

CHAPTER 1. INNOVATIVE PRODUCTION ACTIVITY

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Taking into account that the development of a new product (from the origin of the idea to the moment of net profit) is carried out over several years, a company is largely interested in reducing this period, seeks to speed up the process in all possible ways, however without excessive risk. In addition, it should be borne in mind that new products are easier to master if they are similar to the previous ones in terms of production and sales. It is much more difficult when a company has no experience and knowledge of the product manufacture.

The process of creating new products is a complex set of different activities, the main of which is the innovative activity of the enterprise.

1.1. The essence of innovative activity

Innovative activity – a systematic process of scientific and technical, production, management, financial and marketing and other activities aimed at creating, producing, developing and improving the quality of new types of products, technologies, organizational forms.

Innovative activity – a complex and not risk-free systemic process, which is determined by technical, financial, economic and social prerequisites and covers all functional areas: planning, research, products and technologies development, production, marketing.

In other words – a set of works from obtaining new theoretical knowledge to the use by the consumer of its material embodiment in the product (service).

Innovation is understood as a purposeful change of the object to achieve strategic goals and obtain useful technical, economic, social or economic results.

According to the level of their impact on consumers, there are **radical innovations** that open fundamentally new practical means and opportunities to meet the needs, and **modifying innovations** – which provide improvement of existing practical means of meeting the needs.

Innovations are also divided into technical, technological, socio-economic and managerial (Figure 1.1).

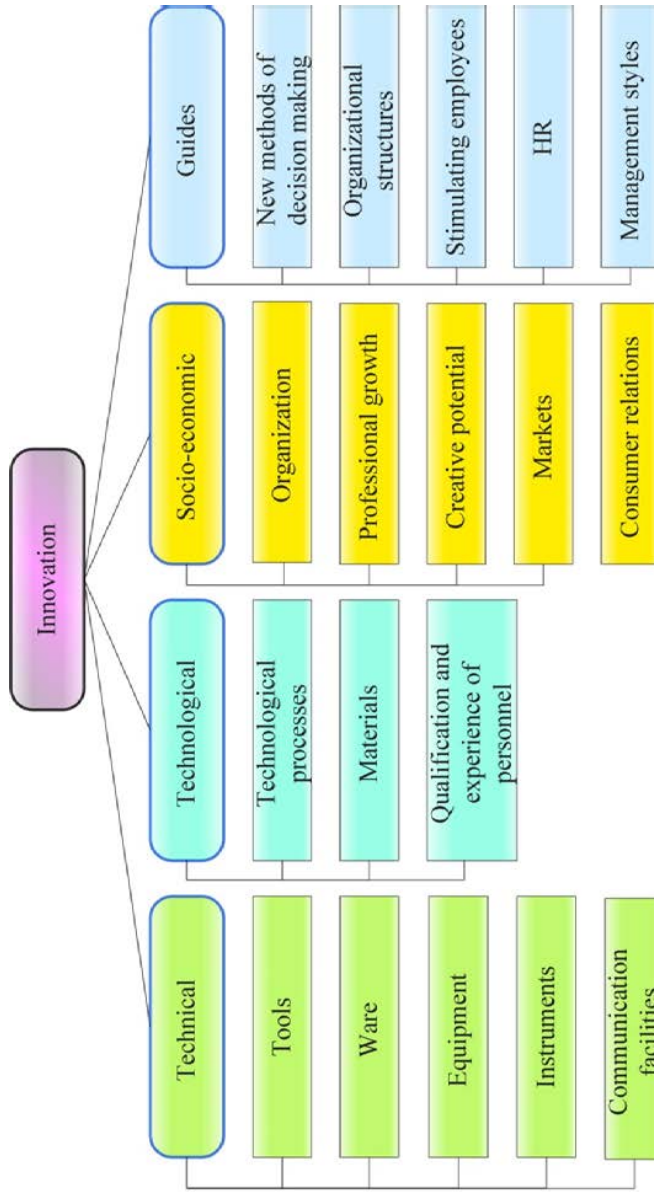


Figure 1.1 – Areas of implementation of innovation processes

Technical innovations are manifested both in new products and in the tools of their production.

