not very appropriate term, since knowledge is a form of existence and systematization of results of cognitive activity of a particular person and, therefore, it is impossible to manage it from the outside[1]. Nevertheless, probably it is necessary to create the environment in which people seek for creation, mastering, exchange and use of knowledge.

There are quite a large number of definitions of KM, but from the point of view of the authors, the most successful one is as follows[2]:

> "Knowledge management is the explicit and systematic management of vital knowledge and its associated processes of creating, gathering, organizing, diffusion, use and exploitation. It requires turning personal knowledge into corporate knowledge that can be widely shared throughout an organization and appropriately applied."

[1] Caroline De Brün. ABC of Knowledge Management / NHS National Library for Health: Knowledge Management Specialist Library [Electronic resource]. – Access mode: http://web.idrc.ca/uploads/user-S/11479492851ABC_of_KM.pdf

[2] Skyrme D. J. (1997), Knowledge management: making sense of an oxymoron, [Electronic resource]. – Access mode: http://www.skyrme.com/insights/22km.htm

Data, information and knowledge

For a better understanding of what is knowledge, let us consider the related concepts: data and information. Data, information and knowledge should be considered not in terms of their differences, but in terms of their mutual conversion into each other.

According to the definition of the French national organization for standardization[3]:

> ″Data is a fact, concept or instructions presented in a conditional form suitable for forwarding, interpretation and processing by a person or by automated means.″

Contextually related data is information. The information in conjunction with the rules, procedures and operations of its processing means knowledge (Fig. 1.1).

Thus, we can make a conclusion that perceived and recorded facts of the outer world represent data. When using data during solution of specific problems there appears an information. The results of problem solving, a true and reliable information (data) summarized in the form of laws, theories, and set of views and ideas is knowledge.

Knowledge in its turn generates new data and information leading to creation of new knowledge, so that the process of knowledge creation is permanent.

[3] http://www.afnor.org/en [accessed 01.04.2014]

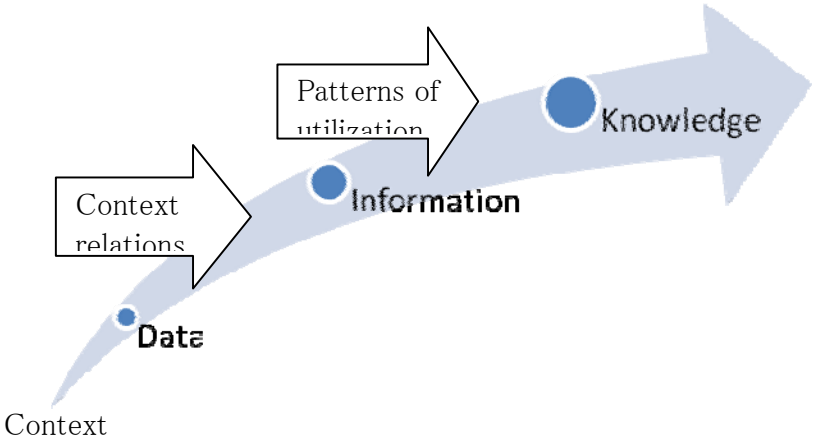


FIGURE 1.1 Interdependence between data, information and knowledge

The rules, procedures and operations for information processing, accumulated in the form of personal experience, skills and competencies, can be presented as a pattern. According to I. Watson[4], transformation of information into knowledge is connected with recognition and application of patterns and with creation of mental models[5], samples and prototypes[6].

Example. *A statement "-10" it's just a number which speaks of nothing to us, i.e. data. These data can become an information if they are supplemented with a context. A statement "Street thermometer shows -10ºC" already presents quite a specific information. Probably, you have a pattern: negative temperature means it's cold outside, it is necessary to dress warmer. According to received information, you know that you need to wear a hat, a scarf and gloves.*

Knowledge types

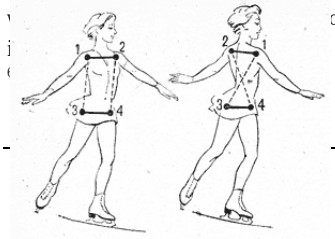
There are two types of knowledge:

Explicit knowledge is that which can be recorded or encoded. Explicit knowledge is easy to formalize and it can be presented in the form of a text, a sound, a video, and so on.

Tacit knowledge is that which one can feel and understand, but which is practically impossible to express. There are no formal procedures which would

[4] Watson I. (2003), Applying Knowledge Management Techniques for Building Corporate Memories. – Elsevier Science (USA)

[5] Mental model in psychology is a complex of empirical knowledge which it is difficult to formalize and d when interacting with the object. Simply speaking, it is how we



allow to adequately and fully presenting tacit knowledge. Tacit knowledge is a product of personal experience of a person. To transfer tacit knowledge one frequently uses analogies, examples, and so forth.

Example. *You want to impart someone your knowledge on how to skate. You probably will be able to explain how to choose the right skates, what clothes it is better to wear on, what skating-rink is better to come to, and even how to lace up strings on skates. But try to explain to a person how to keep a balance, and how to perform a figure correctly. In specialized books they try to formalize this knowledge, for example,: "The second basic movement in turns is shifting of the centre of gravity from one circle to another. It is achieved by shifting the upperparts outwardly against the position of dynamic equilibrium, due to what the centre of gravity of the body moves toward the second circle and there appears an opposite slip occurs in the arc"[7]. It is interesting whether one will manage to use such instruction without a coach?*

Transfer of knowledge from one type to another defines the model of knowledge creation[8] (Table 1.1):

Socialization (from nonformalized to nonformalized). In this case one person (for example, master or trainer) gives tacit knowledge to another person (to the student) directly. Knowledge is the result of observation, imitation and practice.

Combination (from formalized to formalized). New knowledge may also appear due to combination of parts of already existing formalized knowledge. For example, having analysed the income of the company for each year over 10 years, we obtain new knowledge about the income of the company for 10 years.

Externalization (from unformalized to formalized). An example of externalization can be an industrial robot. People's knowledge about actions during welding, loading, painting and other operations is formalized and is used to create the electromechanical device. The robot contains a mechanical part and a control system for this mechanical part, which in its turn receives signals from a sensor part. Mechanical part of the robot mimics movements of a person, the control system performs the work of a nervous system, and sensor part mimics the work of human sense organs.

Internalization (from formalized to nonformalized). For example, formalized knowledge about the method of tying a tie, presented in the form of illustrated instructions and applied several times, will eventually lead to appearance of tacit

[7] Фигурное катание на коньках: Учеб. для ин-тов физ. культ. Под общ. ред. А. Н. Мишина. – М.: Физкультура и спорт, 1985. – 271 с, ил.

[8] Nonaka I., Takeuchi H. (1995), The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation. – Oxford University Press

knowledge on how it's done. These four models of knowledge creation exist in dynamic interaction, forming a knowledge spiral[9].

TABLE 1.1 Models of knowledge creation

	Nonformalized	Formalized
Nonformalized	Socialization	Externalization
Formalized	Internalization	Combination

Components of knowledge management

Knowledge management in the organization is based on interaction of 3 components: people, processes and technologies.

People. One of the most difficult tasks is to analyse the culture of organization, its values, and behaviour of its employees. Generally speaking, organizational culture should support continuous training and knowledge sharing, openness, mutual respect and support. Employees of the organization should be motivated for innovation activity and gaining of experience from mistakes. On the other hand, the unfavourable environment for knowledge management is the organization where knowledge is a competitive advantage and employees are reluctant to share it; where people are under constant pressure of necessity to act and have no time to search for knowledge and reflection, a "blame and shame" culture is also unfavourable.

Processes. In this case we mean business processes existing in the organization. Sometimes it is necessary to modify the internal processes or even the structure of the organization as a whole to overcome barriers in creation, exchange and use of knowledge.

Technologies. Technologies are an important component of knowledge management, as they can facilitate and accelerate all processes related to it. It is important that applied technologies "fit" the processes of a particular organization and the people working in it, otherwise they simply won't be used.

Knowledge management components are in constant interdependence (Figure 1.2). Thus, people help to model and then execute the processes. On the other hand, the processes define the roles of employees and necessary knowledge. People help to design certain technologies which afterwards help them in their

[9] Ibid.

work. Business processes determine technologies to be used and, on the other hand, technologies make possible realization of new processes.

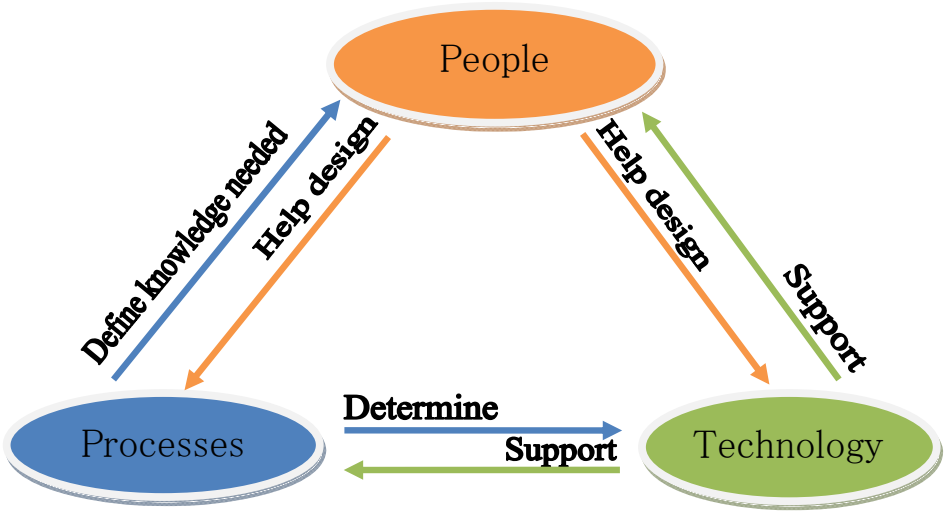


FIGURE 1.2 Three components of knowledge management and their interdependence[10]

Thus, the objective of knowledge management is to create a favourable environment for knowledge-friendly staff conduct which should be supported by appropriate processes with the use of appropriate technologies.

Knowledge Management Activities

According to Karl M. Wiig[11], knowledge development cycle (Figure 1.3) consists of the following stages:

- ✓ Knowledge Development – knowledge is developed through studying, innovation activity or import from outside.
- ✓ Knowledge Acquisition – knowledge is accumulated and stored for further use and processing.
- ✓ Knowledge Refinement (Preservation) – knowledge is transformed, arranged in written form, in the form of databases or knowledge bases for future use.
- ✓ Knowledge Distribution. Knowledge is spread with the use of training programs, automated systems, social networks, forums, etc.

[10] Edwards J. A Process View of Knowledge Management: It Ain't What you do, it's the way That you do it / The Electronic Journal of Knowledge Management Volume 9, Issue 4, 2011. – P. 297-306 [Electronic resource]. – Access mode: www.ejkm.com.

[11] Wiig Karl M. Comprehensive Knowledge Management / Knowledge Research Institute, Inc. Working Paper 1999-4 Rev 1 [Electronic resource]. – Access mode: http://www.knowledgeresearch.com/downloads/compreh_km.pdf

- ✓ Knowledge Application. Application of knowledge is the basis for further learning and creative work on which basis can start a new cycle of Knowledge Development[12].

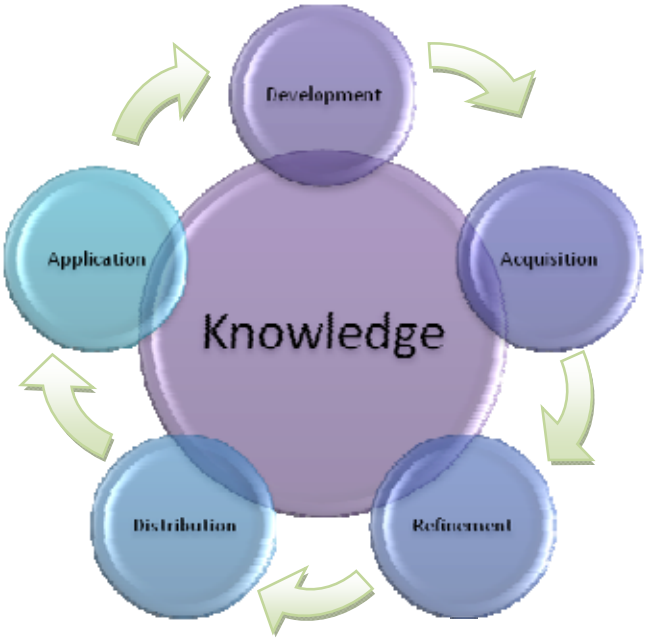


FIGURE 1.3 Knowledge development cycle

It is impossible to presented this process linearly, apply it once or formulate an ultimate goal for it. Knowledge management is a cyclic process of continuous learning and development.

[12] Ibid

Trends and evolution regarding knowledge management

A brief history of KM concept appearance

The concept of "knowledge worker" was proposed by Peter Ferdinand Drucker in his book "Landmarks of Tomorrow: A Report on the New 'Post-Modern' World" in 1959. The author fairly drew attention to emergence of a new type of workers having their own "means of production" — their knowledge. Such specialists having knowledge and skills which their bosses do not have, are highly mobile. P. Drucker formulated an approach, according to which it is important for the employer to "turn specific skills and knowledge of each individual employee into the most effective ones"[13].

First time the term "knowledge management" was applied by Karl Wiig — a specialist in artificial intelligence, management consultant, in 1986 at the session of UN International Labour Organization. According to his ideas, for effective work any organization needs three components: employees, technologies, manufacturing processes, and knowledge management is implemented in two directions:

- ✓ increasing staff efficiency through better and qualitative use of their intelligence and experience (knowledge);
- ✓ multiplication of knowledge through creation of new knowledge and staff training.

In 1986, Karl-Erik Sveiby published a book "Kunskapsföretaget" ('The Know-How Company")[14] in which he drew attention to appearance of information society in which dependence on complex knowledge and know-how will only increase. In such a society appears a new kind of companies "the know-how company", whose main asset is knowledge and skills of their employees. Karl-Erik Sveiby compares a new kind of companies with traditional ones, making the following analogies:

[13] Drucker P.F.(1996), Landmarks of Tomorrow: A Report on the New 'Post-Modern' World. – Transaction Publishers
[14] Sveiby K-E. Lloyd T. (1987), Managing KnowHow. – Bloomsbury Publishing PLC

Knowhow enriched information is the revenue of the knowhow company.

Knowhow on the invisible balance-sheet is the same as fixed assets on the traditional balance-sheet.

Education is for human beings, what maintenance is for machines.

Recruitment is the counterpart of investment.

Time is the raw material of the knowhow company.

The human being is the knowhow machine.

Knowledge management as a field of research starts to develop rapidly in 90's of XX century. Thus, in Japan a research team led by Ikuzhiro Nonaka, studying the experience of successful Japanese companies, found out that mutual transformations of explicit and implicit knowledge lead to creation of innovative products. In 1995, Ikudzhiro Nonaka and Hirotaka Takeuchi published a book "The Knowledge Creating Company"[15] in which they focused on management of people creating knowledge — a unique approach of Japanese managers to create new knowledge.

David Teece holds to similar ideas as Karl-Erik Sveiby. In his article[16] the author focuses on the fact that competitive advantage and commercial success of the enterprise are highly dependent on how it will manage competences and knowledge assets and how it will use them. Under the current economy, difficulties of companies are connected not with their market position, but with difficulties to replicate knowledge assets and methods of their use. Besides, in his works David J. Teece pays special attention to commercialization of knowledge, to intellectual property as the asset of the enterprise, and to technology transfer.

"The modern corporation, as it accepts the challenges of the new knowledge economy, will need to evolve into a knowledge-generating, knowledge-integrating and knowledge-protecting organisation."

[15] Nonaka I., Takeuchi H. (1995) op.cit.

[16] David J. Teece. Capturing Value from Technological Innovation: Integration, Strategic Partnering, and Licensing Decisions/ California Management Review, Volume 40, No 3, 1998. – P. 55 – 79.

By the mid 90's, it was widely believed that competitive advantage of the world leading companies is due to their knowledge assets, such as competences, relationships with customers and innovations. Therefore, knowledge management has suddenly become the main business goal in the pursuit of leaders. Nevertheless, companies failed to quickly achieve the success. It seemed that knowledge management is a theory which looks great on paper, but it fails when it comes to its practical application. Analysis of failures led to understanding that a problem is not in the concept of knowledge management itself, but in the method of its implementation.

Excessive attention to technologies without considering the peculiarities of employees led to the fact that workers took such initiative as additional laborious overhead activity to perform which they had no motivation. Lack of attention to business processes of the organization and to methods of their work also had a negative impact on introduction of KM. Excessive conceptuality of literature, lack of practical advice led to the opinion that KM is inapplicable in practice. Besides, in euphoria companies began to spend money on expensive consultants and vendors, as well as on new ≪sexy≫ technologies which in the long run did not bring the expected return on investment[17].

Realizing the mistakes of previously used practical approach, nowadays the emphasis is shifting towards the workers, their thinking, behaviour, methods of work, processes in which they participate. Technologies should be just a tool helping people to work more effectively. Knowledge management can be and should be an integral part of work of all organizations, as they exist in the information society in which Knowledge Sharing is a part of daily life of people.

KM trends

Let us consider the main trends in development of knowledge management, which today are singled out by practitioners and theorists.

1. Convergence. The use of methods and concepts of knowledge management in various activities. Interpenetration of experience and best practices from various fields (public and private sector, R&D, NGO etc.).

2. Knowledge economy. Thus, at the level of states the integration strategies are being developed in the new phase of economic and social development, the so-called ″knowledge economy″ or ″knowledge-based economy″ in which knowledge is a key factor of success[18]. For

[17] Caroline De Brún, op. cit.
[18] Ibid.

example, World Bank Institute's Knowledge for development (K4D) Program. This Program "helped to build the capacity of client countries to gain access to and use knowledge to increase their economic and social well-being and to strengthen their competitiveness. This process occurs through advanced development strategies –simultaneously addressing the intangibles of education, information and communication technology infrastructure, innovation, and the needed economic and institutional regime."[19]

3. Enterprise 2.0 — A trend which is rapidly becoming popular is transition of organizations from hierarchical structure to networking one. The concept of Enterprise 2.0 involves the use of web 2.0 technologies to optimize business processes by simplifying and strengthening the interaction of employees, customers and suppliers. The use of this technology provides the following business opportunities: identification of experts most suitable for decision of arising problems, exchange of knowledge in corporate blogs, forums, Wiki portals; collection of innovative ideas through communities, etc.

4. The use of opportunities of social networks. — Building of trust relationships both within the organization and in its external environment (social organization capital). Creation of social network between employees, customers and stakeholders will help to overcome barriers in exchange of knowledge, it will lead to improvement of the knowledge flow between people working in different fields.

Apart from accumulation and further search for knowledge, knowledge sharing can now be carried out with the help of a constant dialogue, building relationships and adaptive learning through continuous interaction of users having their own knowledge and desire to share it.

5. Open Knowledge. — Efficiency of knowledge increases when people can freely share and use it.

The first one was the idea of Open Source which today is widely used by programmers. The source code of Open Source programs is available for study, use, improvement, etc. to all users, either as a public domain or under a free license with minimal restrictions.

