TECHNOLOGY AUDIT IN SMALL INNOVATIVE BUSINESS

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Abstract.

The paper deals with the current problems of the technological audit in small innovative business. The causes of reducing number of small innovative enterprises of scientific and educational spheres have been defined. The technological audit has been characterized, as the first phase of the technology transfer. The general structure of the audit process has been shown. A series of factors necessary for the effective commercialization of technologies has been defined.

Keywords: Small innovative enterprise, technological audit, technology transfer, technology commercialization.

Introduction. Small innovative enterprises (SIE) in developed countries play the role of engine of the economy. World experience shows that it is a small business that helps to bring new products and services to market due to its inherent adaptability to changes in the external environment, flexibility, and the desire to survive in the competition. All small businesses, operating in the Russian Federation, can be divided into two groups: the subsidiaries established on the basis of universities and research institutions, and the autonomous and independent enterprises, including those previously separated from the major economic projects. At the present stage of development of the country economy, the vast majority of existing small innovative enterprises operate at universities, are initiated by the academic staff, graduate students, undergraduates and students. This can be explained by the fact that universities tend to have fundamental and applied scientific and research potential, innovative developments, and specific resource provision. Universities are also major participants in targeted government programs and grants aimed at innovative development and promotion of technological entrepreneurship [1].
Small businesses of science and technology and science-intensive spheres have technically competent staff with strong motivation; they are the developers of both the breakthrough and improving everyday innovations. They are the most sensitive to the local needs of each market, and adapt the imported technologies to the requirements of regional or sectoral segments of the global market of high-tech products and services [2].

Russia lags in the level of innovation development behind the developed countries. Over the past three years, the total output of innovative products has not exceeded 8-9%. Russian innovations are low competitive.

Federal laws № 127-FZ of August 23, 1996, "On Science and State Scientific and Technical Policy" and № 273-FZ of December 29, 2012, "On Education in the Russian Federation" established that academic institutions and educational organizations have the right to establish business entities (economic partnerships) with the aim of practical application (implementation) of the results of their achievements. The state provides financial support to these organizations. Nevertheless, there is no growth in the number of such business associations observed. In 2011, according to the monitoring of small innovative enterprises of scientific and educational services, 659 companies were registered, while in 2015 their number has decreased to 232 (Figure 1).

This suggests that there are several problems hindering the commercialization of innovations. The term commercialization should be understood to mean a purposeful process of converting scientific knowledge into new products, technologies, services, and their subsequent involvement in economic circulation from the point of solving potential problems and meeting the needs of consumers in these products, technologies and services in exchange for commercial benefits of educational organizations [3].

The reasons for annual reduction in the number of small innovative enterprises at universities and research institutes are:
difficult, bureaucratized and time-consuming procedures of commercialization of new products and technologies;

- limited possibilities to accumulate own equity, difficulty in obtaining external financing;

- difficulty in receiving access to the state (municipal) order;

- the lack of managers with knowledge and experience in the innovation commercialization, risk assessment and business planning; and

- difficulties in assessing and forecasting the demand for innovative products.

In Russia, according to experts, only about 10% of innovative projects and ideas find their application, while Japan uses 95%, and the US - 62%. Russia accounts for about 10% of all scientists of the world, the share of high-tech products is not more than 0.3% [4]. One of the constituent elements of the innovation commercialization projects is the transformation of technology as a scientific object in the industrial, commercial one. Transfer of innovative research object to the enterprises entails difficulties in identifying a potential commercial success.

In this regard, before the scientific innovation (technology transfer - TT) becomes commercialized, the assessment should be conducted in terms of the problems that can be solved as a result of its implementation. The first stage of technology transfer is a technology audit (TA).

**Methods.** There are several interpretations of the concept of "technological audit". A. Brett explains technological audit as the "technology analysis, analysis of experience, products and knowledge available in the research institute, laboratories, universities and that could potentially be commercialized" [5]. V.V. Titov understands technological audit as “the operation of the objective assessment of the potential innovations as an object of transfer of technologies” [6]. According to the authors of a practical guide, technological audit for the technology commercialization centers “is a method of research aimed at assessing technological potential, procedures and demands of small and medium-sized enterprises and other organizations. In addition, it is a method for determining the strengths and weaknesses of the enterprise and by making its characteristics and overall assessment of its basic know-how (marketing, management, financial and human resources, etc.). This is an analysis process leading to the formulation of specific proposals (action plan)” [7]. The overall objective of the audit process is an integrated and objective assessment of the company's ability to implement new technologies, to work with technology partners, as well as to form an understanding of the need for most successful integration or share of new technologies.

