

# ІННОВАЦІЇ. ІНВЕСТИЦІЇ. КОНКУРЕНТОСПРОМОЖНІСТЬ

## INNOVATIONS. INVESTMENTS. COMPETITIVENESS

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### FORMATION OF AN INDUSTRIAL ENTERPRISE INNOVATION STRATEGY BASED ON TECHNOLOGY AUDIT

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**D**evelopment of modern domestic engineering industry is currently characterized by the fact that the operation and modernization of modern production and the formation of technological processes takes place on the basis of the old technological system and on things that were left after the privatization and restructuring of large industrial enterprises of the Soviet past [4]. In this regard, there is a need of the production technology optimization process and transferring to the fifth and sixth technological types.

#### Analysis of recent researches and publications

The following researchers: Boolev I., Dubnitkiy B. [3], Merkulov M. [4], Molchanov O. [6], P.J., and other scientists have worked to decide problems discussed in this article.

To know how justified was such a transition for the implementation of advanced technological processes in industrial plants of Odessa region, it was needed to analyze the equipment fleet of twelve leading companies (Table 1), belonging to the association "Perspective".

Analysis of the structure of the metal cutting equipment park and the results of inspection of twelve leading industrial enterprises of Odessa region show that in average on the majority of enterprises the CNC machines and processing centers are only about 7% of the total number of machines. Existing technological capabilities do not have sufficient flexibility that does not allow enterprises to quickly rebuild the production on new products.

Furthermore, it should be noted that most examined businesses are characterized by relatively high level of technology upgrade. Enterprises are not able to develop new types of products, due to outdated technology base, lack of specialized software, lost traditions of research and development activities aimed at improving the technical training of pre-production, research and implementation of

*Захарченко В.І., Кандеева В.В. Формування інноваційної стратегії промислового підприємства на основі технологічного аудиту.*

Технологічний аудит представлено у роботі як важливий інструмент розвитку та реалізації інноваційно-інвестиційної стратегії, потужним засобом інноваційного менеджменту на підприємстві.

*Ключові слова:* стратегія, підприємство, технологічний аудит, інновація

*Захарченко В.И., Кандеева В.В. Формирование инновационной стратегии промышленного предприятия на основе технологического аудита.*

Технологический аудит представлен в работе как важный инструмент развития и реализации инновационно-инвестиционной стратегии, серьезным средством инновационного менеджмента на предприятии.

*Ключевые слова:* стратегия, предприятие, технологический аудит, инновация

*Zakharchenko V.I., Kandeeva V.V. Formation of an industrial enterprise innovation strategy based on technology audit.*

Technological auditing is presented in the paper as an important instrument of development and implementation of innovative and investment strategy, as strong tool of innovation management at enterprises.

*Keywords:* strategy, enterprises, technological audit, innovation

measures to improve the efficiency of the organization and management of production.

It is also necessary to consider the outflow of highly qualified personnel from the industry over the last twenty years. Analysis of conditions of

production technology improving by switching to modern high-tech equipment shows that in addition to advanced technology, you must have high level specialists of engineering and work specialties.

Table 1. The state of the metal cutting equipment park of Odessa region industrial enterprises

Types of equipment	The current metal cutting equipment park on 01.07.2014		Average depreciation, %	Prediction of the equipment park in 2017	
	pcs.	%		pcs.	%
Universal equipment	550	76,5	83,3	90	66,2
CNC machines	115	16	73,8	160	21,6
Automatic lines	55	7,5	64,5	90	12,2
Total:	720	100	73,9	740	100

Note: Calculated by authors

At the same time the tasks defined by programs of socio-economic development of the Odessa region until 2020 [2], require concentration of financial and organizational efforts, primarily at those enterprises,

technological capacity of which will allow to effectively master the production of innovative products (Table 2).