An Open Source was followed by the term Open Content. Open Content implies the results of work, which can be used by other people for free and more widely than it is permitted under a common law on protection of copyright. According to

[19] http://siteresources.worldbank.org/KFDLP/Resources/461197-1199907090464/k4d_bookletjune2008.pdf [accessed 04.04.2014]

definition of OpenContent website, the primary permissions or usage rights open content is concerned with are expressed in the "4Rs Framework:[20]"

> Reuse – the right to reuse the content in its unaltered / verbatim form (e.g., make a backup copy of the content)
>
> Revise – the right to adapt, adjust, modify, or alter the content itself (e.g., translate the content into another language)
>
> Remix – the right to combine the original or revised content with other content to create something new (e.g., incorporate the content into a mashup)
>
> Redistribute – the right to share copies of the original content, your revisions, or your remixes with others (e.g., give a copy of the content to a friend)

Open Educational Resources are becoming increasingly popular. To characterize this phenomenon we use the definition of William and Flora Hewlett Foundation[21]:

> "teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any other tools, materials, or techniques used to support access to knowledge"

6. Collaborative knowledge creation.

Collaborative knowledge creation is based on combination of knowledge of various members of the group during interaction and discussion. Usually, participants possess their own knowledge bases in different professional fields, which leads to successful collaborative problem solving. Collaborative knowledge creation is characterized by the following stages: externalizing and sharing, interpreting and analysing, negotiating and revising, combining and creating.

[20] http://www.opencontent.org/definition/ [accessed:02.04.2014]
[21] http://www.hewlett.org/programs/education/open-educational-resources [accessed: 02.04.2014]

7. Development of knowledge management technologies.

Knowledge management technologies develop in the following directions: knowledge representation (ontological developments and semantics), knowledge visualization (interfaces for knowledge presentation and understanding) and knowledge analysis (agent-based and data mining-based knowledge analyses)[22].

A special role of knowledge in the processes and performance results of organizations has been identified in the late 50's of XX century. First time the term "knowledge management" was used by the experts in artificial intelligence in the mid 80's of XX century. Starting from the 90's, the science of "Knowledge management" began to develop rapidly. The urgency of KM problem during transition to a new phase of economic and social development of "knowledge economy" is ever growing.

The appearance of new technologies for information exchange and creation of social networks, new forms of intellectual property and means of joint knowledge creation, as well as means for presentation, visualization and analysis of knowledge, opens up new opportunities to ensure continuous improvement of knowledge flow in organizations.

[22] Giaglis G.M. (2003), Directions and Trends in Knowledge Management Research: Results from an Empirical Analysis of European Projects / Knowledge and Business Process Management, Idea Group Publishing. – P. 1-15.

Specific methods regarding knowledge management

Let us consider methods for implementation of knowledge management depending on the stage at which they are applied (Figure 1.3).

Knowledge Development

Job rotation

Job rotation is a practice of transfer of organization's employees from one position to another for training and development of staff.

In order that this practice was successful, it is necessary to do the following:

1. Accurately determine the purpose of such rotation. Purposes can be different: additional training of the employee before his advancement, provision of interchangeability of employees, ensuring of diversity of tasks to increase satisfaction of staff by their work.
2. According to the purpose defined at the first stage, it is necessary to elaborate a schedule of rotation. Each stage should be connected to the previous one, indicators for achievement of success should be clearly defined.
3. At each training stage one need to assign a mentor — a person responsible for training. Mentor should be an employee who can teach, answer questions, etc.
4. It is necessary to provide for motivation of employees to participate in rotation, both of trainees and mentors.
5. Written documentation of acquired new knowledge and skills will help strengthen the result achieved in the process of job rotation.[23]

Job rotation makes it possible to ensure the exchange of explicit and implicit knowledge in the organization, improve staff skills, their morale, confidence in their own efficiency; it promotes better understanding of the processes occurring in the organization, the appearance of new connections in a social network of the enterprise.

[23] http://humanresources.about.com/od/glossaryj/g/job-rotation.htm [accessed: 02.04.2014]

E-learning

The term E-learning means all kinds of training with the use of ICT. Among e-learning technologies the most popular are webinars, Virtual Learning Environments (learning platforms), open online courses, learning management systems. Usually, e-learning is associated with the concept of distance learning, although this method can be used in conjunction with traditional full-time training. The use of e-learning by organizations allows optimizing and accelerating the process of acquiring knowledge. The advantage of knowledge in this case is that the form and the content are developed by expert teachers. When using such technologies, for employee it is easier to combine work with training process as he can plan his time and place of training.

For successful achievement of training objectives, it is important to determine the type of knowledge that employees should master. The following tree training strategies can be distinguished[24]: market, innovation and intra-organizational. Market strategy is aimed at acquisition of relevant knowledge and skills which correspond to the current level of development of products and services, and which are likely to be already owned by competitors and partners. Innovation strategy is aimed at acquisition of knowledge, skills and abilities necessary to obtain market advantage and to leave behind the competitors. An intra-organizational strategy is focused on acquisition of knowledge and skills necessary for successful solution of internal problems of the organization.

Open Space Technology

Open Space Technology is a way of organizing meetings, conferences, symposia, at which there should be a clear and convincing topic, interested and prepared group, and a leader. At the same time, this event starts without traditional formal program (agenda), materials and plans. During opening remarks one should widely cover the purpose of the meeting and the principle of self-organization of Open Space technology. Then, for 30-90 minutes participants elaborate the program. Participants place the problems and opportunities on the ″notice board″. Each organizer of sectional meeting shall appoint the time and place, and then he is responsible for addressing the problem of sectional meeting and gathering materials. Then materials are sent or distributed to all participants. Participants are free to move between sections, learning and contributing to the exchange of information, knowledge and ideas.

[24] http://blog.newedu.su/2012/08/el.html [accessed: 02.04.2014]

For successful application of technology, there are 4 principles and 1 law[25].

Principle No. 1 Whoever comes are the right people. This principle states that to solve the problem one need people willing to do something, rather than a hundred thousand members and a chairman.

Principle No. 2 Whatever happens is the only thing that could have. One should refrain from such phrases, as could-have-beens, should-have-beens or might-have-beens.

Principle No. 3 Whenever it starts is the right time. This principle states that an inspiration and creative work do not come on schedule. It either happens or not.

Principle No. 4 When it's over — it's over. This principle calls not to waste time, but to do what is necessary and move on to something more useful.

Law of Two Feet The Law of Two Feet says that "if at any time you find yourself in any situation where you are neither learning nor contributing – use your two feet and move to some place more to your liking." Such a place can be another group or even a place outside of the meeting.

Knowledge Acquisition

Best Practice & Good practice

The term "best practice" means the best way (method, solution) for achievement of a defined goal. Nevertheless, often the index of maximum efficiency is unknown. Therefore, one should not state that the method is the best. In this regard, many practitioners prefer to use the term "good practice" to refer to solution which undoubtedly leads to a positive result and can be recommended for use. Exchange of experience in the form of best practices is an important part of knowledge sharing in the organization. Practical experience accumulated by experts usually exists in the form of instructions, manuals and guidelines ("how to" guidelines). However, to practically take advantage of such instructions for solution of new problems is quite difficult, since it is not clear whether this solution is suitable for this task or not. Best practice knowledge has two components: explicit and implicit. Explicit component can be organized in the form of databases or knowledge bases of cases and relevant decisions, in this case the task is to ensure easy and quick access to such databases. Implicit component of

[25] http://www.openspaceworld.com/brief_history.htm [accessed: 02.04.2014]

knowledge can be transferred during direct communication between people. Very helpful in this case are communities of practitioners. In these communities a large number of people with their knowledge and experience can share ideas, theories, and assumptions. Discussions and dialogues help to consider the problem from different aspects, and a constant feedback allows evaluating concrete practical results.

After Action Review (Debriefing)

AAR method is a joint discussion of the event by its participants in order to draw conclusions.

As a rule, the following questions are discussed: ″What happened?″, ″Why did this happen?″, ″What was successful?″, ″What improvements are needed?″, ″What lessons can be learned as a result of new experience?″ One should pay attention to the fact that debriefing is done not for the purpose of a blame game and problem solving, so the manager should ensure the atmosphere of openness and learning. During this process, though participants receive implicit knowledge, the experience can be formalized and documented for dissemination among a wider audience.

Knowledge mapping & Knowledge flow analysis

Knowledge map is a visual representation of knowledge of the organization. To represent the knowledge map one can use a mind map, charts, tables, etc. When making the knowledge map of the organization one can use two approaches. The first implies recording and structuring of knowledge sources in order to visualize what kind of knowledge is in the organization and where it is located. The second approach supplements the knowledge map with knowledge flows which allow studying the movement of knowledge within the organization from the place where it exists, to the place where it is needed. When using the second approach for making a knowledge map, it is possible to carry out ″knowledge flow analysis″ between departments, employees, processes, etc. within the organization.

Knowledge flow implies transfer of knowledge directly from person to person or using special devices.

For existence of knowledge flow it is essential to have three components: the direction (sender and receiver), the carrier (mediator) and the content (knowledge that is distributed). A sender and a receiver of knowledge are employees of the company or the roles which they perform. As a knowledge carrier can be used the Internet, LAN and other types of networks. Knowledge flow analysis ensures that

each node in the knowledge network (the employee or his role) is provided with the necessary knowledge. On the other hand, the efficient knowledge flow eliminates redundant transfer of knowledge, as different team members can perform various tasks and, therefore, the knowledge which they need to be provided with should be different.

Wiki

The author of Wiki Ward Cunningham ideology described it as follows[26]:

> ″The simplest online database that could possibly work.″

Wiki concept is defined by the following three aspects:[27]

> ″Wiki is a piece of server software that allows users to freely create and edit Web page content using any Web browser. Wiki supports hyperlinks and has a simple text syntax for creating new pages and crosslinks between internal pages on the fly.
>
> Wiki is unusual among group communication mechanisms in that it allows the organization of contributions to be edited in addition to the content itself.
>
> Like many simple concepts, ″open editing″ has some profound and subtle effects on Wiki usage. Allowing everyday users to create and edit any page in a Web site is exciting in that it encourages democratic use of the Web and promotes content composition by nontechnical users″.

Thus, Wiki technology can be described as a website which structure and content can be jointly changed by the users with the help of tools provided by the site itself. Such website is written with the use of special software — Wiki engine, and a special markup language — wiki-markup. Wiki website supports the joint multi-user content creation, and technology for accounting changes (versions) on pages provides the possibility to compare revisions and restore earlier versions.

The most famous Wiki representative is Wikipedia website.

[26] http://www.wiki.org/wiki.cgi?WhatIsWiki [accessed: 02.04.2014]
[27] Leuf B., Cunningham W. (2001), The Wiki Way: Quick Collaboration on the Web. – Addison-Wesley

Storytelling

One of the methods of knowledge transfer can be a story told in a social context. Stories are especially important in case when the aim is to transfer implicit knowledge. Humour, exaggeration, caricature have long been the means of transferring experience, worldview, feelings, etc. If you are planning to transfer your knowledge through stories, you need to pay attention to the following recommendations:

- ✓ clearly define the key idea you want to convey to the audience;
- ✓ make the story basing on your own experience;
- ✓ try to intrigue the audience at the beginning of the story, determine its dynamic development which will lead to a happy (sad) end;
- ✓ after your story it should be obvious what lessons should be learned from the story.

World Café

World Café is a method of organizing workshops under which the atmosphere of cafe is created in the room. Participants discuss a problem or a question in small groups, sitting at the tables. At equal time intervals, participants move to another table. At each table remains one participant from the previous group — a "table host" who voices the main results of previous conversation to new guests of the table. At the end, the basic ideas and results are summarized in plenary session during which new opportunities are discussed.

This method allows attracting large groups (up to 2 000 members) to an active discussion of the problem. The optimal number of participants at one table is 4 (5 maximum). Usually, on the tables over the tablecloths large sheets of paper are placed where participants can record their ideas and notes thereto. At the tables it is also recommended to use a "talking object" — a marker, a salt shaker, a vase, etc. "Talking object" will allow ordering conversation, because the right to speak is given only to a person who keeps this thing in hands, and all other participants should listen to the speaker.

There is the following definition of the World Café[28]:

[28] http://www.kbs-frb.be/uploadedFiles/KBS-RB/Files/EN/PUB_1540_ Toolkit _13_WorldCafe.pdf [accessed: 02.04.2014]

> "The World Café is a creative process for facilitating collaborative dialogue and the sharing of knowledge and ideas to create a living network of conversation and action."

Knowledge Refinement

Exit Interviews

Usually an interview before dismissal is used to collect the information about why do the employees leave the organization, what do they like and what they don't about their job, which improvements would they like to see inside of organization. Such information is quite traditional for the department of human resources.

From the point of view of the knowledge transfer during the interview it is critical to understand the gist of the work that has been done by the employee an all the main terms of its realization. Result can become even more powerful if the worker's successor is present, so that knowledge transfer is done without any mediator.

The following recommendations can help to plan the exit interview:

- ✓ Find the replacement of the employee before his dismissal.
- ✓ Define the place of the employee in the knowledge network. Determine who are knowledge sender and receiver for the worker, who is being fired. Notify all the people who may be interested in dismissal.
- ✓ Make sure that all explicit knowledge, accumulated during the working term of the employee is available.
- ✓ To transfer tacit knowledge ask the employee about how he or she fulfilled his/her main objectives and what kind of knowledge is necessary for this.

Project knowledge base

Experience, accumulated in the organization during the project realization, can be documented and applied with the help of knowledge base of projects. In such base project documentation (explicit knowledge) and experience of the employee, who has been working on the project (tacit knowledge), should be represented

together. The following components of project knowledge base can be recommended[29]:

- ✓ Archive of typical projects
- ✓ Corporative templates of project documentation
- ✓ Risks catalogue
- ✓ A list of lessons learned
- ✓ Project management cases.

Archive of typical projects may let the less experienced or new workers quickly understand which and how projects were implemented in the organization. Corporative templates of project documentation let save the time during the project.

Risks catalogue is made for each organization individually, but it should contain at least the following components:

- ✓ Risk name
- ✓ Risk class
- ✓ Terms of risk
- ✓ Possible negative consequences
- ✓ Anti risk arrangements
- ✓ Recommendations.

To gather the lessons learned in practice intermediate short reports of the project realization and more detailed reports after the end of the project can be implemented. The report should contain at least the following paragraphs:

- ✓ Description of situation
- ✓ Solutions possible
- ✓ Decisions made
- ✓ Conclusions and recommendations.

Project management cases may accumulate *tacit knowledge* of project managers, received during the project realization; this can allow transfer the knowledge to other workers.

Document management System

Documents management is applied to increase efficiency of teamwork with information and explicit knowledge, represented in the form of electronic documents. Urgency of the problem has been formulated by Xerox Company[30]:

[29] http://www.pmprofy.ru/files/2713/02-06-Barmina.pdf [accessed: 02.04.2014]

> "In an information economy, documents and data are your currency. Knowledge is power, but people are powerless if they can't find information buried in mountains of paper and disorganized files."

To create the documents management system organization needs to design and implement a plan of the documents management. To do this it is possible to use the following recommendations[31].

Rules of creating. Define an internal template for standard documents of organization: rules of naming the document, place of the document creation and so on. If the document is created by several employees the procedures and rights of reviewing, modifying, updating and versions tracking should be defined.

Storage. There are two aspects of document storage: physical and organizational. Paper documents require rooms, cabinets and folders for their storage. Electronic documents need disk space to store both documents and their backups. From organizational point of view it is required to develop the system of storage and archiving of the documents, which would provide a fast search and retrieval.

Search. Successful solution of previous two tasks allows facilitate and accelerate documents search in your organization. A list of file locations can also become helpful in orientation through the documents storage.

Security and protection. One of the methods of the documents loss protection is a regular backup followed by backup saving separately from the originals. The more copies are remote from the originals – the better. At least they should be physically stored on different carriers, but better would be to store them in separate rooms or even buildings; this could prevent the documents loss because of the wreckage or theft of equipment, fire and so on. To protect documents from unauthorized use the tools of password creation and encryption exist.

To facilitate the task of documents management you may use special software named Document Management Systems (DMS). In general case, DMS provide the following functionality for working with documents: storage, versions management, metadata definition, protection, indexation and search. Let us briefly consider what is meant by these terms.

[30] http://services.xerox.com/document-management-solutions/enus.html [accessed: 02.04.2014]
[31] http://sbinfocanada.about.com/od/datamanagement/a/documentmgt1.htm [accessed: 02.04.2014]

Storage. Electronic documents are stored in the storage, which usually contains the set of instruments for managing these documents; migration of information between the carriers and providing the data integrity. The storage can be organized in the way of file storage or in the way of system of database management.

Versioning is a process of identification the versions of the document. Users can search for previous versions of documents to continue their work from an appropriate moment. Versioning lets maintaining the current state of the document, returning to the previous version or organizing a link to it.

Metadata. If we simplify, the metadata – is data represented according to one of the formats. Format of metadata is designed to do a formal description of objects and is a standard that includes a set of properties (fields, attributes, metadata elements) that characterize an object. Metadata, for example, can include document title, information about the author of the document, the date of entry of the document in the repository and more. Metadata can be recognized by the system automatically or being required from the user.

Protection. For a lot of organizations providing protection of the documents is a very important aspect of work. Requirements to security can be rather different. For example, a lot of DMS contain rights management module that defines the group of users who have the rights to modify, delete, or view a particular document.

Indexation is necessary to provide an efficient search of the documents. It is a process of describing the documents and requests in terms of information and retrieval language. The easiest form of indexation is keeping track of unique identifiers of the documents. More complicated indexation supports the classification of documents with help of metadata and keywords found in the content of the document.

Search. Documents management systems let us do the quick search in the storage. Search can be done with help of a unique identifier and main index. More complex search can be done by the metadata, key words and also with use of special user's expressions with Boolean operations.

Expert database / yellow pages / white pages

Expert database ("yellow pages" or "white pages") contains not only the contacts of the employees, but also information about their knowledge, skills, rights and tasks in the organization. Such database allows doing a review of knowledge existing in the organization from the point of view of people that have it. Existence

of expert database permits to facilitate the process of search of suitable for taking part in projects and problem solving employee.

Knowledge Distribution and Deployment

Groupware system

Groupware is a technology, allowing organizing a teamwork and efficient knowledge and information exchange inside of this team. Usually groupware solutions include the following elements:

- ✓ Computer networks (internet or intranet);
- ✓ Instruments of documents management, including a central storage of files;
- ✓ Common task schedules and event calendars;
- ✓ Web conferencing;
- ✓ Instant messaging.

The most famous program products of groupware are IBM Collaboration Solutions software (Lotus)[32] and Microsoft SharePoint[33].

Forum

Forum is a web-application, which allows users to communicate with each other. Usually such applications give users an opportunity to create their own topics to discuss, post comments, ask questions and receive answers from other users, give advices and so on. Besides the fact that forums are an effective platform for knowledge sharing and spreading, they also provide knowledge storage by saving questions and answers in their databases. In future, results of collaboration and knowledge gained during the discussion remain available to direct participants in the forum, and for all other users.

Newsgroups

Newsgroups are Internet forums, where groups of people with similar interests can discuss certain subjects. To view the messages in the newsgroup you need to install special software – newsgroup reader. Reader lets subscribing to certain newsgroups and thus read only those messages that are interesting for a particular user.

[32] http://www-01.ibm.com/software/lotus/[accessed:02.04.2014]
[33] http://office.microsoft.com/en-001/sharepoint/ [accessed:02.04.2014]

In organizations newsgroups can be used for quick distribution of information instead of sending it by e-mail. Employees receive news or messages about changes, as they are subscribed.

Conclusions

Presented methodologies, technologies and their realization are quickly overviewed to familiarize the reader with the world of knowledge management tools. Of course, this list is not comprehensive and does not contain details. To learn more about specific tools there are links for additional sources.

Use and exploitation of knowledge management

An important feature of the processes of knowledge transfer is their variety. Applying certain approach of knowledge management in a concrete organization depends on a lot of factors. So, during development of holistic approach of knowledge transfer we need to take into account such factors as: main field of activity of organization, age of employees, type of training, social and cultural environment, used technologies etc. Obviously, the same approach cannot be applied in every case – each organization has its own needs and "recipe of success".

Hypothesis about existence of precise set of recommendation, which provides (at least theoretically) success in development of effective system of knowledge transfer in every case, is refuted.