Technology audit in developed countries is carried out by consulting companies that specialize in a particular type of activity. Often, their activities and audit reports have a security classification. However, the techniques used by such
companies find their description in the scientific literature. Based on the analysis of the economic literature, the following techniques can be defined: LIFT (LinkingInnovation, FinanceandTechnology), LIFT scoring technique and TAMETM (TechnologyAndMarketEvaluation) [8]. It should be noted that the information related to the procedures of the technological audit is rather closed. This is especially true of personal techniques of various organizations engaged in technological audit. Despite the fact that the above methods of technology audit are publicly available, they, nevertheless, are only templates, since any technology audit of an individual scientific and technical potential is a unique process that requires a special approach.

Main part. The overall structure of the audit process includes: information collecting - analysis - synthesis - report writing. At the end of the XX century, the so-called linear model of commercialization was used: research and development (R&D) - scientific research, design, and testing (RD&T) - production. However, this chain did not include influence of such factors as the market. Moreover, this chain had no feedback between the manufacturing and R&D and RD&T. At present, the commercialization of technology should focus on market model. The available feedback allows to take into account the market climate at a very early stage of work on the new technology. While one sectors, where the period of the development of a new product can range from several days to several years, can focus on today's market, the other sectors with long-term experience in research should focus on the market of the future [9]. The success of technology commercialization in a small business, including its first stage, is determined to a great extent by the initial selection of the most promising products and technologies. For small businesses, according to experts, innovative activity is confirmed by the fact that the number of innovations per one researcher is 4 times higher than in large organizations. At the same time, the number of innovations related to $1 spent on RD&T in the sector of small and medium-sized businesses in the US, for example, 24 times higher than of large enterprises [2]. The collection of information during the first stage should be consistent with the technology audit. Each small innovative enterprise and scientific organization has its own peculiarities, however, technology audit should be directed at both the use of technology in their own production and the realization of the rights to technical solutions. With respect to one and the same technology, various ways of deriving income can be considered.

Technology audit of a small enterprise intending to use the technology in its own production should be aimed at identifying the following circumstances:

- the present stage of the enterprise development;
- whether there is a need for new technology and products;
whether there are resources (intellectual, financial, logistical) for potential innovations;

- what is the probability of bringing innovations to their applicable state;

- whether the introduction of innovations will provide a commercial result.

In the case of using new technical solutions for fee-based assignment of rights to other organizations, the technology audit should reveal the following facts:

- what practical use is possible for innovative technical solutions;

- whether the intellectual property rights are fixed and protected to the full extent;

- whether there is a potential consumer (business), interested in innovative technologies (products);

- what form the contractual relationship with the purchaser of innovative technical solutions and products should have;

- whether there is an opportunity to use technical solutions independently, without the consumers of the innovation;

- what time is required for bringing the innovations to the market and what further steps are needed.

In fact, these questions are aimed at identifying the enterprise’s opportunities to carry out certain marketing activities for technology transfer. The most important general conclusions of experts on a small business regarding the technology audit are:

- only external consultants can effectively conduct technology audit;

- small enterprise can itself carry out technology audit under unconditional support of the management and its staff.

In the first case, a professionally competent consultant should be chosen. Moreover, it is important that this consultant could demonstrate both its professionalism and loyalty to the small business and its employees.

In the second case, to conduct effectively the technology audit, an employee (employees) of small enterprise should have some knowledge about the basics of innovative technological activity. It is also important to solve the issue of property rights to existing innovative technologies. Problems of sufficient legal protection always arise from the owners of intellectual property, as they can be copied out of control. In Russia, as in other countries, a special legislative and regulatory framework has been adopted for legal protection and use of creative achievements (Table 1) [11].

Table 1: Enterprise’s intellectual resources.

<table>
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<tr>
<th>Characteristics</th>
<th>Research and development results</th>
<th>Results of intellectual activity</th>
<th>Employees’ experience</th>
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The next step involves preparation of a small business to the technology audit. This process includes: preparation of questionnaires and forms, staff training and briefing. In fact, the questions raised should disclose the topics that will reveal the potential of the enterprise. Questions should relate to new technological knowledge, human resources, systems, education and training, the technology owned by the enterprise, and intellectual property rights (patents, patent applications, know-how, trademarks, databases, unpatented knowledge) [7].