Technological innovations are new ways of producing old or new products, by creating and applying a new technology or workflow.

Innovative work process is a new way of interaction of the working tool and the subject of work.

The result of technological innovations, as a rule, is a rapid and significant increase in labour productivity. Technological innovations can also have a good commercial effect (increased sales of products, possible price increase, etc.). For production it is equally important to update both products and technology, ie “symmetry” of the two directions of scientific and technological progress of a particular industry or enterprise.

Socio-economic innovations are new forms of activation of human activity, new forms and methods of organizing production and economic activity.

Management innovations are new methods of decision-making and personnel management in the conditions of new organizational structures.

Two important characteristics of innovation are its novelty (scientific and technical aspect) and commercial success (economic aspect).

The novelty of innovation is determined by the degree of novelty of embodied knowledge: innovation on the basis of known or on the basis of unknown laws, patterns, effects. The level of novelty is the main criterion for the effectiveness of innovations.

Each innovation “violates” the established, tested and justified operating system of production and sale of production or the organization of the enterprise.

The emergence of innovation is not accidental, but begins when certain conditions are created for the implementation of a new idea: the social need, a certain level of knowledge, the possibility of material realization.

A fundamental feature of modern production – a sharp reduction in the period of manufacture of new products. It is known that the LC (life cycle) of innovations is reduced by about half every 20 years, and now is, for example, for mechanical engineering lasts 7... 8 years. The rate of obsolescence of products doubles every five years.

Therefore, it is necessary to create new products in time and to organize their production taking into account the change of tastes, technologies, designs (Figure 1.2).

of innovation is determined by many factors, which depend on the nature of the innovation, as well as on the amount of investment and the ability of the market to perceive these innovations.

To remain competitiveness, any modern firm must constantly and effectively engage in engineering developments, design and creation of new products.

1.2. Ability to innovate

To determine its purpose and place in the market, the company must properly assess its potential and constantly enrich its resources.

Identification of potential is performed to compare the capabilities of the enterprise with its goals.

The ability to innovate is characterized by the readiness of all types of enterprise resources.

Thus, the **technical capacity** lies in relevant technologies, equipment and facilities or the technical feasibility of its acquisition in a timely manner.

Organizational capacity for innovation is ensured by the presence of appropriate organizational structures and their clear interaction between each other, as well as with other structural units of the enterprise in the operational solution of innovative problems.

Financial capacity – the availability of appropriate finance to invest in research, development, production and promotion of innovation on the market or the acquisition of a license.

Personnel capacity – the availability of qualified human resources, both engineering and production, and relevant technical, technological and production knowledge.

Closely related to human resources is the psychological readiness for innovation: the developers' knowledge of modern methods of finding new technical solutions and overcoming the psychological inertia of thinking, the presence of motivation, etc.

The work on ensuring a company's ability to innovate should be carried out not sporadically, but constantly at all levels of the management hierarchy.

The capacity of enterprises must correspond to the specific market situation and is defined as follows (Figure 1.3):

1) on the basis of forecasts determine the future demand for products "PD";