A typical example is given in the memoirs of outstanding scientist in the field of mechanics, one of the founders of Ukrainian Academy of Sciences – Stepan Tymoshenko[34]. Working on the organization of department of mechanics in Ukrainian Academy of Sciences (1918), he made an acquaintance with new approach in development of technical sciences in USA. Huge American companies started to organize research institutes, were solutions to the scientific questions could be found. Thus were born the mechanisms of convergence of pure science with its technical applications. S. Tymoshenko had an opportunity to take part in such projects because of his immigration to USA; it was connected with revolution events in the beginning of XIX century in Russian Empire.

Remembering his work in Research Department of Westinghouse Electric Corporation he has written: "A small groups of researchers appeared in different technical departments of the factory. These groups included representatives of the Research Department. In such a way a contact between theoretical research and practical application has been provided. Close contact between scientific research and practical application has been very productive. Workers of Research Institute received a lot of interesting tasks from people–practicians and practicians applied theoretical approaches for practical applications. Just with such close contact

[34] Тимошенко С. П. (1993), Воспоминания. 2-е изд. – Киев: Наукова думка

between researchers and practicians a full effect of research work for progressive development of technology is possible to be done…"

From modern point of view of science about the knowledge management it is obvious that successful activity of research department of Westinghouse Corporation is connected to forging an effective communication between the scientists (creators of new knowledge) and technical staff, who used this knowledge.

S. Tymoshenko gives a counterexample, when such communication is not available. Describing an organization of research on the factory of another company, he writes: "The factory had a perfectly equipped research institute. A famous scientist was a head of the institute. His nearest co-workers were people also known for their scientific works. Any connection between these scientists and equipment in the factory was absent. They could have successfully worked on technical tasks, but the result of their labor wasn't received by people working with equipment."

Making conclusions, the scientist comes to the result that is very modern

> "Success of research institute of any technical enterprise largely depends on ways of achieved results are transferred to people directly involved in the process of manufacturing."[35]

Even though this statement refers to the situation prevailed in the research organizations in the first half of previous century, it is still actual. In translation to the modern language it means, that communication is a key to the knowledge transfer.

According to a survey, conducted by International Data Corporation (IDC), the main obstacles for implementation and introduction of the system of data management in organizations are as follows:

- ✓ employees lack of time for realization of activities in data management (41,0 %);
- ✓ existence of culture of corporation prohibiting exchange of experience and knowledge (36,6 %);
- ✓ lack of understanding of knowledge management system (29,5 %);
- ✓ difficulties in measuring the financial benefits of the introduction of knowledge management system (24,5 %);

[35] Ibid.

- ✓ employees lack of skills of data management (22,7 %);
- ✓ lack of activities funding in data management (21,8 %);
- ✓ lack of promotion and encouragement for knowledge exchange from the leadership of organization (19,9 %)[36].

Thus the main barrier for implementation of the data management system is: lack of knowledge and understanding of the process of data management in the leadership of organization and between staff, existence of culture of corporation prohibiting exchange of experience.

The modern companies advanced significantly in design of processes of the knowledge transfer. A lot of progressive companies provide corporative standards in the sphere of data management and development of appropriate systems. At the same moment the main element of such system is evolution of employees. New knowledge increases the competence of staff to the level corresponding to the level of development of technologies, products and services.

Nowadays companies understand that success of their performance depends directly on the opportunity of each worker to open his abilities to the limit. In fact, now it is possible to build individual trajectories of careers of the employees, taking in account their abilities, educational level, professional skills, desire to take part in the knowledge sharing, etc.

If a couple of decades ago personal growth of workers has been done with the help of increasing the amount of trainings, in which they've been taking part, now the preference is given to "learning through work". Such training gives an employee the opportunity to take part in projects, which contribute gaining the necessary knowledge and experience for further independent work. There are other methods that also work efficiently, for example, "job rotation", when employees are transferred to work in other units of the company, sometimes to other cities and even countries. Job rotation may pursue different aims, but the most important is that it promotes the distribution of knowledge in the organization.

Attraction of workers to spread the knowledge they've gained and its transfer to the general fund of organization knowledge is an extremely difficult task. Information technology has allowed to facilitate the process of storage and transmission of certain types of knowledge. Infrastructure of knowledge management lets to find the most convenient ways of its presentation that facilitate the use of knowledge within the organization. However, the most complicated is to convince people that in the end knowledge transfer will give the

[36] Milam, J. H., Jr. Knowledge Management for Higher Education. ERIC Digest. URL: http://www.ericdigests.org/2003-1/higher.htm. [accessed:02.04.2014]

benefits to the organization and them in person. Most of them think that transmission of received knowledge to the general fund would decrease their value for the organization.

For the biggest part of organizations processes “Training” and “Spreading” are new. Recognition of these processes to take an important part in creating the competitive advantages of organizations appeared recently. Their implementation into the process of manufacturing requires a rejection from the “crisis” type of thinking, when short-term goals are always evaluated as more important than the questions of structural reforms, which give results in the longer terms.

In recent years, the concept of organizational culture – regulation of the system of values and beliefs of employees has been one of the key points in the theory and practice of organizations management. Creating organizational culture that encourages creative approach to business, susceptibility of new ideas and desire to experiment is critical for any organization. In this context the main task for the head of the organization is formation of suitable system of values for achieving aims of the enterprise, with help of this system it is possible to mobilize efforts of collective. Formation of new culture of organization always is a complicated and lasting process.

The process of creation of the management system can be divided into the following steps:

Step 1. Formulate aims and approaches to the construction of knowledge management system (storage of staff skills, improving customer satisfaction, increasing profits, reducing the product manufacturing cycle, providing conditions for the realization of projects, etc.).

Step 2. Determine the subjects and objects of management, which are combined in the organizational structure. Determine ″who″ has the knowledge and ″whom″ the knowledge should be transferred. Determine the knowledge required for successful implementation of the organizations working process.

Step 3. Select methodology, methods and tools for knowledge management system design. Develop procedures of fixation and transferring of knowledge.

Step 4. Create creative teams and communities.

Step 5. Develop and implement an adequate training system. The system should have self-tuning functions, functions of monitoring and control of

Step 6.

the learning process.

Usage of knowledge in the current activity.

The circle has closed. Followed by revision of goals, taking into account the results and experience gained a new cycle begins the transfer of knowledge for new aims (Fig. 1.4).

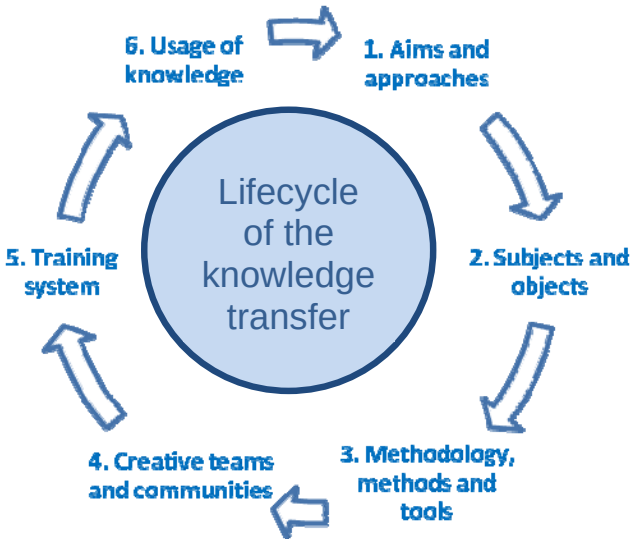


FIGURE 1.4 Lifecycle of the knowledge transfer

Knowledge and technology transfer in universities and scientific establishments

Generation of new scientific knowledge and educational activity are two main functions of classical university. Universities together with scientific organizations are the main source of new knowledge; this explains support of their scientific research by the government, especially in the field of fundamental research.

It is admitted, that "German" model of the university, dominating from the beginning of the XIX century, known as "university of Humboldt", can't give answers and solutions for all the challenges of innovative society formed nowadays. The basis of classical university is research activity and its inseparability with educational process.

Innovational activity requires from university knowledge and information to become a market product, such as goods. For realization of this requirement a certain infrastructure is needed, its main function is to transfer the knowledge.

For successful transfer of knowledge and commercialization of results of scientific research a research university uses diversity of methods and ways: taking part in network structures, clusters, exhibitions, fairs, informational activities, advertisements on university's web-sites, letters to potential customers, etc.

Knowledge transfer in university has two main areas: commercialization of results of scientific research and realization of market-oriented educational programs. The first area includes research for businesses, the use of intellectual property rights in university research and development, participation in national and regional development programs, job technological incubators and science parks. The first area includes conducting scientific research for enterprises, usage of the rights of intellectual property for scientific design of university, taking part in national and regional programs of development, work of technological incubators and scientific parks. The second one is connected to design and implementation of demanded in market educational services, which allow the client to get the necessary economic effect.

Existing experience of transition of classic universities to the model of innovative university show this process to be accompanied by serious problems connected to "human factor".

Two problems that hinder the inclusions of scientific and pedagogical workers to innovation are identified – stereotypes of academic profession and professional suitability for academic entrepreneurship.

The stereotypes of academic profession should be understood as a common in academic world opinion about the priority role of fundamental research. In conditions of innovative economics demand for applied research is increasing. At the same time the scientists have to face the problem of commercialization of received results. Their motivation is critically changing: from "pure science serving" they need to move to the customer service. The similarity of such activity to the entrepreneurship is obvious.

Adding the elements of entrepreneurship to the academic activity is a serious barrier for involving the scientific and teaching staff into the innovative practice.

The second obstacle that hinders the inclusion of scientific and pedagogical workers to innovation is a professional aptitude of classical university teachers for entrepreneurship. Success in traditional academic and entrepreneurial activity has various psychological conditions, and success in one type of activity is not automatically guaranteed in the other.

Because of this it is extremely difficult to change university from traditional to innovative form. The following tasks are needed to be solved. On the one hand, this is the task of overcoming common professional stereotypes, which do not meet modern requirements of academic profession. On the other – it is formation of professional aptitude of the teaching staff to academic entrepreneurship.

Experience of energy sector organizations

There are a lot of examples of successful practice in the sphere of knowledge management in the energy sector. In particular, oil and gas giants Shell and BP are the leaders in the knowledge management practice.

A book of Collinson and Parcell[37] tells about the system of knowledge management of BP, here they share their practical experience received during working in the company. In the book simple and accessible instruments are presented, they can be easily used in each company. The most important element of the system of knowledge management of BP is learning, it is conceptually described in approach: to learn before the project, to learn during the project and after the end of it (learning before, learning during and learning after).

A serious attention to the systems of knowledge transfer is also paid in the nuclear power engineering. International Atomic Energy Agency has published a number of reports with recommendations of using the methods of knowledge management in the nuclear energy enterprises[38].

A research by Intellectual Assets Centre in Scotland is devoted to assessment of knowledge management in small and medium enterprises (SMEs) of Scotland, working in the sector of renewable energy sources. In research it is noted an importance of knowledge assets management in the enterprises of this sector of industry, which is dynamically developing nowadays and has a high science intensity.

Review of the best examples of such activity is represented in the work[39].

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[37] Collison, C., Parcell, G. (2004), Learning to fly: Practical knowledge management from some of the world's leading learning organizations. Chichester, West Sussex: Capstone

[38] INTERNATIONAL ATOMIC ENERGY AGENCY, The Nuclear Power Industry's Ageing Workforce: Transfer of Knowledge to the Next Generation, IAEA-TECDOC-1399, IAEA, Vienna (2004); INTERNATIONAL ATOMIC ENERGY AGENCY, Knowledge management for nuclear industry operating organizations, IAEA-TECDOC-1510, IAEA, VIENNA (2006). http://www-pub.iaea.org/MTCD/publications/PDF/te_1510_web.pdf [accessed:DD.MM.YYYY]

[39] Weir, M, Huggins, R, Schiuma, G, Lerro, A and Prokop, D. (2010), "Valuing Knowledge Assets in Renewable Energy SMEs: Some Early Evidence" Electronic Journal of Knowledge Management Volume 8, Issue 2, 2010. – P. 225 – 234

There are a lot of examples of practice in the field of knowledge management in the energy sector[40] and some organizations, especially in the oil industry, are leaders in the knowledge management practice.

[40] Edwards J. (2008), Knowledge management in the energy sector: review and future directions / International Journal of Energy Sector Management, Vol. 2 Iss: 2, 2008. – P. 197 – 217

Chapter

2

Features of technology transfer in the field of energy efficiency and renewable energy sources

Transfer of technologies

The notion of technology and transfer of technology

According to the definition of the World Intellectual Property Organization (WIPO), technology is a systematic knowledge about manufacturing of products, application of process or rendering of service regardless whether this knowledge is reflected in the invention, industrial sample, useful model, new processing system, technical information, services or assistance provided by the specialists in design, installation, management of production or its activity. National legislations have their own definitions of technology.

The component of a technology is a part of technology where its separate elements are presented in the form of scientific and scientifically-applied results, objects of intellectual property, as well as technological equipment and engineering services.

There are several definitions of technology transfer. Here are the definitions which have been adopted in the United States[41]:

> "The process of utilization of technology, knowledge, know-how or equipment with the aim which was not foreseen by its developers.

[41] Корсунский С.В. Трансфер технологий в США. – К.: УкрИНТЭИ, 2005. – 256 с.

> Transfer of technology can lead to its commercialization or modification of the product or process."
>
> "A process which allows using the existing knowledge, equipment or capacities developed within the framework of budgetary financing, to satisfy certain public or private needs."
>
> "Formal transfer of new knowledge or innovations obtained as a result of research work in universities and non-profit research organisations to commercial sector for a common benefit."

Though the above-mentioned definitions differ from each other, the main idea put in them is the same – it is promotion of technology towards its practical use with gaining profit or other benefit in the long run.

The process of technology transfer

If we formally treat the term "transfer of technologies", transfer should start when a technology is developed.

However, this interpretation of transfer seems to be rather narrow. In a broad sense the concept of "technology transfer" should cover all processes, starting from appearance of innovative idea, including the stages of research work, development of the technology itself, including design and technological documentation, organization of production of innovative produce and, finally, making profit or other benefit from market sales of goods or services produced under the developed technology (Fig. 2.1)[42].

The scheme of conversion of the innovative idea into profit in Figure 2.1 has rather theoretical nature and is rarely implemented in practice. The model of a real technology transfer process is more like a ″black cybernetic box″ at the beginning of which there is an innovative idea, and at the end is a final result – profit. Everything that happens inside the ″box″ is often random and depends on many factors which can influence the initial idea changing it beyond recognition. However, this excludes implementation of tasks typical for stages of technology transfer presented in Figure 2.1.

[42] Перерва П.Г., Коцински Д., Сакай Д., Верешне Шомоши М. (2012), Трансфер технологий/Монография.– Х.: Віровець А.П.《Апостроф》, 2012. – 668 с.; Экопедия / Энергоэффективность и ресурсоэффективность. [Electronic resource]. – Access mode http://www.ecorussia.info/ru/ecopedia/energyefficiency_and_energysaving

Main tasks of technology transfer

The stage of research work consists of four stages:

- ✓ decision on the direction of research;
- ✓ theoretical and experimental research;
- ✓ generalisation and estimation of research results, preparation of reporting documentation;
- ✓ acceptance of research work (RW).

At the stage of research work the following tasks are carried out:

- ✓ selection, analysis and generalisation of scientific and technical, and patent documentation;
- ✓ consideration of possible directions for research and their evaluation;
- ✓ decision on the direction of research;
- ✓ motivation of the accepted research direction;
- ✓ development, harmonization and approval of terms of reference for the components of research work (if necessary);
- ✓ development and harmonization of methodology and of the work program on carrying out a research;
- ✓ making and processing of the progress stage report;
- ✓ consideration of results and acceptance of the stage, if it is stipulated by the terms of reference.

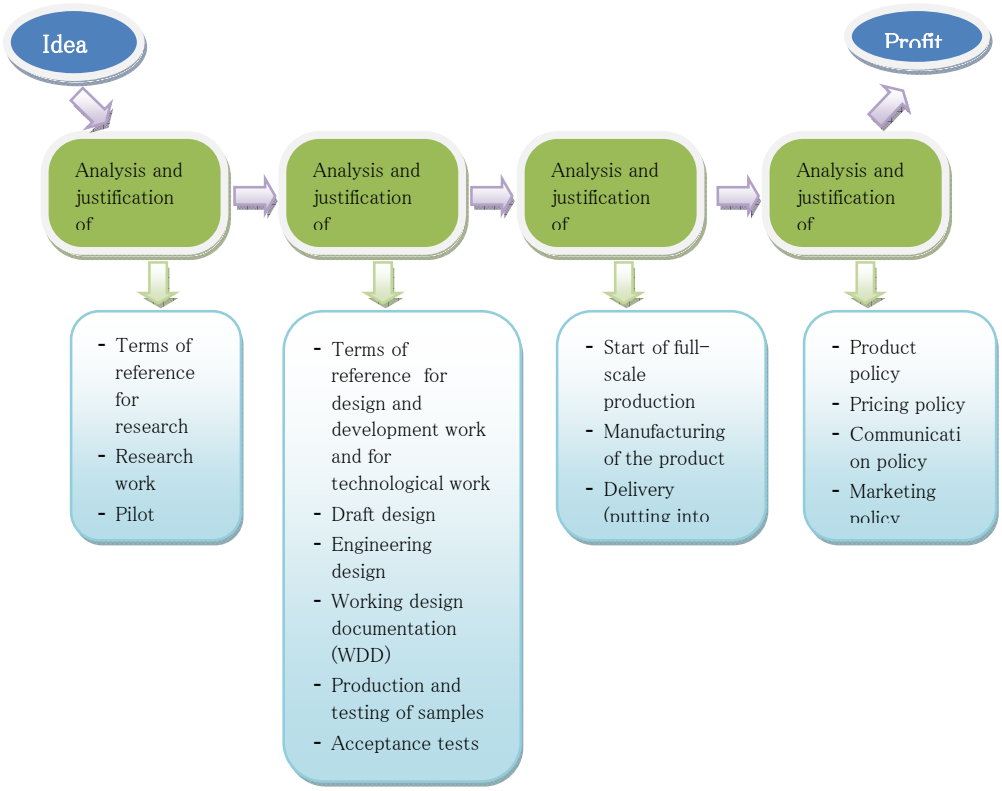


FIGURE 2.1. The process of technology transfer

At the stage of 'theoretical and experimental research' there are the following tasks:

- ✓ theoretical search, calculations and investigation of principal questions;
- ✓ elaboration of documentation, production and check-out of mock-ups, models or test samples of the future products, programs and algorithms (if necessary);
- ✓ performance of experimental work and research;
- ✓ processing and correction of results of theoretical and experimental research;
- ✓ drawing of conclusions according to the research results;
- ✓ making and processing of the stage report;
- ✓ consideration of results and acceptance of the stage, if it is stipulated by the terms of reference.

At the stage of "generalisation and estimation of research results, preparation of report documentation" there are the following tasks:

- ✓ generalization of results of theoretical research and experimental work;

- ✓ evaluation of comprehensiveness and performance quality of the assigned tasks;
- ✓ synthesis of materials of a patent search and preparation of report on patent research (if necessary);
- ✓ drawing up of patent protection for potential objects of intellectual property and working out of measures to preserve a know-how;
- ✓ elaboration of terms of reference for the next research work in case of the need for further research, or elaboration of terms of reference for design and development or technological work;
- ✓ preparation of report documentation package;
- ✓ drawing up of conclusions on the basis of research results and working out of guidelines on the use of research results;
- ✓ consideration of research results;
- ✓ submission of work for formal acceptance.

At the stage of "acceptance of research work" there are the following tasks:

- ✓ preparation activities for acceptance of research work;
- ✓ acceptance and registration of research work, if it is stipulated by the legislation.