Preparation for technology audit should include the preparation of convenient schedules of data collection activities, as each employee should be individually interviewed. The interview should be carried out with the participation of two or more consultants or employees, since during the process of communication, listening and recording the responses some of the details can be missed, the meaning of which will be understood later.

The next stage - the classification of technological ideas and their analysis - evaluates the state of small business and its development prospects. Often this stage involves SWOT-analysis (identification of strengths and weaknesses of the company, opportunities for and obstacles to its development). Small businesses often have poorly developed prediction of the future, so the SWOT-analysis is useful for the development of goals and visions.

The key elements of the analysis of the scientific organization are:

- a study of the market potential (market size, growth dynamics, market availability, the level of profitability, the qualitative assessment of the forecast of both market and technological prospects);
- the quality of an innovative product (degree of uniqueness, degree of function upgrade, the degree of function price reduction, environmental qualities);

<table>
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<tr>
<th>Definition</th>
<th>Knowledge presented in the report documentation on RD&amp;T agreements</th>
<th>Knowledge presented on a tangible medium, not included in the reports on RD&amp;T agreements</th>
<th>Knowledge is not expressed on a tangible medium, but can be used</th>
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<tr>
<td>Examples</td>
<td>Reports, design documentation package</td>
<td>Scientific papers, results of laboratory studies, the description of processes and technical solutions</td>
<td>Professional skills, creative potential</td>
</tr>
<tr>
<td>Methods of legal protection</td>
<td>Patent right, copyright, related rights, official and trade secret</td>
<td>Agreement between the employee and the employer</td>
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- the feasibility of the technology (the accuracy of the concept, the novelty of the concept, technical readiness, regulatory restrictions);
- technology resource availability (material availability, the duration of the complete development cycle, financial and human resources);
- degree of intellectual property protection (available patents, clarity of intellectual property rights);
- availability of a business plan for the commercialization of technologies;
- analysis of the obstacles and risks associated with the commercialization of a particular technology.

Studying the technology used by competitors, as well as comparing the technology used by small business with the best technological solutions in the industry should take a special place in the analysis.

Once the objective is clear, the recommendations should be developed. At this stage, the reason, for which all technology audit is conducted, becomes clear. As a rule, the recommendations or a "road map" are aimed at developing long-term strategies to achieve this goal. They are usually developed on the basis of a comparison of analysis results with a known "good" practice. It is hard to expect that a small business having management shortcomings in terms of technology will be able after the audit to offer effective solutions in this area. However, using regular methods of innovation, the company can bring outstanding technology and products to the market.

The next stage includes drawing up of the report to show audit data, with indication of the used methods of data collection, description of the results of research and the offers developed. The offers must relate to the determination of opportunities for the technology transfer within and from the small enterprise itself. The report also ranks the offers according to their importance, urgency of an action, and implementation order of these actions.

An important and often underestimated step of the technology audit is the presentation of the report. Its particular value lies in that all the parties concerned can receive the information on the results of the technology audit:
- a small business has the possibility to agree on the points of view and record their differences. Without the internal consent, the domestic risks of failure in the performance of recommendations for the technology audit grow substantially;
- the prepared recommendations help small enterprises to improve their business, expand communication, master the markets, find business and transfer partners for its technologies.

Such an order of technology audit allows for creation of a mechanism of complex estimation of innovative performance of a small enterprise and its innovation potential [12].
Summary. Starting the technology audit at a small enterprise, one must consider several factors:

- the management shall be initiator of the technology audit;
- the staff of small enterprise should be aware of the goals and objectives of the technology audit;
- the staff must participate in all stages of the technology audit;
- technology assessment, even in the case of external experts, should be carried out with the participation of all employees of a small enterprise;
- to carry out the technology audit it is advisable to involve a group of experts, since an individual expert opinion can be subjective;
- technology audit process can be time-consuming.

A positive moment in conducting the technology audit by a small enterprise by itself is that the company realizes a specific goal and possesses extensive knowledge in a particular scientific field. On the other hand, the company may face such negative moments as a biased or superficial assessment, increase in labor costs for skilled personnel, opposition of the staff to future changes [13, 14]. The risk of leakage of confidential information is also possible.

We can say summarizing that one should not start the transfer of a particular technology without technology audit of its own innovative intellectual property baggage, as there is a risk that the technology would be a random choice having no commercialization value. The end result of the technology audit is the development of certain recommendations for the commercial use of specific RD&T results. Technology audit for small innovative enterprise is not only the collection of information on its state, but also the method of identifying the potential of innovative activity.

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References