Table 2. Indicators of socio-economic development of the Odessa region until 2020

The name of indicator	Fact			Plan		
	2012	2013	2014	2012	2013	2014
The task. Formation of a regional innovation system and creating the conditions for innovative activity activation						
Level of innovative activity (the proportion of organizations engaged in innovative activities in the total number of examinees, %)	7,6	7,3	5,7	7,2	8	12
Expenditure on technological innovation to the GRP, %	0,65	0,48	0,32	0,4	0,7	0,9
Gross domestic expenditure on research and development to the GRP, %	0,32	0,31	0,31	0,32	0,45	0,65
The share of innovative products in the total volume of products, %	6,8	3,7	3,3	5	7	11

Note: Calculated by authors

At the same time, despite the existing difficulties, industrial machine park of Odessa region was recently replenished with modern automated equipment in the form of CNC machines, made in Germany, Switzerland, Czech Republic, Japan, equipped with various CNC systems (Siemens, Bosh, Fanuc, Fagor, Hedenhain etc.). Effective use of such equipment requires different approaches to technological processes design, selection of machining attachments, cutting tools and engineering control [5]. The technological audit, whose ultimate aim is to set the technological diagnosis, allows formulating technological approaches to improve the competitiveness of products and the efficiency of enterprise.

Currently you can find a number of "technology audit" concepts, summarizing which we can say the following: [7]. Firstly, as a rule, technology audit is considered as a type of consulting activity, at least - as a kind of analytical work of one of the company's structures. In both cases, technology audit is

perceived as a kind of one-off, unsystematic events. Each one of said options has a right to exist, and the choice of a particular approach to the organization of the technological audit in the company is determined by a complex of factors. Secondly, there are broad and narrow meanings of the term: narrow one is technological audit like the evaluation of technologies, wide is the technological audit as a tool for the technological strategy formation of the organization to ensure the release of specific products. If the ultimate goal of technological audit is considered as maintenance of competitive products release, the sequence of its carrying out is determined by the scheme shown in Fig. 1.

Auditing of the technological equipment of production can be divided into three main stages [7]:

The first stage is the analysis of technology used at the enterprise and the evaluation of these technologies application.

The second stage is the overview of the technologies used at other enterprises, primarily at

competitors, and identification of technology standards, i.e. best practicably used technology. The basic management tool for solving these problems is the benchmarking.

The third stage of technological audit is to compare the used technologies to identified technological standards in order to assess their relative effectiveness, and therefore prospects. The basic management tool for solving problems of the third stage of technological audit is the analysis of technology portfolio.

Technological audit procedures begin with the formation of technological reserve, i.e. audit problem

statement. Depending on conditions of enterprise's functioning, the directions of the technological audit tasks statement may be the following [8]:

I. Baseline: the presence of the technological equipment park and advanced factory infrastructure, described expenses' limitations for a new product production. The purpose of the customer is mastering a new product release: annual output, the technical requirements for the product and its components are defined. In this case, the technological audit's task is defined as follows:

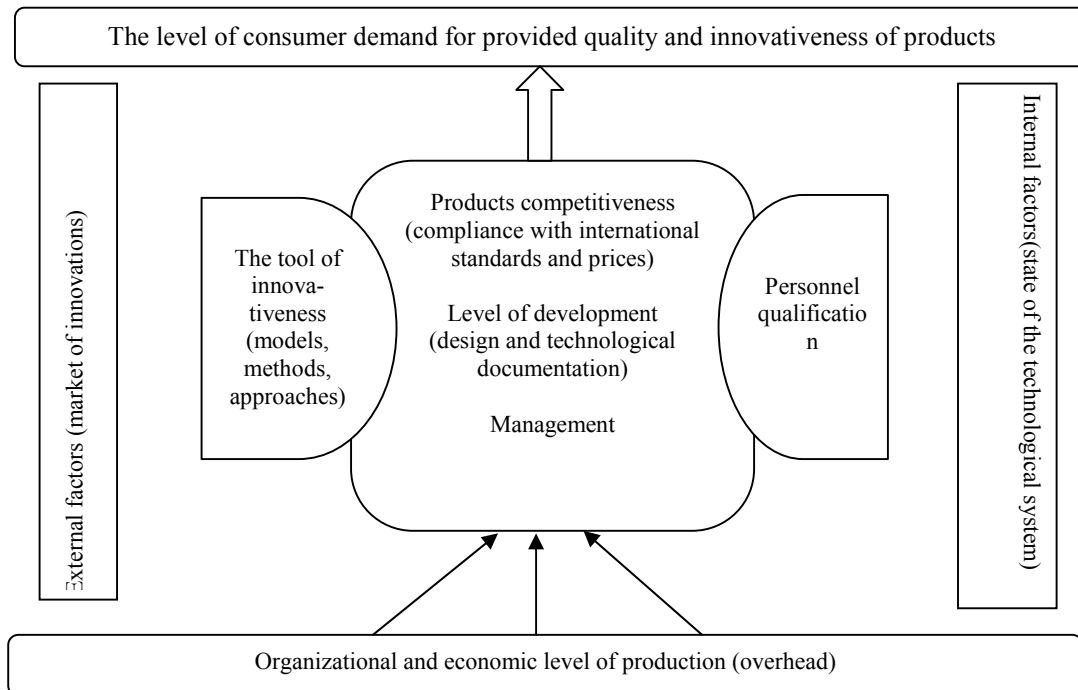


Fig. 1. Directions of industrial enterprises' audit

- It is possible to ensure the required quality and the required program on existing equipment and in current conditions of the production organization;
- technical capabilities and (approximately) the amount of equipment that you need to buy, that is, what kind of investment and in what terms you need to do;
- what you need to know (with high confidence) about the parameters of production to obtain adequate data on the share of variable costs for different technical and organizational options to make economic sound decisions.

II. For given operating conditions of the enterprise to determine possibility of the profits increasing by reducing the cost of production. The technological audit's task in this case is formulated as follows:

- to determine the areas of irrational use of equipment, staff time, tools, materials in technological processes and in current organization of production;

- to give recommendations of technical and organizational nature to reduce expenses per production unit;
- to estimate approximately the amount and timing of investments to achieve this goal [8].

The main methods of obtaining the necessary information at the first stage are the polls: (interviewing, questionnaires, group expert methods). Except carrying out surveys, when characterizing used technologies it is important to apply various quantitative indicators, such as the number of patents, new products, research papers, etc. Expert assessments of used technologies and the indicators of their position in the company are supplemented by a retrospective analysis of technological development.

The result is sufficiently complete and detailed description of the technological state of the enterprise, from which you can make informed conclusions about the level of used technologies.

The second stage of technological audit is to identify technological standards (benchmarking). The stage is aimed at identifying the best appropriate

technology (standard), as well as determining the level of cost reductions during the transition to this technology. This allows assessing the attractiveness, efficiency and productivity of the used technology relatively the identified standard. Due to the fact that benchmarking requires the use of information related to the competitive struggle, you cannot expect that other companies will be completely open for research. Therefore, as public information sources for the analysis of technological standards there can be used:

- published reports of competing enterprises;
- interviews with customers and suppliers;
- buying and analysis of the competitors' products and services;
- study of competitors' advertising;
- results of information (patent) search;
- visiting trade shows, etc.

At this stage of technological audit when analyzing techniques used by competitors, and identifying best of them there can be used, for example, questions about the implementation of quality control functions, the training and retraining of workers, about how to achieve the desired process parameters, etc.

At the third stage of technological audit there is a comparison of applied technologies to identified technological benchmark. The method that is called "Analysis of company's technology portfolio" acts as a basic comparison tool. The main purpose of this analysis is to classify all technologies used in the company into three groups:

- 1) Technologies that should be further developed using additional financial, scientific, technical and other resources;
- 2) Technology, the use of which must be maintained at the current level, i.e. for which the maintenance of the status quo is important;
- 3) Technologies that should be excluded from the enterprise's technology portfolio.

Thus, the analysis of the enterprise's technology portfolio is focused primarily to identifying the most effective technologies, which should form the basis of its innovative and investment strategy.

Analysis of enterprise's technology portfolio is a kind of matrix analysis, which is actively used, for example, when forming the economic portfolio of diversified businesses.

Technology portfolio matrix is a diagram of the technologies used by enterprise, built in a two-dimensional coordinate system: y-axis reflects the importance of technology, their relative efficiency, productivity compared with the corresponding standard technology, x-axis is the position of the company in relation to technologies' application, and i.e. how strong is the company's position (Fig. 2).

Classification of all the technologies used in the enterprise, to one of four quadrants of the technology portfolio allows optimizing a set of used technologies.