The stage of development of a technology or a product consists of four steps:

- ✓ technical proposal;
- ✓ draft design;
- ✓ engineering design;
- ✓ working design documentation of the pilot sample (test batch) of the item to be produced.

At the stage of "technical proposal" the following tasks are carried out:

- ✓ selection and synthesis of scientific and technical, and patent documents, preparation of analytical review;
- ✓ development of technical proposal basing on the analysis of scientific and technical, patent and normative documents, marketing research and terms of reference for design, development and technological work;
- ✓ consideration and approval of technical proposal.

At the stage of "draft design":

- ✓ elaboration of a set of documents for a draft design, production and testing of mock-ups or experimental models (if necessary);
- ✓ consideration and approval of a draft design.

At the stage of "engineering design" there are the following tasks:

- ✓ elaboration of a set of documents for engineering design;
- ✓ development of design concepts for a product and its components;
- ✓ consideration and approval of engineering design.

At the stage of "working design documentation for the pilot sample (test batch) of the item to be produced" there are the following tasks:

- ✓ drawing up of working design documentation intended for manufacturing and testing of the product pilot sample (test batch);
- ✓ production and preliminary testing of the pilot sample (test batch);
- ✓ correction of design documentation according to the results of production and preliminary testing of the pilot sample (test batch);
- ✓ acceptance tests of the pilot sample (test batch);
- ✓ correction of design documentation according to the results of acceptance tests of the pilot sample (test batch).

At the stage of preparation and mastering of production, to ensure readiness of an enterprise for serial (mass) production of goods, manufacturer with involvement of a developer (if necessary) organizes preparation and mastering of production.

Preparation of production, as a rule, starts simultaneously with elaboration of technical documentation and manufacturing (if necessary) of separate product components or of the whole product.

Mastering of production, if it was not implemented earlier, is carried out in the course of manufacturing of a setting batch (first-off production batch). At the same time, one carries out activities aimed at trying out of technology and training of the staff for production of goods with stable properties in the given output volume.

To confirm the readiness of an enterprise for serial (mass) production of goods, one has to check the completeness of manufacturing process, quality and consistency of production steps as well as carry out qualification tests of the setting batch samples (first-off production batch).

Qualification tests are also carried out while starting the full-scale production of goods which was earlier coped with at another enterprise or manufactured under the license. The results of qualification tests enter the protocol (statement).

If qualification test results are positive, mastering of production is considered to be finished and produced goods can be delivered to the customer (user) under the certified documentation.

At the stage of marketing of innovative produce the main tasks are as follows:

- ✓ carrying out of marketing research;
- ✓ identification of market segments and positioning on this segment;
- ✓ implementation of product, pricing, communication and sales policies;
- ✓ delivery, distribution, etc.

Apart from the above-listed tasks of technology transfer, at the stages of innovative product life cycle there are a lot of specific tasks which can recur at different stages. For example:

- ✓ search for strategic business partners;
- ✓ search and attraction of investment;
- ✓ business planning;
- ✓ management of intellectual property;
- ✓ value appraisal of technology and its components;
- ✓ signing of license and other contracts;
- ✓ estimation of amount of flow of funds;
- ✓ carrying out of patent-market research;
- ✓ information support of technology transfer;
- ✓ establishment of contacts between holders of technology transfer and others.

Barriers on the way of technology transfer

Developed countries, which finished development of national innovation systems (NIS), have all preconditions for successful transfer of technologies. However, in developing countries, which have not yet built the NIS, there are numerous barriers on the way of technology transfer. These barriers involve four dimensions: political, economic, legal and social.

In the political area barriers appear are due to the lack of clear government strategy for the development of innovation activity and effective government innovation programs, and to the excessive duplication of functions of innovation management between the government and others.

Insufficient funding of innovation, non-transparent financing schemes and lack of effective criteria for evaluation of productivity from the use of allocated funds, as

well as tax advantages of innovative projects create additional obstacles for technology transfer.

Incomplete and contradictory national legislations in the sphere of innovation activity also hamper the process of technology transfer. For example, if the law stipulates that the rights to the objects of intellectual property, which are created for public money, belong to the government, then the developer of these objects loses motivation to transfer them to industry.

People of creative work – scientists, authors and inventors, creating objects of intellectual property and developing technologies are at the head of technology transfer. But if their work is not appreciated by the society, their desire to create disappears. The latter is not conducive to technology transfer. This situation is typical of post-Soviet countries, in which during transition from a planned to a market economy and change of the dominant form of ownership, formerly prestigious specialty of a scientist lost its attraction.

Mediators in technology transfer

Participants of technology transfer are scientists and inventors, research institutes and design engineering bureaus, industrial enterprises, market structures, investors and other entities. And all these holders of technology transfer speak different languages. Thus, most scientists poorly imagine the practical side of the commercialisation of their research results. The manufacturers are not familiar with peculiarities of scientific search for new ideas to create innovative technologies. Investors do not understand what both the scientists and manufacturers do. In these conditions technology transfer is like building the Tower of Babel. Thus, in addition to those who are directly engaged in development and use of technologies, we need mediators who could talk to all participants about technology transfer using language which they understand for the purpose of increasing the effectiveness of technology transfer and achievement of its ultimate goal (Fig. 2.2).

Mediator in technology transfer can both contribute to creation of new technologies and the use of existing ones. Taking into account the fact that application of existing technologies is much cheaper than creation of new ones, technological mediation provides additional advantages in the pursuit of innovations.

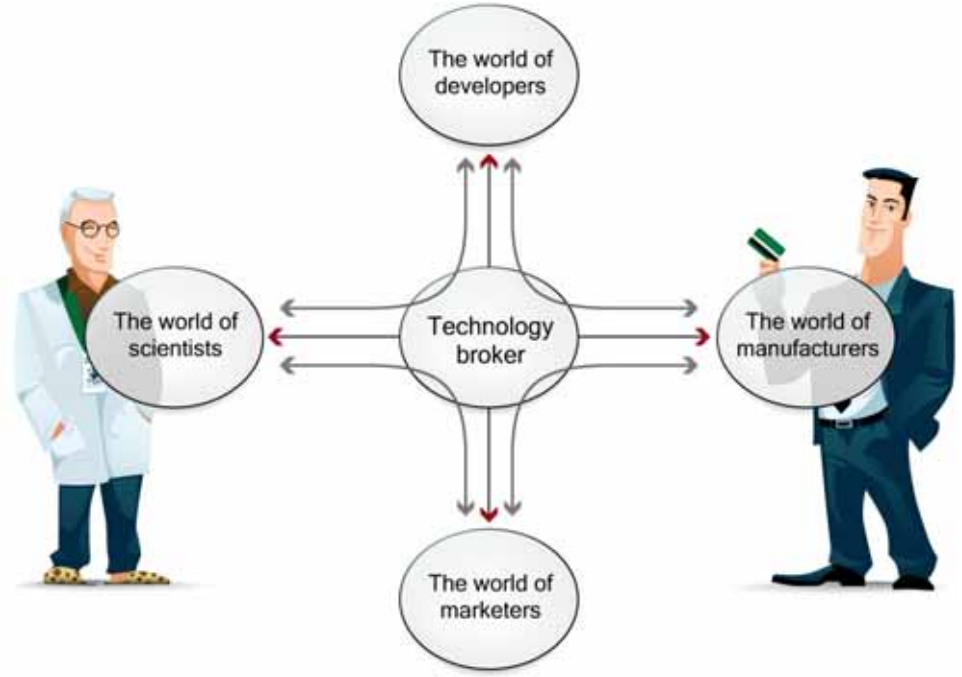


FIGURE 2.2 Technology broker as a communicator between holders of technology transfer

Mediators of technology transfer can be divided into four groups:

- ✓ corporate mediators;
- ✓ group mediators;
- ✓ individual mediators;
- ✓ occasional mediators.

Corporate mediators are the companies which fully dedicated themselves to technological mediation. Taking advantage of its ability to combine new technologies with the existing objects and ideas as well as a wide network of people and organisations at their disposal, this company creates a community around its innovative products and processes.

Some firms successfully practice group technological brokerage, i.e. create internal groups which are relatively free to move between different parts of a large organisation and watch what ideas of one subdivision can be used in another. Group (internal in relation to the parent company) broker can establish the necessary links between the company units or individual performers to achieve the company's goals in creation and promotion of technologies.

Individual mediators, the so-called technology brokers, are physical persons who can be private entrepreneurs providing services to participants of technology

transfer for searching of business partners, investors, or for establishing contacts between individuals, groups or organisations for promotion of innovative ideas through creation of new or use of existing technologies for gaining profit or other benefit.

The process of technology transfer requires carrying out a lot of work that is not typical or is not rational for implementation by the participants of technology transfer. Such work includes: registration of rights for intellectual property objects, development and conclusion of license agreements for transfer of technologies, information services and many others.

At the same time, there are a lot of business entities which are not direct participants of technology transfer, but they are willing to provide business services necessary for technology transfer. Each of such organisations has specific business and mediation in technology transfer is not in their plans. But they are interested in making a profit from rendering business services. Since the appeal to such organisations has random character, these organisations can be attributed to a group of random mediators.

Thus, the task of a mediator is not to create inventions and develop new technologies, but to combine existing objects, ideas and people from different areas and thereby solve a problem. A classic example of such a mediator is Henry Ford who is considered to be the father of mass production of cars. Here's what he said about himself:

> "I did not invent anything new. I just combined in the car inventions of other people before whom were centuries of developments"

Taking into account external environment of technology

A common mistake during transfer of technologies is consideration only of technological factors, and ignoring of environmental factors: political, economic, legal, social, connection between which is presented in Figure 2.3[43].

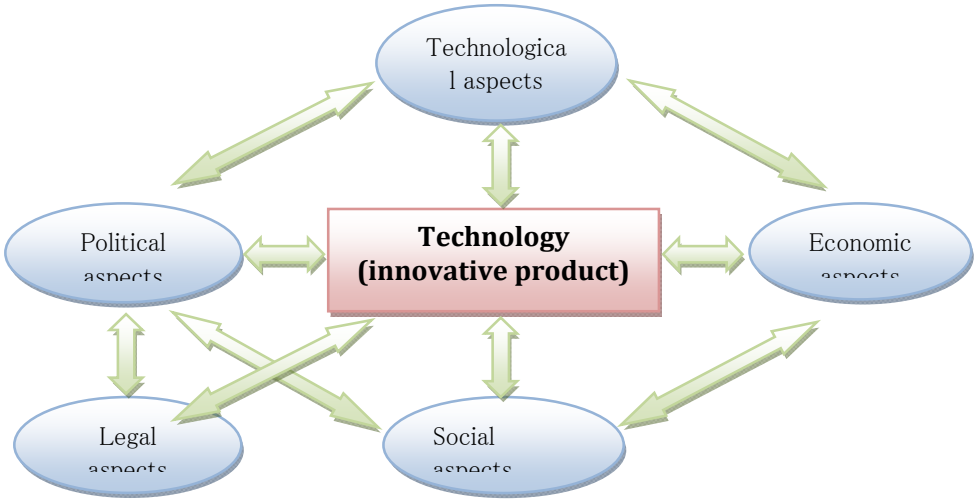


FIGURE 2.3. External environment of technology

Example. *Scientists have developed a genetically modified potato variety and the technology of its cultivation. Field testing of the variety was conducted on the territory of Ukraine, and confirmed excellent economic performance (economic aspect). However, the population has expressed concerns about the fact that consumption of genetically modified potatoes can lead to undesirable changes of health or even have consequences for the descendants (social aspect). The Government considered publications in press and recommended the Supreme Council to examine this issue (political aspect). As a result, the Supreme Council adopted the law banning cultivation of genetically modified potato varieties in Ukraine (legal aspect). Thus, they failed to implement transfer of science-intensive and very cost-beneficial technology.*

[43] Sigel D.S., Waldman D., Link A.N. Assessing the Impact of Organszational Practices on the Productivity of University Technology Transfer Offices//Exploratory Study. Research Policy.– 2003.– №.32(1). P.27–48.

Legislation in the field of technology transfer

In the years 1975–1985 in the framework of the United Nations, a draft of the International Code of Conduct on Technology Transfer was developed, which established the right of state regulation of international technology transfer, contracting mechanisms in the field of technology transfer, etc. Although the Code was not adopted, it was nevertheless important for development and harmonization of national legislation in this area.

For example, in the U.S. the activity in the field of technology transfer is regulated by 27 legislative acts, the most important of which are the following ones[44]:

- ✓ The Stevenson–Wydler Technology Innovation Act of 1980
- ✓ Bayh–Dole Act of 1980
- ✓ The Small Business Innovation Development Act of 1982
- ✓ National Cooperative Research Act of 1984
- ✓ Federal Technology Transfer Act of 1986
- ✓ National Competitiveness Act of 1989
- ✓ Small Business Technology Transfer Act of 1992
- ✓ National Technology Transfer and Advancement Act of 1995
- ✓ Technology Transfer Commercialization Act of 2000.

Some post–Soviet countries also have passed technology transfer acts. For example, the Law of Ukraine "On the State Regulation of Activity in the Sphere of Technology Transfer" was adopted in 2006. In addition to these laws, the activity in the field of technology transfer is regulated by the contract law. All agreements on technology transfer can be divided into two groups:

- ✓ agreements which directly establish relations in the field of technology transfer;

[44] Bayh–Dole Act of 1980; Public Law 96–517; Stevenson–Wydler Technology Innovation Act of 1980; Public Law 96–480; Small Business Innovation ; Act of 1982; Public Law 97–219; University and Small Business Patent Procedure Act of 1980; Trademark Clarification Act of 1984; Public Law 98–620; National Cooperative Research Act of 1984; Public Law 98–462; Federal Technology Transfer Act of 1986; Public Law 99–502; Omnibus Trade and Competitiveness Act of 1988; Public Law 100–418; National Institute of Standards and Technology Authorization Act for FY 1989; Public Law 101–189.

- ✓ agreements which indirectly establish such relationships.

The first group consists of agreements which deal with scientific and scientifically applied results, intellectual property rights, including know-how. These contracts are directly related to technology transfer, i.e. to transfer of property rights to technology. They include: the agreement on transfer of exclusive intellectual property rights, licensing agreement, franchise agreement, agreement on transfer of know-how.

The second group consists of contracts which even though they contain the elements of technology transfer, but not directly they deal with procedure for the use of technology transfer object. This group includes: constituent treaty, the contract on transfer of the entire property complex, lease contract or contract on leasing of technology components; agreement on joint activities, etc.

Modern technologies in the field of energy efficiency and renewable energy sources

Currently one of the most promising and rapidly emerging areas of the world energy development is the use of renewable energy sources (RES). It solves the number of issues related to exhaustion of organic energy resources and gives an impetus to the use of energy efficient and environmentally friendly technologies[45].

There are the following types of renewable energy sources:

- ✓ solar energy;
- ✓ wind energy;
- ✓ water energy;
- ✓ biomass energy;
- ✓ geothermal energy;
- ✓ environment energy.

In recent years, the attitude in the world and in Europe towards renewable energy has radically changed. Renewable energy enables to effectively treat the main problems existing for other types of generation, namely the limited nature of energy resources, dependence on their suppliers, loading on the environment.

A significant scientific and technical progress in this field provided substantial and steady decline in the prime cost of electricity, and for some renewable energy directions the prime cost has become comparable and even lower than the prime cost of electricity obtained via traditional generation technologies.

According to experts, the share of heat and power engineering on the base of renewable sources in the world amounted to 4.1% of the total final use of energy; the share of hydropower was about 3.7% and of wind, solar, geothermal and biomass energy was 1.9%.

The total fixed power of the world renewable energy in 2012 exceeded 1470 GW which is 8.5% more than in 2011. The total fixed capacity of hydropower increased by 3% and amounted to 990 GW. At the same time the share of other renewable

[45] Renewables Global Status Report 2013 [Electronic resource] – Access mode: http://www.ren21.net/gsr; Кудря С.О. Нетрадиційні та відновлювані джерела енергії. Підручник. НТУУ «КПІ», Київ, 2012.– 493 с.

energy sources grew by 21.5% and exceeded 480 GW. The share of the wind energy amounted to about 39% of all renewable energy facilities that were added in 2012; hydropower and solar photovoltaic systems occupied 26%.

In 2012, the increase in the share of renewable energy amounted to more than a half of the total increase of electric generating capacities in 2012. At the end of the year, they amounted to more than 26% of global generating capacities and produced about 21.7% of the world's electricity, including 16.5% of electricity of hydropower stations.

In recent years, the use of renewable energy for heating and cooling is continuing to grow. Now it is a huge but largely unrealized market of biomass, solar, geothermal sources of energy, which is still developing quite slowly. On the other hand, ever more countries adopt legislative provisions exactly for development of this sector of renewable energy.

In 2012, the highest growth in development of renewable energy showed China, the U.S., Brazil, Canada and Germany. In China, production of electricity using wind power for the first time exceeded the indicators of thermal power plants working on coal. In the European Union more than 70% of electric power capacities set in 2012 were based on renewable energy sources (mainly wind power stations and solar power stations).

The total global investment in renewable energy in 2012 amounted to 244 billion of dollars.

The most promising technologies in the use of RES are solar energy, wind, and hydropower, the use of biomass and the energy of the environment.

According to the Institute of Renewable Energy of NASU, the total annual technically feasible potential of RES in Ukraine is quite significant and is 68.9 million of tons of oil equivalent (o.e.) per year, of which 15 million of tons of o.e. per year is wind power, 4.2 million of tons of o.e. per year is solar energy, 7 million of tons of o.e. per year is hydropower, 21.7 million of tons of o.e. per year is bioenergy, 8.4 million of tons of o.e. per year is geothermal and 12.6 million of tons of o.e. per year is environmental energy.

Solar power

In most countries, the amount of solar energy falling on roofs and walls of buildings far exceeds the annual energy consumption of the residents of these houses. The use of sunlight and heat is a clean, simple, and natural way to get all forms of

necessary energy. With the help of solar collectors we can heat the houses and commercial buildings and/or provide them with hot water.

There are two main types of solar energy technologies which can be used in Ukraine:

- ✓ production of electricity using photoelectric converters (PEC);
- ✓ production of heat for heating of buildings using solar energy collectors and passive solar systems.

Solar energy potential in Ukraine is rather high for wide introduction of both photovoltaic and heat-and-power equipment. The annual average amount of total solar radiation coming to the surface of 1 square meter on the territory of Ukraine ranges from 1070 kW/h/m^2 in the northern part to 1400 kW/h/m^2 and above in the Crimea.

The total fixed power of solar photovoltaic systems in Ukraine at the end of 2013 amounted to 566.9 MW.

The most developed direction in the world is the use of solar energy for heating of buildings. Almost all directions of solar technologies are widely used — heat supply (including hot water supply and heating, refrigeration, air conditioning, etc.).

Wind power

Wind power plants (WPP) convert kinetic energy of the wind into electrical energy with the help of a generator due to rotation of the rotor. WPPs with horizontal axis of rotation, which have three blades and mounted on top of the tower is the most widespread type of WPP. The fixed power of modern WPP is 2-7 MW.

In Ukraine, the use of wind turbines for commercial production of electricity is most effective in regions with a high wind potential: on Azov and Black Sea coast, in Odessa, Kherson, Zaporozhye, Donetsk, Luhansk, Nikolayev regions, in the Crimea and in the Carpathian region.

Hydropower

Hydropower plants use kinetic energy of falling water to produce electricity. The turbine and the generator convert the energy of water into mechanical energy, and then into electricity. Turbines and generators are installed either in the dam or next to it. Sometimes the pipelines are used to bring pressurized water below the dam or to diversion unit of hydropower station. In general, hydropower is divided into two main types: large and small hydropower stations. In Ukraine, for

example, the total fixed capacity of hydropower station is 5.470 MW (of which 75 MW are small hydropower stations).

Bioenergetics

Biomass is one of the most popular and universal resources on the Earth. Today, biomass fuels can be used for different purposes — from heating of houses to production of electricity and fuels for vehicles.

Biomass is used in the following directions:

- ✓ as a fuel or additive to the coal of large and small boiler houses;
- ✓ for electricity generation;
- ✓ for heat production;
- ✓ to obtain biodiesel;
- ✓ for production of bioethanol;
- ✓ as an additive to coal in boilers of power plants;
- ✓ to obtain fuel from peat.

By the end of 2013, the total fixed capacity of biomass plants for production of electric power in Ukraine amounted to 12.2 MW.

Environment energy

The natural sources of heat of the environment include air, water from rivers, seas, topsoil and groundwater. Here may be also included surface waste water.

The thermal energy of the soil and groundwater can be used for heating and ventilation of rooms. Production of thermal energy from the ground can be realized by using any type of ground-coupled heat exchanger.

Heat pump system of heat-and-cold supply, which works with the use of environmental heat, is one of the most energy efficient heating technologies. The advantages of heat pump systems compared to conventional systems are connected not only with significant reduction in the cost of primary energy resources and with environmental cleanliness, but also with the possibility of increasing the degree of autonomy of the life support systems of buildings.

At present, geothermal heat pump units are the most effective energy-saving units in heating and air conditioning. Geothermal heat pumps are widely used in the U.S., Canada and in European Union countries.

Geothermal heat pump systems are installed in public buildings, private houses and at the industrial buildings.

In recent years, Ukraine has reached significant success in such area of renewable energy as production of electricity. In 2009, Verkhovna Rada of Ukraine adopted the Law ″On Amendments to the Law of Ukraine ″On Electricity″ in relation to promotion of the use of alternative energy sources″. The mentioned legislative act introduced a special stimulating ″green″ tariff for electricity derived from wind, solar, and biomass energy as well as produced by small hydropower stations.

From February 1, 2011 Ukraine became a full member of the Energy Community. In accordance with the decisions of the Community, Ukraine pledged to ensure the share of RES in the final energy consumption by at least 11% in 2020[46].

These factors have provided a significant impetus for a rapid development of the industry: on December 1, 2013 in Ukraine a fixed capacity of renewable energy facilities working under ″green″ tariff amounted to 999.65 MW, of which 353.65 MW were introduced in 2013 (which is 50.6% more power introduced in 2012), of which:

[46] Веб-сайт Державного агенства енергоефективності України [Electronic resource] – Access mode http://saee.gov.ua

- ✓ wind energy facilities – 144.423 MW;
- ✓ solar energy facilities – 195.408 MW;
- ✓ small hydropower facilities - 1.282 MW;
- ✓ bioenergy facilities which produce electricity from biogas - 6.538 MW;
- ✓ bioenergy facilities which produce electricity from biomass - 6.0 MW.

Methods for assessment of market attractiveness of technologies

Risk assessment

An effective tool to select the idea among several ones which are under consideration is risk analysis. It is assumed that a number of ideas which initially looked very attractive, after such a review will be discarded. The remaining technology in the future will be subject to an in-depth analysis involving methods which use quantitative characteristics[47]. Selection procedure involves study of risks according to six aspects:

1. Attractiveness of the market.	This item includes market size of the technology, growth prospects of the market, barriers on the way to the market, intensity of competition and typical profit margins.
2. Synergy of business.	This item takes into account the use or disuse of professional knowledge and existing production (distribution) systems available in the company, as well as the possibility of selling to available customers. Synergy presupposes obtaining of additional profit due to these factors.
3. Validity of idea.	One analyses a complexity of idea underlying the technology, novelty of technology, level of its patent clearance, and the need to obtain a permission to use it.
4. Resource needs.	This item presupposes study of the need in additional manpower and equipment, assessment of timeline of the project and the amount of external funding.
5. Benefits for the user.	Here one considers the ″uniqueness″ of obtained benefits, functional aspects and cost benefits, as well as evidence of the need for a new technology or product.
6. Legal protection of technology.	This item considers a strategy of legal protection, possibility of duplication of technology by unscrupulous competitors,

[47] Зинов В.Г. Менеджмент інновацій. – М.: Дело, 2005. –496 с.

possible types of licenses for developed technology.

For each item one formulates positive and negative indicators which are recorded in the table (Table 2.1). If some items turn to be insignificant, they can be ignored or replaced. There are many variants for quantitative assessment of factors under consideration. In the first approximation, one can choose the scheme by which each factor is given a score: from (+2) (for a powerful positive indicator presented in the first column) to (−2) (for a powerful negative indicator presented in the second column of the table). If for a technology under consideration the indicator has an intermediate value, it is assigned (+1), (0), or (−1). The score for each indicator is entered in the third column. After assessment of the risks for each technology under consideration and after calculation of total scores, one can easily select the technology whose implementation is associated with less risk.

TABLE 2.1. Factors of risk tracking

Positive indicators	Negative indicators	Scores
1. Market attractiveness		
The idea has good market prospects	The market for the idea is too small to deal with it	
This sector is growing very fast	This market sector is static or declining	
It will be relatively easy to enter this market	There are serious obstacles on the way to this market	
Competitors are weak and are not organized against the new technology or product	Market leaders are large companies with extensive resources	
It is known that profit margin in this sector is quite large	Tough competition leads to minimal profit	
2. Synergy of business		
Innovation meets the company's strategy	The idea gives a chance to diversify	
The idea can be sold to one's own customers	The idea will require the development of a new customer base	
When developing and implementing the idea there is no need for new professional skills	The company should obtain new practical experience to work with the idea	
The existing production and distribution systems can be applied at the operational phase	Operational phase will require investment in production and/or distribution system	
3. Validity of idea		
Technology underlying the idea is approved and understandable	The idea is based on a new unproven concept	
The idea implies a new application of the	The idea implies a new product concept	

Positive indicators	Negative indicators	Scores
product or the process	or a new concept of the process	
Success does not depend on other developed items	Innovation depends on other developed items	
Innovation does not involve complex and unknown subsystems	Several complex systems will be integrated to result in emergence of innovation	
The use does not require any approval and permit	One will need approval and permit allowing to implement the idea	
4. Resource needs		
One needs a small amount (or does not need at all) additional resources for development and implementation of the idea	There will be a need for additional funding before one can fully realize the idea	
The idea can be quickly developed and implemented	It will take a long time before the idea is developed and put into practice	
There is an access to funds/grants for development work	Development of the idea will entirely depend on external funding	

TABLE 2.1. (continued)

There will be enough staff for exploitation of the idea	One will have to hire new people to develop and implement the idea	
5. Benefits for the user		
The idea will provide unique benefits for the users	The idea will not give any special advantages for users	
The idea offers improved performance qualities of the product	Performance qualities of the product will be approximately the same as before	
Product price advantages will be significant	The new idea will not have any price advantages	
The idea will have a positive impact on the environment	Special efforts will be needed to reduce the ecological implications after implementation of the idea	
There is a clear and confirmed need for amenities derived from implementation of the idea	There is no reason to suppose that te benefits from implementation of the idea will be appreciated by users	
6. Legal protection of the idea		
For other companies it will be difficult to copy the idea	Once the idea comes into the market, others will be able to copy it	
Most likely it will be possible to obtain legal protection of technology (patents, certificates)	The prospect of effective patent protection of the idea is very weak	
One can earn additional income through licensing agreements with third parties	Income from licensing will hardly cover extra expenses	
	Total:	

Analysis of competitors

Very often one can hear that someone offers a unique technology, that nothing of this kind exists in the whole world, and there is no competition in this field. Sometimes it is really the case that in some fields there is no competition. But mostly an assertion that there is no competition is erroneous. Thus, analysis of business plans presented to investors in the U.S., showed that 32% of business plans and presentation materials stated that a company either has no competitors at all, or the strength of competitors was underestimated. Besides, it was also found that almost 30% of cases poorly explained possibilities and benefits of a new technology or a new product.

Therefore, an effective tool for selection of technologies is to compare characteristics of technology or product which is expected to be produced under the technology in question, with characteristics of technologies or products of competitors[48].

For this purpose one should write down in column 2 of Table 2.2 at least five key technical factors for compared technologies or products. Such factors may be as follows:

- ✓ physical characteristics (e.g., weight, size, etc.);
- ✓ performance (e.g., speed, power, efficiency, ease of use, durability);
- ✓ production characteristics (e.g., ease of assembly, manufacturing method, quantity of manufacturing steps).

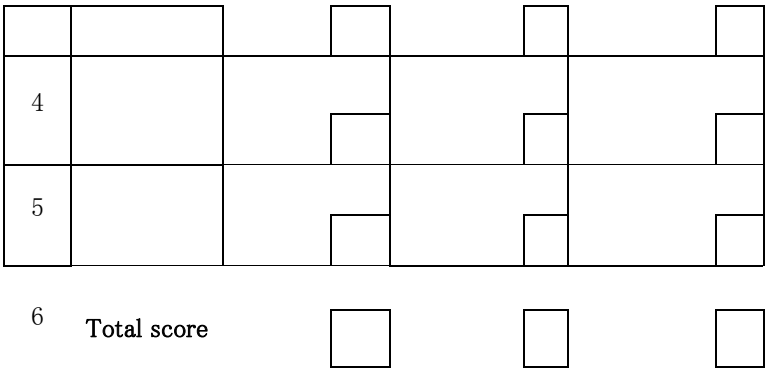
In column 3 one enters quantitative or qualitative (e.g., design) values of factors for technology in question, and in columns 4 and 5 – factor values for technologies or products of the strongest competitors. Then one should assess each factor for compared technologies or produce in scores, according to the scale: +2– excellent; +1– well; 0–medium, (–1)–bad, (–2) very bad. Obtained numerical values of factors should be put in small squares of each of the five rows of the table. Total score of columns 3, 4 and 5 is entered in squares of the row 6.

Comparing total scores it is easy to identify the rating of the technology in question or of the produce. If it proves to be lower than that of a competitor, probably one should discard this technology or produce.

TABLE 2.2. Analysis of competitors

No.	Factor	Technology in question	Competitors' technologies	
1	2	3	4	5
1				
2				
3				

[48] Пфеффер, Джеффри. Формула успеха в бизнесе: на первом месте – люди.:Пер. С англ.– М.: Издательский дом《Вильямс》, 2006. – 560 с.; Pererva Petro, Gladenko Ivan, Kosenko Aleksandra. Monitoring of processes of the transfer of technologies an commerzial realization of innovations//Miskolci Egyetem Gazdasagtudomanyi Kar. –VI Nemzetkozi Konferenzia. – Miskolc: University of Miskolc, 2007/– Oktober 10–11. – S. 390–394.



Assessment of cost-effectiveness of technology

Preliminary assessment of technology can be made using the criterion of "net present value" (*NPV*) which is used by investors. Assessment is done by calculating the value of the net present value for each of the selected technologies.

Value of the *NPV* is estimated by the formula:

$$NPV = -C_0 + \sum_{t=1}^{n} \frac{C_t}{(1+i_t)^t}$$

where: *NPV* – net present value;
C_o – sum of initial investment;
C_t – future cash flow for a period t;
t – periods (years) during which it is expected to gain a profit;
i_t – rate of discounting (discount rate) appropriate for a period t.

Discount rate can be determined by the equation:

$$i = i_0 + i_k$$

where: i_o – the risk-free rate equal to % of remuneration for government securities; i_k – cumulative component of the discount rate, which is determined through the indicators of expected risk of the company (Table 2.3).

TABLE 2.3. Expert assessment of magnitude of the bonus for the risk associated with investing in a particular company (i_k)

No.	Type of risk	Probable range of values, %
1	The administrative board: quality of management	0–5

2	Size of the company	0–5
3	Financial structure (sources of financing)	0–5
4	Merchandise/territorial diversification	0–5
5	Diversification of clientele	0–5
6	Level and predictability of profit	0–5
7	Other sources of risk	0–5

Bonus amount for the risk is defined as the sum of seven types of risks. The value of each risk is determined by the range from 0 to 5% (0–no risk, 5–maximum risk, 1–3 – intermediate risk value).

In the formula for *NPV* the discount rate is presented not in percentages but in fractions of a unit.

NPV criterion is simple to understand. Technology will be profitable only under positive value of *NPV*. If one compares several technologies, then according to this criterion one should choose that technology for which *NPV* has the maximum value[49].

[49] Цибульов П.М., Чеботарьов В.П., Зінов В.Г., Суініо. Управління інтелектуальною власністю / За ред.. П.М.Цибульова: монографія. – К.: «КІС», 2005. – 448 с.; Практические руководства для центров коммерциализации технологий [Electronic resource].– Access mode http://ictt.by/rus/Default.aspx?tabid=273 ; Robert Freund. Intelektuelles Kapital und betriebliche Weiterbildung [Electronic resource]/Robert Freund.– Access mode : http://www.RobertFreund.de

Chapter

3

Intellectual property rights and licensing in the field of energy efficiency and renewable energy sources

Intellectual property rights and licensing

The concept of intellectual property and intellectual property rights

Intellectual Property (IP) in a broad sense means the rights fixed by the law to the results of intellectual activity in the field of production, science, literature and art.
Intellectual Activity is a creative activity, whereas creative work is a purposeful mental work of a person the result of which is something quite new notable for its uniqueness and originality.

The result of art activity is literary and art works. The result of technical creative work are inventions, utility models, industrial designs, trade secrets etc. The results of art activity are mainly used in humanitarian field to enrich the inner world of a person and develop his world outlook. The results of technical creative work facilitate increasing of technical level of social production and its efficiency; provide competitiveness of produced goods and services. According to established historical tradition, the results of technical creative work are referred to as

objects of industrial property right or ″industrial property″. In this context ″industrial property″ is intellectual property which is mainly used in industry.

Initially, the results of creative activity of a person, the so-called intellectual property objects, are intangible. This implies that in contrast to material objects, the objects of intellectual property can be much easier taken into possession. For example, if during the conversation a trade secret is disclosed, it will move to the head of the interlocutor and it will be impossible to get it back, unlike the material object.

To prevent the loss of the object of intellectual property it is necessary to secure the right to it. In some countries, the rights to intellectual property objects are similar to those for material objects. I.e. it is a triad of rights: the right to own, the right to use and the right to deal with the object. In other countries, for example in Ukraine (fig. 3.1), there are two groups of rights to intellectual property objects — material (property) and intangible (non-property, i.e. private) rights. The latter include: the right on name, the right to inviolability of the work, etc[50].

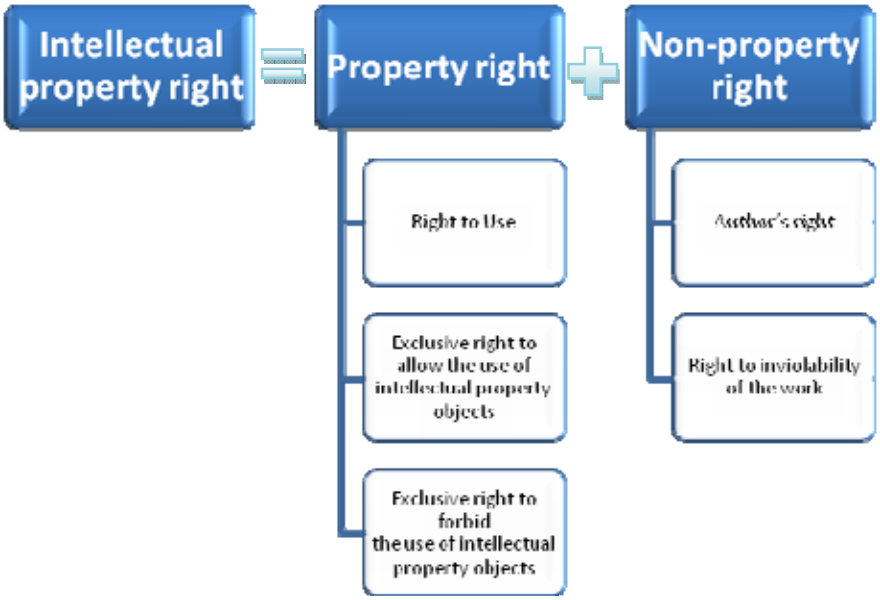


FIGURE 3.1 Intellectual property right

Objects and subjects of intellectual property right

Objects of intellectual property right (OIPR) are results of intellectual and creative activity which correspond with legal requirements (fig. 3.2).

[50] Введение в интеллектуальную собственность. – ВОИС, 1998. – 578 с.

The first group is divided into two subgroups – actually the objects of copyright: literary and art works, computer programs, data compilations (databases). The second group includes the objects of related rights, i.e. rights related to author's rights: performance of works, phonograms and videograms, programs (broadcasts) of broadcasting organizations.

Invention (utility model) is a result of intellectual human activity in any field of technology. Industrial sample is a result of creative human activity in the field of industrial designs.

Plant variety is a separate group of plants (clone, line, hybrid of the first generation, population) within the framework of the lowest known botanical taxon.

Animal breeds are usually selection achievements in animal breeding.

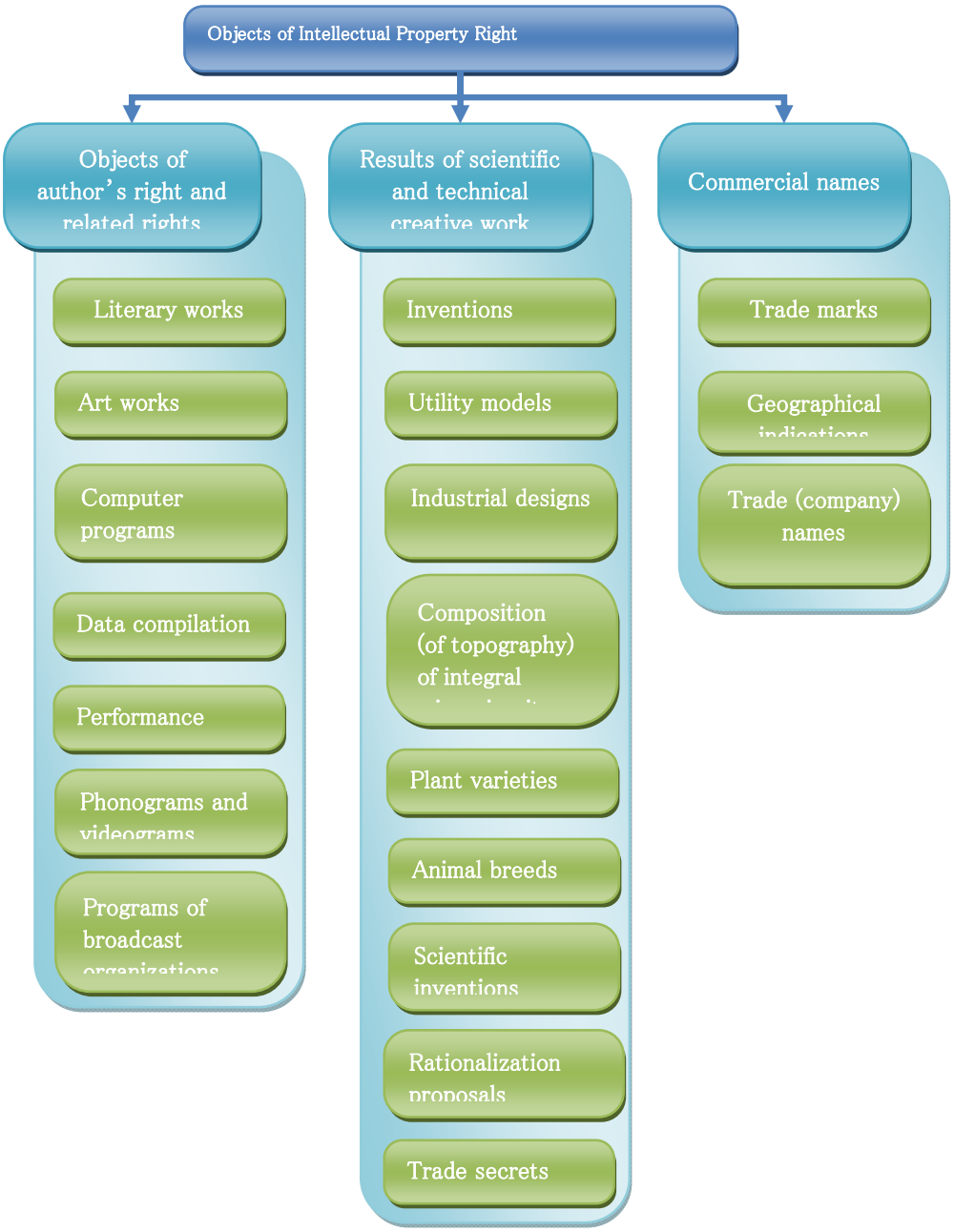


FIGURE 3.2 Classification of objects of intellectual property right

A spatial-geometrical layout for integrated microcircuit set of elements and connections between them, which is fixed on the material object, is defined by the law as topography of integrated microcircuit.