When managing innovation and investment projects it is advisable to adhere the following guidelines [6]:

- funds generated by technologies of C quadrant must be used partly for the development and maintenance of B quadrant technologies and the technologies of A quadrant that have a chance to go to the B quadrant;
- it is needed to avoid excessive investment in stable technologies of C quadrant;
- it is needed to avoid the dispersal of resources to all technologies in A quadrant, and it is better to focus resources on those ones who have a chance to go to the B quadrant;
- prime candidates for exclusion from the technology portfolio may be the technologies in quadrant A, which are not able to go to the B, because despite the need for significant investment in their development, they are doomed to slide into Quadrant D;

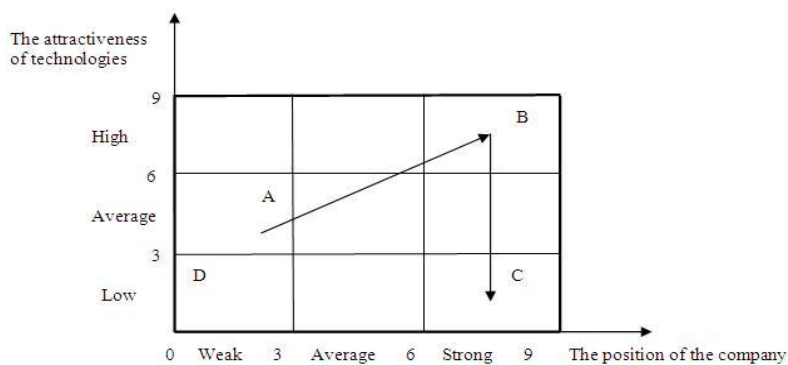


Fig. 2. Technology portfolio of the company matrix (perfected on the basis of [6])

— the lower and the more to the left is the position of the technology in quadrant D, the greater is the confidence that it is necessary to apply its exception from the technology portfolio.

Thus, in managing of innovation and investment projects it is needed to strive to the promotion of the technology by the following scheme: A → B → C.

By results of work a report describing the results of technological audit is prepared and issued. It includes:

- a brief description of the problem;
  - systematic description of the existing production and basic solutions;
  - recommendations for organizational and technical solutions that can provide obtaining the required characteristics of production;
  - evaluation of required investment and the timing of investment funds, assessment of investment payback period;
  - proposals for long-term program of activities aimed at achieving the goal facing the client;
  - suggestions on the types and volumes of work, which can be taken by the external organizations (outsourcing);
  - suggestions and technical materials for the software, computers, hardware, tools, equipment, etc., which may be recommended for the effective application of by the customer.
- Thus, the technological audit represents an important management tool in the development and implementation of innovative and investment projects and as a powerful tool for solving problems of enterprise innovation management.

### References:

1. Закон України «Про інноваційну діяльність» // Урядовий кур'єр, 2002. – № 143. – С. 1 – 7.
2. Програма соціально-економічного розвитку Одеської області до 2020 р. Постанова №272-VI від 28 жовтня 2011 р. Режим доступу: <http://oda.odessa.gov.ua>
3. Амоша А.И. Украина и ее регионы на пути к инновационному обществу / А.И. Амоша, В.И. Дубницкий, В.И. Захарченко и др. – Донецк: Юго-Восток, 2011. – В 4-х томах.
4. Захарченко В.И. Инновационное развитие Украины: наука, технология, практика: монографія / В.И. Захарченко, Н.Н. Меркулов, Л.В. Ширяева – Одесса: Фаворит, 2011. – 598 с.
5. Захарченко В.И. Современное машиностроение: структура, организация, мировые тенденции / В.И. Захарченко // Ринкова економіка: сучасна теорія та практика управління. – 2008. – Т.11. – Вип. 17. – С. 7 – 25.
6. Молчанова О.П. Инновационный менеджмент: курс электронных лекций. Режим доступа: <http://www.conferences.spa.msu.ru/Innov-Management2>.
7. Технологический аудит: ООО «Инженерный консалтинг». Режим доступа: <http://www.e-consul.ru/content/view/23/69>
8. Технологический аудит предприятий машиностроительного комплекса /ФГУП «Станкоимпорт». Режим доступа: <http://prom-audit.narod.ru/tech-audit.html>

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