Trade secret is technical, commercial, organizational and other information which can increase the efficiency of production or of any other socially expedient activity, or can ensure some other positive effect.

Invention means establishment of new laws, properties and phenomena of material world.

The group of commercial designations includes: trademark, geographical indication, commercial (company) name. Trademark is a designation by which goods and services of one person differ from goods and services of others. Geographical indication is a name of geographical place, which is used to designate a product originating from this geographical area, and which has a certain quality, reputation or other characteristics, usually due to natural conditions or human factors typical of this geographical place, or due to a combination of these natural conditions and human factors. The essence of commercial (brand) name results from the very name this object. The list of IPR objects, which is shown in fig. 3.2, is not exhaustive. With the development of human civilization will appear more IPR objects, primarily in the field of information technologies, genetic engineering, etc.

The IPR subjects are the creator (creators) of IPR object (the author, executor, inventor, etc.) and others who possess private non-property and (or) property IP rights under the will or under contract. That is, subjects of IPR are only natural or legal persons. The state is not the subject of IPR because the intellectual property right is an institution of civil (private) law, whereas the state is a subject of public law.

The authors are persons whose creative work resulted in development of a product. Along with natural persons, the owners of copyright can be legal entities who purchased individual author's powers under the contract with the author or obtained them under the will or in other cases prescribed by the law.

Registration of rights to intellectual property objects

Any property needs to be protected. Intellectual property is not an exception. The essence of legal protection of rights to intellectual property objects implies that the author (developer) of the IPR object or any other authorized person obtains sole rights from the government to developed IPR object for a certain period of time and on a certain territory. These rights are regulated by a protective document — a patent or a certificate which is issued to the owner of IPR object.

The author, who obtained a protective document, e.g. the patent, feels confident because his rights are protected by the law. At this point, one can present the invention to a wide range of people for them to use this object on legal grounds. If the author does not fix the rights to IPR object, everyone will use this object

without his permission. Besides, the assumption of personal (non-property) as well as property rights facilitates the independent use of the IPR object with gaining advantages over competitors, or by allowing third parties to use the IPR object in exchange for payment of royalties.

The main benefits from acquisition of rights to the objects of intellectual property are as follows:

- ✓ ensuring monopolistic market position of goods and services, in which OIPR are used;
- ✓ creation of fundamentally new goods and services;
- ✓ provision of access to technologies of other companies;
- ✓ provision of access to new markets;
- ✓ formation of barriers for competitors on their way to the market;
- ✓ support of innovation activity of the staff;
- ✓ additional revenue from innovative product created with the use of OIPR;
- ✓ profit from full or partial sale of the rights to OIPR, etc.

Acquisition (occurrence) of rights to copyright objects unlike the objects of industrial property, in accordance with the Berne Convention for the Protection of Literary and Artistic Works of 1886, arises automatically from the moment of disclosure of the object and do not require any formalities[51]. In some countries, the copyright owner has the right to get the state certificate and register it in the official state registries at any time during the term of copyright protection. Protection of property rights is valid throughout the life of the author plus the period (established by the national legislation) after his death (50 years in the U.S., 70 years in Ukraine). The law permanently protects the right of authorship, the right on name and the right to counteract distortion or other change of the work, or any other infringement of the work which is likely to harm the honor and reputation of the author.

Acquisition of rights to the objects of related rights also does not require going through any formalities. Personal (non-property) rights of performers are permanently protected. Property rights of performers, producers of phonograms and videograms, as well as of broadcasting organizations are protected for 50 years.

The rights to inventions, utility models and industrial designs are protected by the state and certified by the patent.

[51] Ibid.

Patent is a technical and legal document issued to the applicant for an invention, utility model or industrial design which meets the conditions of patentability and confirms the authorship, priority and the right of ownership to mentioned objects.

The invention meets patentability requirements if it is new, has an inventive step and is industrially applicable. The criterion of novelty means that invention is not part of the state of the art, it does not reflect the information which became generally accessible before the filing date to the Patent Agency or, if priority is claimed, – before the priority date.

The invention has inventive step if it is not obvious for the specialist, i.e. it does not obviously follow from the state of the art.

Industrial applicability means that the invention can be used in the industry or in any other field of activity.

For each object of intellectual property there are its own criteria of protectability which meet the standards of national or international law.

For registration of rights to inventions, utility models and industrial designs it is necessary to submit a properly made up application to the patent office of the country where the applicant wants to obtain legal protection. In some countries it is preceded by submission of application to the national patent office. It is the applicant who draws up an application and submits it to the patent office. But more often this matter is dealt with by professionals — patent attorneys.

Each country has a certain national patent office which assesses applications for legal documents and issues such documents (patents or licenses) to the applicant. For example, in the U.S. it is USPTO, in Ukraine it is the State Intellectual Property Service of Ukraine.

Apart from national patent offices, there are regional intergovernmental structures in this field. They include: International Bureau of WIPO, European Patent Organization, African Regional Intellectual Property Organization (ARIPO), African Intellectual Property Organization (OAPI), and Eurasian Patent Organization (EAPO).

A convenient tool for submission of international patent applications is Patent Cooperation Treaty (PCT). According to PCT, international patent applications can be submitted to any national patent office of partner countries, to European Patent Office or directly to WIPO. These applications, wherever they are submitted, are processed by the International Bureau of WIPO. The international application has the same effect as national applications (i.e. applications submitted

to national patent offices or to European Patent Office) for each country specified in the application.

Legal relationships in the field of intellectual property in each country are governed by the regulations of national legislation. However, such relationships between countries are established by international treaties provided that countries are the members of these treaties:

- ✓ Convention establishing the World Intellectual Property Organization
- ✓ Universal Copyright Convention
- ✓ Paris Convention for the Protection of Industrial Property
- ✓ Patent Cooperation Treaty (PCT)
- ✓ Madrid Agreement Concerning the International Registration of Marks
- ✓ Berne Convention for the Protection of Literary and Artistic Works
- ✓ International Convention for the Protection of New Varieties of Plants
- ✓ Treaty on the Law of Trademarks
- ✓ Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure
- ✓ Nairobi Treaty on the Protection of the Olympic Symbol
- ✓ Madrid Protocol to the Agreement Concerning the International Registration of Marks
- ✓ Nice Agreement Concerning the International Classification of Goods and Services for the Purposes of the Registration of Marks
- ✓ Convention for the Protection of Producers of Phonograms against Unauthorized Duplication of their Phonograms
- ✓ WIPO Copyright Treaty
- ✓ WIPO Performances and Phonograms Treaty
- ✓ International Convention for the Protection of Performers, Producers of Phonograms, and Broadcasting Organizations (Rome Convention)
- ✓ Hague Agreement Concerning the International Registration of Industrial Designs
- ✓ Patent Law Treaty (PLT)
- ✓ Locarno Agreement on Industrial Design International Classification
- ✓ Strasbourg Agreement Concerning the International Patent Classification
- ✓ Vienna Agreement Establishing an International Classification of the Figurative Elements of Marks
- ✓ Singapore Treaty on the Law of Trademarks

These treaties are managed by the World Intellectual Property Organization (WIPO) which is one of 16 specialized organisations the United Nations.

Patent for invention is valid only on the territory of the country where it was obtained. To obtain the patent in several countries one can submit an application to each of these countries. There are patenting procedures when one application is submitted but patents are obtained in several countries. This reduces the cost and accelerates the process of registration of rights. Such procedures are stipulated by regional agreements: the European Patent Convention (EPC), the Eurasian Patent Convention (EAPC), the agreements of the African Intellectual Property Organization (OAPI) and the African Regional Intellectual Property Organization (ARIPO).

In most countries a patent for the invention is valid for 20 years from the filing date. Action of protective document for the object of industrial property can be completely or partially terminated before the appointed time on the basis of the following reasons:

- ✓ at the request of the patent owner;
- ✓ because of the late payment of the annual fee for maintenance of the action of protective document;
- ✓ in accordance with the court decision.

Duration of validity of rights to other intellectual property objects, as well as the procedure of registration of rights to them, is determined by national legislation and international agreements which are administered by the World Intellectual Property Organization (WIPO).

Methods for commercialization of intellectual property

Commercialization is aimed at making profit through the use of IPR objects in production, as well as from sale or transfer of rights to use these objects to other legal and natural persons. Commercialization is mutually beneficial (commercial) activities of all participants of the process when the results of intellectual labour are turned into market product.

The main methods for commercialization of IPR objects are as follows (fig. 3.3):

- ✓ the use of IPR objects in production of innovative products and services;
- ✓ transfer of rights for OIPR to third parties for remuneration.

It is believed that commercialization through the use of IPR objects in production of goods and services is more beneficial than transfer of rights to the OIPR. It is because the whole profit that is generated by the IPR objects is retained by their rightholder.

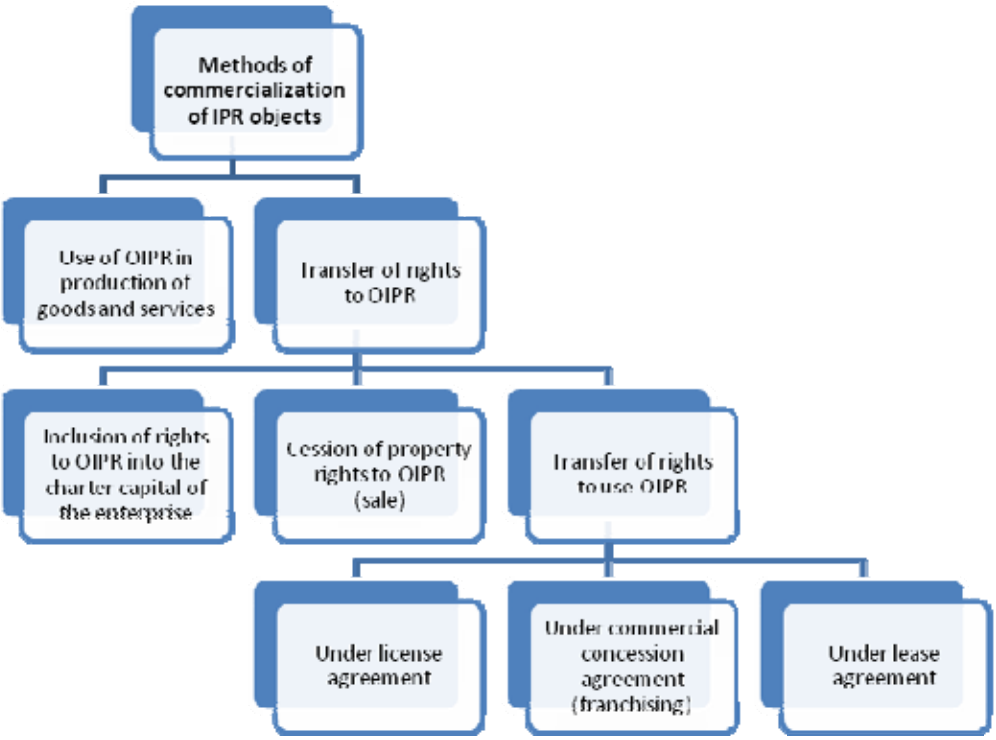


FIGURE 3.3 Methods for commercialization of intellectual property

Since the volume of produce can be large, so the profit coming from sale of innovative products can greatly exceed the cost of rights to OIPR in case of their transfer. It is clear that this method of commercialization involves considerable start-up financing for improvement of OIPR, development of production technology, etc. However, in case of success the revenue from sales of the product will compensate for these costs and, apart from this, one will receive significant additional income through the use of intellectual property.

When forming charter capitals of new business companies, intellectual property rights may be included into the charter capital instead of property, money and other tangible property, and it requires only the goodwill of all founders. The use of intellectual property in the charter capital enables one to form it without involving money and with obtainment of a number of other advantages.

If the copyright holder does not intend to use the objects of intellectual property in his own production, or to establish a new business, or to create a joint venture — he can give the right of ownership for OIPR completely or partially to another natural or legal person.

Full sale of rights is realized through the sales contract (as a contract of exchange transaction) under which, as a result of transfer of the ownership right to OIPR (sale of protective document – a patent or a certificate), the owner as a party who sells, loses all property rights to it. That is, if the patent for invention is sold, this patent will be re-registered in the name of a new copyright holder and he will get all property rights to this object.

But more often one obtains only the right to use the IPR object. Owner of rights to any object of industrial property (the licensor) can sell the license (grant a permission to use the object of intellectual property) to any person (the licensee), if the owner is unwilling or unable to use the appropriate object[52]. When selling the license, one aims to make a profit without wasting capital for production and market development. Sale of license — is the way of launching technology in the market without sale of commercial output. By means of revenue from sale of licenses, legal or natural persons cover their spending for research[53].

The patent owner can obtain additional profit from the use of his intellectual property object due to payments under a franchise agreement. Copyright holder (franchiser) allows another person (franchisee) to use the rights to industrial designs, trade names, trademarks, technologies, trade secrets and the like. The difference between the franchise agreement and the usual license agreement is that the rights are transferred at preferential, privileged basis. Thus, the user gets a ready-made technology under the well-known trade mark. Therefore, he does not need to win a place in the market and his risks are minimized. The franchise agreement should contain a condition that a quality of goods and services of franchisee will be not lower than a quality of goods and services of a franchiser, and the latter will control the application of this condition[54].

A widespread form of commercialization of rights to intellectual property objects is leasing. Under the lease agreement one hands over different technological equipment, etc., which is made at the level of invention and protected by patents. That is, together with technological equipment and the process, the right to use intellectual property is also transferred. Choice of such form of commercialization as leasing allows first-time entrepreneurs to open and expand their business even

[52] Valuation of Intellectual Property and Intangible Assets, Gordon V. Smith and Russell L. Parr, New York, USA, 1989; J. Mey, Commercialization of Inventions and Research Results: Marketing and Business Planning, WIPO/IP/R&D/ABV/00/13, October 2000

[53] Стюарт Томас А.(2007), Интеллектуальный капитал. Новый источник богатства организаций / Пер. с. Англ. – М.: Поколение, 2007. – 68 с.; Intellectual Property, A Power Tool for Economic Growth by Kamil Idris, WIPO Pub. No. 888, January 2003

[54] Valuation of Intellectual Property and Intangible Assets, op. cit.

with fairly limited start-up capital, operatively using modern scientific and technological achievements in production.

Protection of intellectual property rights

Once the information about intellectual property object is known to unscrupulous competitors, they are tempted to use it to their advantage without permission of the copyright holder. At the same time, violator of rights is in more favorable conditions than a copyright owner. Without incurring the costs at the stage of creation and protection of the IPR object, he can release the product using IPR objects and promote it on the market at a lower price quicker than a copyright holder. Such fact not only violates the rights of a particular copyright holder, but has serious consequences for society in general, slowing down its social and economic development and complicating civilized cooperation with other countries[55].

Type of violation of rights relative to different objects of intellectual property is different. However, in general, any use of the object of intellectual property without permission of a copyright holder and without paying him a compensation for the use, is a violation of intellectual property rights.

Disputes concerning intellectual property are divided into two groups. The first group includes disputes on recognition (or decline) of the result of intellectual activity by the object of intellectual property. As far as the objects of industrial property is concerned, there are the following disputes:

- ✓ connected with refusal to grant a patent;
- ✓ on objections of third parties against granting of a patent;
- ✓ on identifying the patent as being invalid.

The second group includes disputes concerning violation of rights:

- ✓ on prohibition of actions that violate patent rights;
- ✓ on reimbursement of damage caused by the violator of patent rights;
- ✓ on recognition of actions that do not violate the patent;
- ✓ on further use of inventions which is connected with conclusion or use of license agreements;
- ✓ on granting compulsory license;
- ✓ on payment of remuneration to the author by the employer;
- ✓ on compensation for the use of invention by the state, etc.

[55] Введение в интеллектуальную собственность. Op. cit.

There are two forms of protection of intellectual property rights: jurisdictional and non-jurisdictional (fig. 3.4).

Non-jurisdictional form provides protection of intellectual property rights on its own, without seeking assistance from the government or other competent authorities. For example, it may be a refusal to take certain actions stipulated by the signed contract on transfer (concession) of intellectual property rights or under licensing agreement; a refusal to perform an invalid contract; limiting of access of individuals to trade secrets, etc. Selected means of protection should not be prohibited by the law and should not contradict moral principles of society.

Jurisdictional forms of protection involve two procedures: general (legal) and special (administrative). General procedure of protection is carried out in courts.

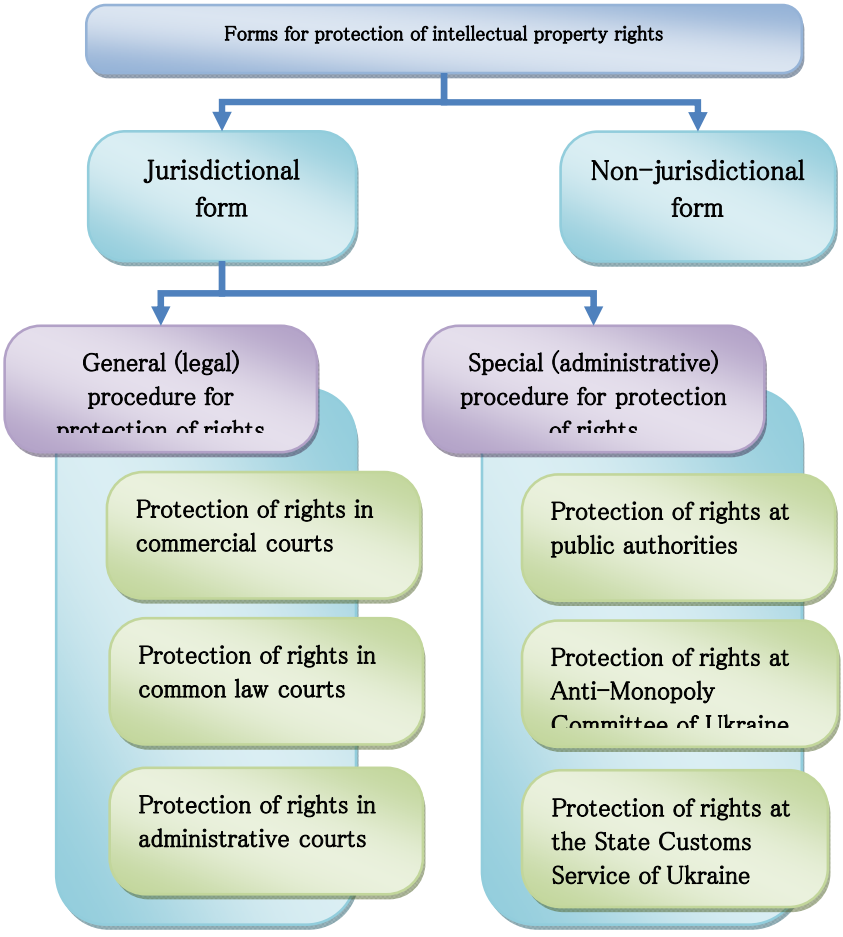


FIGURE 3.4 Forms and procedures for protection of intellectual property rights

Special procedure for protection of rights is carried out at public authorities, at the State Anti-Monopoly Committee, or at State Customs Service.

Typical kinds of administrative penalties may include: warning, fine, correctional labor, administrative arrest, etc.

Disputes related to infringement of intellectual property rights are dependent on the courts. In case of violation of rights, the victim registers a claim — a statement to the court on administration of justice in order to protect property or personal non-property rights. The statement of claim indicates the form of protection (prohibition to do any action violating the rights, compensation for losses, etc.), the size of damage, provides evidence of the validity of requirements. By the general rule of civil justice, particular civil case is usually considered at the location of the defendant. In any judicial proceedings on infringement of intellectual property rights two main issues are addressed. The first indicates whether the fact of use of OIPR is established or not. The second determines the amount of damage to be recovered from the defendant for the plaintiff.

The owner of rights to OIPR is entitled to demand of the infringer:

- ✓ recognition of rights of the owner;
- ✓ restitution of the state which existed before violation of rights;
- ✓ cessation of actions infringing the right or threatening to infringe it;
- ✓ compensation for losses, including the lost profit, etc.

If as a result of illegal use of OIPR the infringer received an income, the victim has the right to claim compensation for lost profit in the amount not less than the amount of such income.

If together with violation of property rights personal non-property rights of the author are also infringed, he may claim property compensation for moral damage, and the amount of compensation is determined by the court. Violation of the rights of authorship means appropriation of results of other people's creative work and an attempt to present these results as one's own developments.

Application of civil penalties for infringement of rights to the objects of IPR is possible within the total period of the claim, i.e. within three years from the date when the copyright holder learned or should have learned of the violation of his rights.

In the UK, Germany, Russia and in some other countries there are specialized patent courts. It enables one to accumulate the experience of solving patent disputes, create conditions for proper and equal application of regulations, and reduce the number of instances dealing with disputes.

Along with standards of civil protection of the rights to OIPR, legislation also makes provisions for criminal liability. Imposition of fine or deprivation of liberty are applied as a punishment to the offender. Institution of criminal proceedings against certain persons responsible for the crime does not exclude claims for compensation of damage.

A special case — is protection of rights to OIPR when crossing the border. The law stipulates that goods and other items made with violation of intellectual property rights can be neither imported nor exported through the customs border.

Each country has its own national legislation on protection of intellectual property rights. Protection of intellectual property rights in member-states of the World Trade Organization is regulated by the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). This Agreement is recognized by the world community as a legal document covering the issues related to protection of the rights to IP objects which are regarded as a commodity[56].

According to the requirements of Part III of the TRIPS Agreement "Protection of intellectual property", member-states on their territory are obliged to ensure the action of such procedures which allow preventing violation of the legislation in the field of protection of intellectual property rights and ensuring their exclusion. Article 41 of the TRIPS Agreement notes that legislation of each country should have standards which would allow to turn to effective actions against any infringement of intellectual property rights, including prompt actions to prevent infringements and legal sanctions in case of future violations.

The TRIPS Agreement provides for protection of intellectual property rights through administrative procedures, civil methods for protection of rights, as well as criminal procedures and penalties which can be applied to violators.

[56] Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement)// Geneva: WIPO, 1996. – P. 48.; International Bureau of WIPO, The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement) WIPO/IPR/BZE/00/4, February 2000

License agreements

Classification, structure and essential terms of license agreements

The subject of intellectual property rights can use this object at one's own discretion, complying with the rights of other persons, as well as transfer these rights to other natural or legal persons, i.e. to give them a license. The license to use the object of intellectual property is a contract under which a person who has the exclusive right to authorize the use of OIPR (the licensor) grants to another person (the licensee) a written permission giving the licensee the right to use this object in a certain limited field.

The license to use the object of intellectual property can be issued as a separate document or can be a part of a license agreement.

In case when the license to use is drawn up as a separate document, it is a unilateral deal, and a contract of adhesion in its essence. It is considered that if this contract is not an integral part of a license agreement, it applies only to legal relationships on the use of objects of the copyright and related rights. For example, the license to use a computer program.

At the same time, the license to use the invention, utility model, industrial design, trademark, topography of integrated microcircuit is an integral part of a license agreement. In this case the term ″license″ is identical to the term ″license agreement″.

A license to use the object of intellectual property may be exclusive, individual, non-exclusive, and of other kind (e.g., full, compulsory, open, patent, non-patent, etc.).

An exclusive license is issued only to one licensee and excludes the use by a licensor of the object of intellectual property in the field, which is limited by the license; and excludes the issuance of a license to others to use this object in this field.

An individual license is also issued only to one licensee and excludes the cases when a licensor gives other persons the licenses to use the object of intellectual property in the field, which is limited by this license. At the same time, an individual license does not preclude the use of this object by the licensor in a specified field. This is the difference between the exclusive and individual license.

Within non-exclusive license the licensor can use the object of intellectual property in the field, which is limited by the license and can give other persons the licenses to use this objects in a specified field.

Under a license agreement, one party (the licensor) grants to another party (the licensee) a permission to use the object of IPR (the license) on terms determined by mutual agreement of parties with regard to the requirements of the legislation. In cases stipulated by the license agreement, one can conclude a sublicense agreement according to which the licensee shall give to another person (sublicensee) the sublicense to use the object of intellectual property. In this case, the responsibility before the licensor for the actions of the sublicensee rests with the licensee, unless other is stipulated by the license agreement.

The license agreement defines the type of a license, the field of use of IPR object (specific rights granted under the contract, ways of using of the specified object, the area and the period for which the rights are granted, etc.) the amount, the procedure and the terms of remuneration for the use of IPR object. These terms are usually essential, without which the contract is considered invalid. Other terms can also be included into the contract by mutual agreement.

The parties of a license agreement should choose the type of license granted to the licensee. If there is no condition on the type of license, a non-exclusive license is granted under the license agreement.

The subject of the license agreement cannot be rights to use the IPR object, if they were invalid for the time of conclusion of the agreement, for example, if a patent (a certificate) for industrial property objects is invalid or its effect is suspended.

It is necessary to keep in mind that:

- ✓ the rights to use the IPR object and ways of its application which are not defined in the license agreement are considered to be not given to licensee;
- ✓ if in the license agreement there is no condition concerning the territory (region, district, city, factory, etc.) to which the given rights to use the IPR object are spread, the license applies to the whole country;

- ✓ if in the license agreement on publication or other reproduction of the work the remuneration is identified as a fixed sum of money, the agreement should determine the maximum number of copies of the work.

The license agreement is concluded for a period specified by the contract which should expire no later than the expiration of the exclusive property rights to a specified IPR object. The licensor may withdraw from a license agreement if licensee violates the start date established by the contract for the use the IPR object.

The licensor or the licensee may withdraw from a license agreement if one of them violates other terms of the contract.

If in license agreement there is no condition on the term of a contract, it is considered to be concluded for a period left before the expiration of the exclusive property rights to specified IPR object, but not more than five years.

The legislation of most countries does not regulate the structure and content of the license agreement and gives some freedom to the parties. Usually, the license agreement has item-by-item structure and includes (according to the type of the contract and object of licensing) the following articles:

1. Preamble
2. Definition of terms used in the text of the agreement
3. Subject of the agreement
4. Rights and obligations of the licensor
5. Rights and obligations of licensee
6. Allowed ways of application of the IPR object
7. Protection of transferred rights
8. Technical innovations and rights to new objects
9. Payments
10. Technical documentation
11. Warranties and liabilities
12. Technical assistance, support and consulting
13. Fees and taxes
14. Confidential information and documentation
15. Advertising
16. Information and reporting
17. Force – majeure
18. Arbitration (dispute resolution)
19. Validity period and terms of termination of the agreement
20. Consequences of termination of the agreement

21. Other terms.

Preparation and conclusion of license agreements

As soon as potential licensee is found and preliminary agreement on negotiations is reached, it is time to start preparing for their implementation. No deal is possible unless both parties feel that they have won.

With increasing complexity of equipment and technology, it became obvious that for real application of technologies it is not enough to have only a permission to use the rights to the IPR objects which are included in these technologies. Often it is necessary to transfer technical documentation, knowledge, experience and equipment of the licensor, which would provide a licensee with the opportunity of actual production under the license. Participation of specialists of the licensor in the initial testing activities, as well as technical assistance to the licensee during operation of technology — can also be negotiated. In addition, important terms of the future agreement on transfer of technologies are also subject to negotiation: type of a license, period of validity of the agreement, licensed territory for IPR objects, etc. The cost of the agreement, kinds and procedures of payments to the licensor are an important subject of negotiations[57].

To answer these and other questions which are necessary for conclusion of a license agreement, one should prepare in advance.

The success of negotiations largely depends on the competence of negotiators. Therefore, a significant consideration should be given to formation of the negotiating team. It will be more comfortable if negotiating partner receives a clear program of business negotiations in advance, as well as a general program of activities accompanying the negotiations. Before negotiations it is appropriate to introduce negotiators to each other[58].

During negotiations there is always a moment when partner asks to share confidential information related to the subject of negotiations, and which he needs to make decisions. If other party refuses to provide such information rightly fearing that a partner having got it can at any time leave negotiations and take this information with him, it is likely that the deal will fail.

To protect the interests of a seller of technology and prevent the leak of confidential information, it is necessary to conclude confidentiality agreement before the start of negotiations. Such agreement is concluded so that a party

[57] Innovation Management Tools, David Brown Warwick Institute, University of Warwick, UK, 1997
[58] Intellectual Property: Licensing and Joint Venture Profit Strategies, Gordon V. Smith and Russell L. Parr, USA, 1995

which provided the information could be sure that a recipient of the information will keep it a secret from third parties and will use it only for the purposes specified in the agreement.

If in the contract there is a provision on legal liability for disclosure of information, it is a significant guarantee of protection of licensor's interests.

There is no generally accepted form of the license agreement, but one can easily find an appropriate form.

Negotiation skills are important competencies needed to work with foreign business partners. The importance of such skills increases significantly when it comes to long-term cooperation. In this context it is quite important to search for and invite to participation in negotiations a professional manager who has experience of mediation during such negotiations.

The aim of a professional negotiator is to achieve such outcomes of negotiations, which would be beneficial to both parties.

Each participant of negotiations should know and understand his own position and position of the other party. It is desirable that all negotiators were leading specialists. The general rule is that participants enter into debate not when they consider it appropriate, but when the moderator gives them the floor.

As soon as negotiations are over, it is recommended to sign a letter of intent. This document can have another name. This agreement does not impose on the parties legal liability in case of non-compliance. However, it clarifies future negotiations and imposes some moral responsibility in case of non-fulfillment of the contract by both parties. The protocol is drawn up in any form. The content of the license agreement is generated step-by-step in the process of negotiations. At the initial stage the positions of the parties with respect to essential terms of the contract are specified. At the second stage a draft of the future agreement is made up. At the third stage the positions of the parties previously not agreed should be specified, and then the agreement is signed by the parties. Of course, there may be a different number of stages.

Prior to conclusion of a license agreement, it is important to ensure that, on the one hand, the licensor has the right to all IPR objects which are subject of the license, and that these objects can provide long-term benefits. On the other hand, one should understand that the licensor gives to the licensee not only rights but also the responsibility for realization of these rights, particularly in relation to the licensor.

The following recommendations may be useful when concluding a license agreement:

1. Type of a license. The license may be exclusive, non-exclusive or individual. It can also be geographically and territorially limited or limited by the market segment.

2. Terms of validity of the license. In most countries patents are valid for 20 years. In pharmaceutics the patent may be extended, but not more than for 5 years. The rights to other IPR objects have different validity periods. Therefore, the period of validity of the license can vary from several years to complete exhaustion of IP rights as defined by the law.

3. Territory. It can spread to the whole area of existence of intellectual property rights. These rights according to the patent cover production and sale of products under the patent. Thus, one can grant the rights to produce the product only in one country, and the right to sell products worldwide.

4. Field of application. In case of non-exclusive license it is possible to give rights only for a certain market or technological segment, e.g. ″only for use in the healthcare market″.

5. Payments. They are usually divided into initial fees and payments under the license (license fees). Each of them has several varieties. There are no established rules regarding the amount of payment. It always depends on the negotiations.

6. Control. The licensor should ensure that he will have the right to control the licensee with respect to the correctness of royalties.

7. Performance criteria. It is important that the licensee properly fulfilled the criteria stipulated by the contract.

8. Obligations of the licensor. For the licensor some typical commitments include:

- ✓ maintenance of rights. It also includes protection of rights for which the license is obtained. Usually it is presented ″at the discretion″ of the licensor;

- ✓ introduction of technology. It is necessary to identify and include into agreement the additional terms. For example, training programs and consulting services;
- ✓ informing of the licensee about new improvements.

9. Obligations of the licensee. Licensee's obligations may include:

- ✓ the use of the invention to the best advantage for the benefit of both parties;
- ✓ presentation of product samples to the licensor for quality control;
- ✓ permit of inspection of production for quality control of the product, etc.

10. Sublicensing. When granting sublicenses the licensor should make sure that it covers all the obligations of the licensee.

11. Violations. If the licensor or licensee discovers the violation, they immediately should inform the other party. Both parties should take necessary measures to remove the violations.

The license agreement is concluded in duplicate in the languages of both parties. Texts of agreements should be authentic and have the same effect. In case there are matters of argument, both texts of the agreement will be used to address them.

Features of intellectual property and licensing in the field of energy efficiency and renewable energy sources

The dynamics of patenting of inventions in the field of energy efficiency and renewable energy sources

Observation of the dynamics of patenting allows seeing the general tendency towards the interest for renewable energy sources (RES), the increase or decline of interest in relation to certain types of RES, specialization of countries in this area, and makes it possible to identify leading companies in each type of RES. Since patenting precedes creation and entry of new technologies in the market, the analysis of the dynamics of patenting can become a good tool to forecast such technologies.

Below are the results of patent research in the field of solar energy, wind energy, hydropower (including wave and tidal energy), as well as fuel energy. Data used in the graphs and the table were obtained from the patent database PATENTSCOPE of the International Bureau of the World Intellectual Property Organization (WIPO). In the search request, to identify relevant records in databases, symbols of the International Patent Classification (IPC) (as amended on 01.01.2014) and the keywords characterizing the selected area, are used. Figure 3.5 shows the tendency of patenting of inventions in the field of renewable energy sources

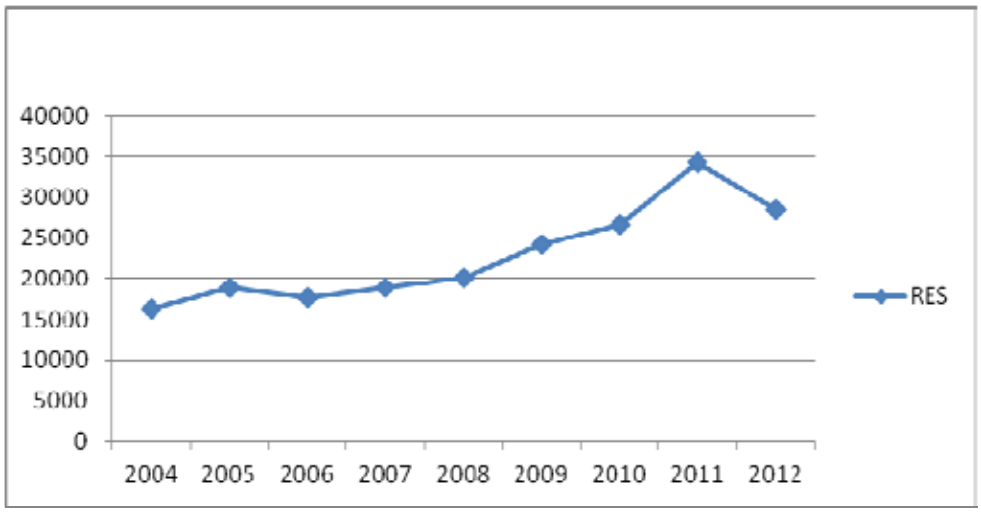


FIGURE 3.5 Dynamics of patenting of inventions in the field of renewable energy sources (in total)

Distribution of patents among countries according to energy types is presented in Table 3.1. As it follows from the table, the leaders in the number of patents granted in the field of renewable energy sources are Japan, the U.S. and China. The greatest number of patents obtained by these countries is in the field of solar energy. Then come fuel energy, wind energy and hydropower. It should be noted that by the number of patents obtained in the field of hydropower, China ranks first.

TABLE 3.1 Distribution of patents obtained in the years 2004–2012 among countries by the type of alternative energy sources

No.	Country	Solar energy	Fuel energy	Wind energy	Hydropower	Total number
1	Japan	25143	24719	5709	783	56354
2	The U.S.	26938	15594	8493	802	51827
3	China	16463	6957	9881	1343	34644
	Total:	68544	47270	24083	2928	142825

Fig. 3.6 shows the dynamics of patenting of inventions according to certain types of renewable energy sources. This figure shows that patents in the field of solar and wind energy have the best dynamics. Also there is a slight increase in the field of hydropower, however, the number of patents is 16.6 times less than in the

field of solar energy. And in the field of fuel energy after 2007 there has been a steady decline in the number of patents.

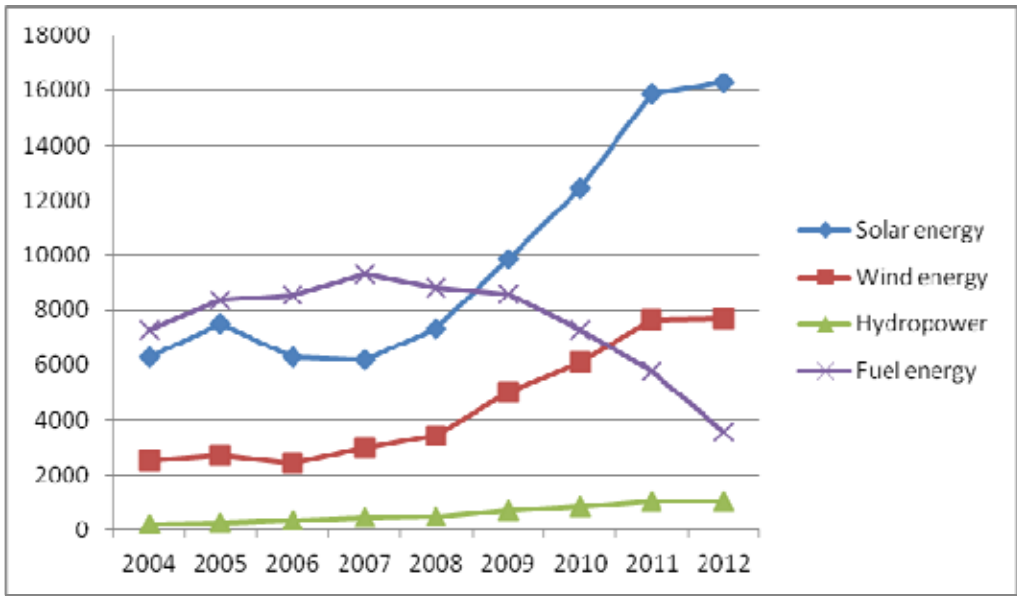


FIGURE 3.6 The dynamics of patenting of inventions according to certain types of renewable energy sources

As it can be seen from Fig. 3.6, after 2009 the undisputed leader by the number of patents is the field of solar energy. Fig. 4.7 shows the distribution of patents among the leading countries in this field. Until 2011, the U.S. and Japan were undoubted leaders with roughly equal results. However, in 2012 there has been a decline. At the same time, China and South Korea are rapidly catching up with them. In 2012, by the number of patents in this field China came in the first place, leaving behind the U.S. and Japan.

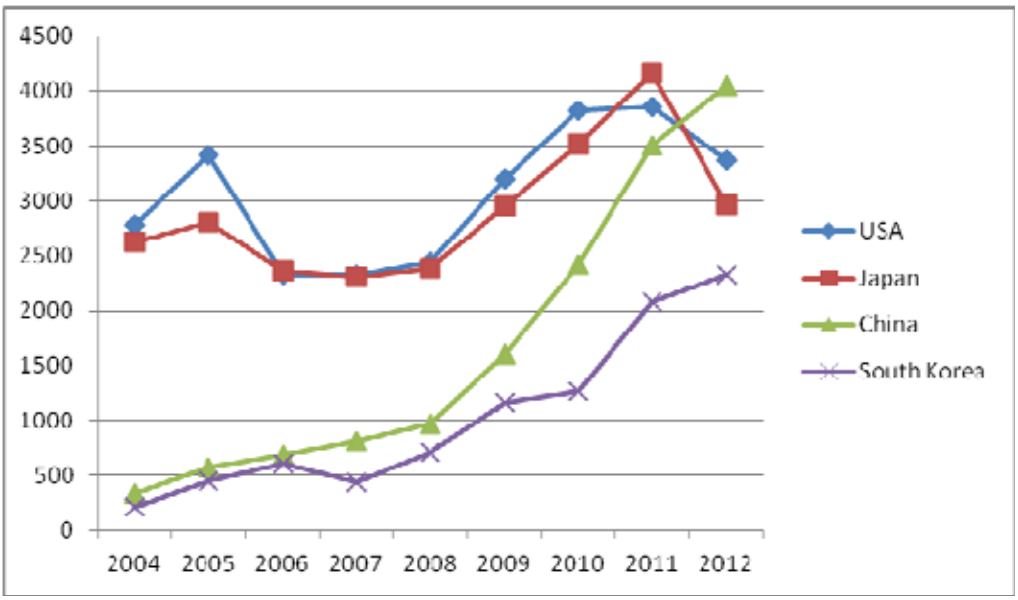


FIGURE 3.7 Patenting of inventions by leading countries in the field of solar energy

Table 3.2 presents the leading companies by the number of patents in the considered types of energy.

TABLE 3.2 Leading companies on patenting of inventions in the field of renewable energy sources

Solar energy		
No.	Companies	Number of patents
1	SHARP CORP	2343
2	LG ELECTRONICS INC.	1076
3	KYOCERA CORP	1032
4	SAMSUNG ELECTRONICS CO., LTD.	645
5	SANYO ELECTRIC CO LTD	614
Wind energy		
No.	Companies	Number of patents
1	GENERAL ELECTRIC COMPANY	1469
2	VESTAS WIND SYSTEMS A/S	1066
3	SIEMENS AG	964
4	MITSUBISHI HEAVY INDUSTRIES, LTD.	845
5	SAMSUNG HEAVY IND. CO., LTD	349

TABLE 4.1 (continued)

Hydropower		
No.	Companies	Number of patents
1	VOITH PATENT GMBH	64
2	CHUGOKU ELECTRIC POWER CO INC:THE	61
3	OCEAN POWER TECHNOLOGIES, INC.	50
4	SEABASED AB	34
5	KOREA OCEAN RESEARCH AND DEVELOPMENT INSTITUTE	30
Fuel energy		
No.	Companies	Number of patents
1	TOYOTA MOTOR CORP	7049
2	NISSAN MOTOR CO LTD	2538
3	HONDA MOTOR CO LTD	2226
4	SAMSUNG SDI CO., LTD.	1786
5	TOSHIBA CORP	855

Data of Table 3.2 indicate that large companies create large patent portfolios in order to become leaders in technology transfer in the field of renewable energy sources.

Judging by the large amount of such portfolios, it can be expected that legal monopoly granted by patents on the production and marketing of products protected by patents, in practice can turn into an ordinary monopoly, thereby preventing less powerful competitors from launching their products in the market.

Conclusions

From 2004 to 2011there has seen a steady increase in the number of patents in the field of renewable energy sources.

Leaders in the number of patents are Japan (56354), the United States (51828) and China (34644).

Most rapidly is increasing the number of patents in the field of solar and wind energy, and in 2012 by the number of patents granted in the field of solar energy China took the lead over Japan and the United States.

Large multinational companies created significant volume of patent portfolios in the field of renewable energy sources:

- ✓ 2343 in the field of solar energy;
- ✓ 1469 in the field of wind energy;
- ✓ 7049 in the field of fuel energy.

One can assume that for weaker competitors it will be difficult to launch new technologies in the field of renewable energy sources in the market.

Patenting and "patent wars" in the strategy and tactics of the international patent and licensing business

According to expert information, at the heart of the world production of high-tech products which are valued at 2.3 billion of dollars per annum, there are 50-55 macrotechnologies protected by many patents established and controlled by leading countries (39% by the U.S., 30% by Japan, and 16% by Germany). In conditions of global competition, a special role is played by transnational corporations (TNCs) which concentrate intellectual property in patent portfolios of parent companies and related firms. TNCs implement market penetration in the following way:

- ✓ they generate a powerful package of patents with which they block scientific and technical developments of competing companies;
- ✓ by the results of research and technological works the international standards and technologies of licensing are created, and within the framework of these standards and technologies all innovative products coming to the market should be produced. Along with this, the abilities of other competitors to freely enter the commodity markets are significantly limited because of the difficulties arising from certification of such products in accordance with international and national standards;
- ✓ if there is absence or weakening of competition for goods protected by the patents, or unconformity of goods to operating standards of the importing countries, monopolies begin mass expansion of high-tech products into selected sectors of the commodity market. At the same time, both the developers of high technology products and their manufacturers are suppressed.

In recent years, leading companies have developed and successfully apply highly efficient strategies of "patent wars". They moved from patent protection of particular products or technologies to patent protection of promising market sectors of innovative products. Exercising aggressive patent pressure on competitors, companies-patentees skillfully use their exclusive rights to IPR objects, production and sale of innovative products with the aim of causing maximum damage to competitors and restraining their scientific developments.

Thus, the companies achieve monopolization of the world and national markets of innovative products without violating the existing antimonopoly law. However, at the same time a limited monopoly on IPR objects which is allowed by the legislation actually turns into a natural monopoly prohibited by the law and it poses a potential threat to the progress[59].

Most critical patent wars are going on between the large companies such as: Apple, Samsung, IBM, Intel, Toshiba, Hitachi, etc. Thus, in April 2011 Apple Company filed patent lawsuits against Samsung for violating their numerous patents for technologies and numerous rights to design.

The patent war between these companies continued to grow and in September the district court in San Jose (USA) exacted in favor of Apple Company more than 1 billion of dollars as a compensation for infringement of rights to six objects of intellectual property, including design of their mobile devices. In their turn, Apple has lost a number of patent disputes in Korea, Japan and the UK. Relatively new participants of patent wars are the so-called "patent trolls". Patent trolls are natural or legal persons specialized in actions of patent infringement. Usually they extensively buy up patents from bankrupt companies forced to sell them at auction, then look for violators of purchased patent rights and take them to court.

Patent trolls carefully watch the market and thoroughly examine applications for registration of new patents. The attack often begins not from the claim, but from the threat of its submission. Taking into account that the average cost of treating a patent suit, even in case of recognition that the defendant is not guilty, is 2.5 million dollars, many companies which underwent the attack of patent trolls prefer to negotiate with them and get rid of much smaller amount, because it is difficult to predict the outcome, and royalties can significantly exceed not only the court costs, but also compensation.

Examples of successful licensing of intellectual property in the field of energy efficiency and renewable energy sources

In many countries with emerging economy the field of renewable energy faces many obstacles on its way, partially owing to the lack of experience and limited access to appropriate technologies and knowledge[60].

[59] Мухопад В.И. (2012), Коммерциализация интеллектуальной собственности. – М.: Магистр: ИНФРА-М, 2012. – 512 с.

[60] Green Economy and Trade. Renewable Energy. United Nations Environment Programme, 2013 [Electronic resource] – Access mode http://www.unep.org/greeneconomy/

International Intergovernmental Panel on Climate Change (IPCC) defines the process of technology transfer in the following way[61]:

> ″A wide set of processes, which includes know-how, experience and equipment for facilitation and adaptation of the process of climate change between different interested parties, such as governments, subjects of private sector, financial institutions, non-governmental organizations (NGO) and research/educational institutions…″

Marketing can play a key role in the process of technology transfer. Different experts came to a conclusion that international transfer of technologies by means of marketing is realized when a country imports more qualitative goods than it can produce on its own for application in the own production processes and for further export. In this case, marketing is indeed the channel for international transfer of technologies to countries with emerging economy.

As for the renewable energy and energy efficient technologies, world leaders of technology transfer in this field are presented in the table 3.3. China should be singled out as an absolute leader in this field. Due to activity of China in the market of technology transfer, today the prices for renewable energy equipment are significantly reduced – for photovoltaic power systems, equipment and components for wind-power engineering, and heat pumps.

TABLE 3.3 World leaders of technology transfer in the field of renewable energy and energy efficient technologies[62]

Technology	Leading countries	
	Producers and exporters	Users of technologies
Production of ethanol (from sugarcane)	Brazil	USA, Brasil
Biodiesel (from Jatropha)	India	India, Indonesia, EU
Wind-power engineering	China, India	China, Germany
Solar photovoltaic system	China	Germany
Compact fluorescent lamp	China	EU countries
Solar heliosystems	Mexico	China
Coal gasification	China	China, USA

[61] Методологические и технические аспекты передачи технологии, МГЭИК, 2000 [Electronic resource] – Access mode: https://www.ipcc.ch/pdf/special-reports/spm/srtt-ru.pdf

[62] Brewer, T. Climate change technology transfer: a new paradigm and policy agenda. Climate Policy, 2008 [Electronic resource] – Access mode: http://www.tandfonline.com/doi/pdf/10.3763/cpol.2007.0451

Heat pumps	China	Switzerland, EU
Hybrid transport	Japan	USA, EU, Japan
Residue utilization	Sweden	Sweden

For the present time five countries – Germany, Japan, Korea, Great Britain and USA are the source of more than 80% of innovations developed in the field of renewable energy and energy efficient technologies.

A striking example of effective transfer and licensing of technologies in the field of renewable energy can be a development of the wind power industry in Ukraine. Despite the fact that since Soviet times in Ukraine has existed a developed technology and production base of solar energy, namely photovoltaic technologies production of silicon, modules, and batteries, in the field of wind energy there were no such examples and industry leaders were Denmark, the U.S., Germany and others[63].

Almost all wind power stations (WPS) of the network type, which function on the territory of Ukraine are at present built through the use of licensed models of wind power facilities (WPF)[64].

The first stage of development of wind power in Ukraine was the elaboration and implementation of the State complex program for WPS construction (1993 –2010). At that time, in the country there were no own developments of wind power facilities whose manufacturing technologies would result in serial production[65].

The main principles of selection of wind power facilities for construction of WPS within the framework of the Programme were as follows:

- ✓ Creation of competitive conditions for sampling of wind power facilities whose components should be manufactured at domestic plants;
- ✓ Competitive selection of foreign companies' proposals on production of licensed wind power facilities at Ukrainian factories.

These principles laid the foundation for development of the mechanisms for selection of wind power facilities as a basis for WPS construction at the first stage of the Complex Program (1997–2000).

[63] Экопедия / Энергоэффективность и ресурсоэффективность. [Electronic resource]. – Access mode http://www.ecorussia.info/ru/ecopedia/energyefficiency_and_energysaving

[64] Рейтинг энергоэффективности Украина [Electronic resource]. – Access mode http://www.energy-index.com.ua/uk/

[65] Кудря С.О. Нетрадиційні та відновлювані джерела енергії. Підручник. НТУУ «КПІ», Київ, 2012.–493 с.

At this stage of the Program for WPS construction, it was planned to apply the licensed WPF USW56-100 (product of American company "Kenetech Windpower") which were produced in Ukraine.

Production of WPF USW 56-100 in Ukraine was launched in 1993. For this purpose in 1992, the enterprise "Windenergo Ltd" with foreign investment was established for implementation of the Ukrainian-American project to produce wind power equipment based on technology provided by the American company KENETECH WIND-POWER Inc.

Technology transfer was carried out in the form of design documentation (specifications, drawings of parts and components, electric circuits, etc.) for wind power facilities USW 56-100, the control system and weather equipment, the maintenance documentation (instructions for collection and exploitation of wind power facilities), the program "Management system of WPS and accounting" and so on.

Design and maintenance documentation on the conditions of production and operation in Ukraine was translated and adapted, and specifications for licensed wind turbine were elaborated and registered at the State Standard of Ukraine.

At the public enterprise Industrial Merger "A.M. Makarov Southern Engineering Plant" in Dnepropetrovsk was established a base specialized production of wind power equipment for assembly of WPF USW 56-100 modules, and at JSC "Osnastka-Energo" was established a specialized production of separate components of wind power facilities, a special instrument and equipment for operation of wind power facilities within WPS. Altogether in production of wind power facilities USW 56-100 were involved more than 20 enterprises and organizations of Ukraine.

After production of the first-off production batch and after qualification tests the wind aggregate was certified within the UkrSEPRO system.

USW56-100 wind power facilities were first installed at Ukrainian WPS in 1993. At first, there were three samples of wind power facilities of U.S. production installed at Donuzlav WPS near the village Novoozernoe (the Crimea), further construction was carried out on the basis of licensed WPF of domestic production. All in all there were produced 774 of this type of WPF.

Production of USW56-100 ceased in 2006. At first, Ukrainian localization of production in these units was about 40%, which was connected with the necessity of considerable preparation for their production and in the future this figure reached almost 100%.

The second stage of the Complex Programme provided organization of production of wind power stations with the capacity over 500 kW and further construction of wind power facilities on their basis.

There were negotiations between representatives of government agencies and German companies Genesis, Nordex, DeWind, Fuhrlander, Enercon and others which produced wind power equipment. Besides, Ukraine received a proposal from the Belgian company Turbowinds on transfer of the license for manufacture of wind power facilities T600-48 producing 600 kW with rotor blades whose diameter was 48 m, which have been certified by the typical CIWI (Netherlands, the Institute for Certification of turbines).

The main assembling of WPF T 600-48 was carried out at the public enterprise Industrial Merger "A.M. Makarov Southern Engineering Plant" in Dnepropetrovsk.

The list of components of licensed wind power facilities whose production is mastered at Ukrainian factories, included: hub parts, nacelle frame, control cabinet, distribution cabinet, switching center, heating block of the nacelle, cable kit, nacelle jacket, front hub fairing and the parts of the nacelle.

During the Complex Program 774 of USW56-100 and 24 of T600-48 wind power facilities were produced and delivered to the customers.

A new stage in development of the wind power industry in Ukraine has become a production of the multimillion-kilowatt wind power facilities[66]. In 2011, the Limited Liability Company Fuhrlander Wind Technology bought from its German partner JSC Furlander a license for production of wind energy facility FL2500 with capacity of 2.5 MW. On the basis of Kramatorsk Plant of Heavy Machine-Tool Construction was established a modern production of wind power facilities. Today Ukraine has mastered production of the main components of wind facilities: the anchor basket, the tower, nacelle frames, the rotor and the hub. Fuhrlander Wind Technology (Kramatorsk, Dotetsk region) owns the licence to 2 MW, 2.5 MW and 3 MW wind turbine whose production is scheduled for the nearest future.

For the present time, almost all wind power facilities which are operated in Ukraine, are based on licensed technologies. Ukrainian legislation which encourages the development of renewable energy in Ukraine, namely the requirements for the local component in the manufacture of renewable energy equipment to get a ″green″ tariff, motivates manufacturers of renewable energy

[66] http://fwt.com.ua [accessed 04.04.2014]

equipment to establish appropriate production in Ukraine and technologies transfer in the field of renewable energy[67].

[67] Tranzition Technologies. Products and Services Follow Parallel Journeys. Op. cit.; Экопедия/ Энергоэффективность и ресурсоэффективность. Op. cit.

Glossary

After Action Review is a method for joint discussion of the event by its participants in order to draw conclusions.

Authors are persons whose creative work resulted in development of a product.

Best practice is the best way (method, solution) for achievement of a defined goal.

Commercialization is aimed at making profit through the use of IPR objects in production, as well as from sale or transfer of rights to use these objects to other legal and natural persons.

Data is a fact, concept or instructions presented in a conditional form suitable for forwarding, interpretation and processing by a person or by automated means.

Explicit knowledge is that which can be recorded or encoded.

Forum is a web-application, which allows users to communicate with each other.

Groupware is a technology, allowing organizing a teamwork and efficient knowledge and information exchange inside of this team.

Industrial sample is a result of creative human activity in the field of industrial designs.

Information is a contextually related data.

Intellectual Property (IP) in a broad sense means the rights fixed by the law to the results of intellectual activity in the field of production, science, literature and art.

Invention is a result of intellectual human activity in any field of technology. Invention means establishment of new laws, properties and phenomena of material world.

Job rotation is a practice of transfer of organization's employees from one position to another for training and development of staff.

Knowledge is the information in conjunction with the rules, procedures and operations of its processing.

Knowledge management is the explicit and systematic management of vital knowledge and its associated processes of creating, gathering, organizing, diffusion, use and exploitation.

Knowledge map is a visual representation of knowledge of the organization.

License to use the object of intellectual property is a contract under which a person who has the exclusive right to authorize the use of OIPR (the licensor) grants to another person (the licensee) a written permission giving the licensee the right to use this object in a certain limited field.

Objects of intellectual property right (OPIR) are results of intellectual and creative activity which correspond with legal requirements.

Open Space Technology is a way of organizing meetings, conferences, symposia, at which there should be a clear and convincing topic, interested and prepared group, and a leader. At the same time, this event starts without traditional formal program (agenda), materials and plans.

Patent is a technical and legal document issued to the applicant for an invention, utility model or industrial design which meets the conditions of patentability and confirms the authorship, priority and the right of ownership to mentioned objects.

Tacit knowledge is that which one can feel and understand, but which is practically impossible to express.

Technology is a systematic knowledge about manufacturing of products, application of process or rendering of service regardless whether this knowledge is reflected in the invention, industrial sample, useful model, new processing system, technical information, services or assistance provided by the specialists in design, installation, management of production or its activity.

Technology brokers are physical persons who can be private entrepreneurs providing services to participants of technology transfer for searching of business partners, investors, or for establishing contacts between individuals, groups or organisations for promotion of innovative ideas through creation of new or use of existing technologies for gaining profit or other benefit.

Technology transfer is a promotion of technology towards its practical use with gaining profit or other benefit in the long run.

Trade secret is technical, commercial, organizational and other information which can increase the efficiency of production or of any other socially expedient activity, or can ensure some other positive effect.

Trademark is a designation by which goods and services of one person differ from goods and services of others.

Wiki technology is a website which structure and content can be jointly changed by the users with the help of tools provided by the site itself.

World Café is a method of organizing workshops under which the atmosphere of cafe is created in the room. Participants discuss a problem or a question in small groups, sitting at the tables.

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Union of Slovak Clusters		Slovakia
Belarusian State Agrarian Technical University		Belarus
Republican Centre for Technology Transfer		Belarus
International Centre for Advancement of Research, Technology and Innovation		Georgia
Georgian Technical University		Georgia
National Technical University of Ukraine "Kyiv Polytechnic Institute"		Ukraine
Centre for Science and Technical Information and Innovation Promotion of Ukraine		Ukraine
E.O. Paton Electric Welding Institute of NAS of Ukraine		Ukraine

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