Scheme for determining the level of capacity

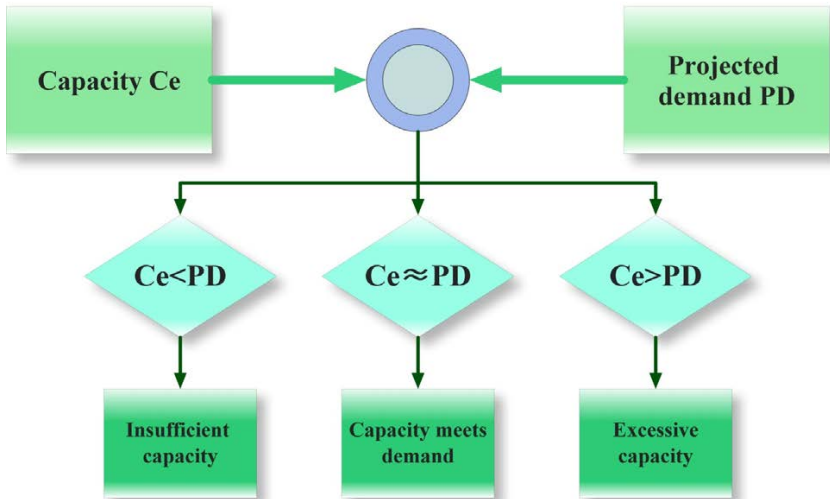


Figure 1.3 – Scheme for determining the level of production capacity

2) compare the existing capacity (C_e) (forecast) with forecasted future demand: determine their compliance, which may be – insufficient, sufficient and excessive;

3) in case of insufficient or excessive capacity perform the analysis of possible alternatives and take the most rational one;

4) develop a plan (with a time schedule) to expand or reduce production. Decision-making involves considerable risk.

When capacity lags behind demand ($C_e < PD$) – this requires less investment and therefore provides higher return. However, there is a danger of losing potential sales and reducing one's market share.

When capacity roughly meets demand ($C_e = PD$) then due to the unevenness of its change over time, this can lead to both excessive and insufficient capacity. If capacity is ahead of demand ($C_e > PD$), then such additional capacity increases the amount of tied funds, the company can provide better service to consumers or put itself in a better position to lure

consumers from competitors who do not have stocks. However, losses are possible if demand “PD” will be less than expected.

Identification of the ability to innovate is carried out by collecting information about the available capacity for each of its types.

Thus, the assessment of technological heritage is carried out through the assessment of the quality of functioning of existing technological processes and the effectiveness of technological measures.

Functioning of technological process (TP) obeys certain laws, knowledge of which is necessary for forecasting and managing this process. Identification of these patterns is one of the most important parts of the analysis of the TP in assessing the technical heritage.

To compare the possibilities of heritage with the goals, enterprises carry out its inventory (audit).

Inventory includes:

1. Compiling a list of all technologies, competencies, skills that the company has in all areas of activity from development to after-sales maintenance of products. The list includes TP by types of production used in the production of this product or a typical representative (procurement, machining, assembly, testing, maintenance).

2. Construction of a “tree” by area of activity, which allows to assess the company’s ability to control them.

3. Certification of technological processes.

For this, technologies are divided into main, auxiliary, advanced and basic.

Main technologies – technologies that determine the specialization of the enterprise are the basis of its future development (main production technologies).

Auxiliary technologies – technologies related to auxiliary activities of the enterprise (auxiliary production technologies).

Advanced technologies – technologies that are the basis of enterprise competitiveness. They ensure its ability to protect the competitive advantages in selected markets.

Considering the array of promising technologies, analyse the potential of their development. On this basis, technologies are divided into **mature (obsolete) and new (with high development potential)**. It should be noted that there are various intermediate types between mature and new promising technologies.

Basic technologies – technologies that include the minimum competencies required for an enterprise to perform its functional purpose. Basic technologies are owned by all competitors, so the company must ensure that the degree of their perfection was not lower than that of competitors, i.e. the technology must be competitive.

Inventory and classification of technologies, competencies, skills help the company to better understand its essence, identify sources of competitive advantage, choose the appropriate organizational structure.

Inventory also gives the company the opportunity to assess its competitive status. The competitive technological potential of the enterprise is determined on the basis of the matrix “progressivity-maturity of TP”. This assessment is usually carried out by experts of the enterprise, and in case of misunderstanding between them – external experts.

1.3. The life cycle of innovation

The life cycle of innovation (Figure 1.4) consists of periods of theoretical and applied research, development, mastering and use of scientific and technical ideas, improvement of technical and economic parameters of manufactured products, their operation and maintenance, and ends with the disposal and replacement of a qualitatively new product.

The process of creating an innovation involves research of various kinds.

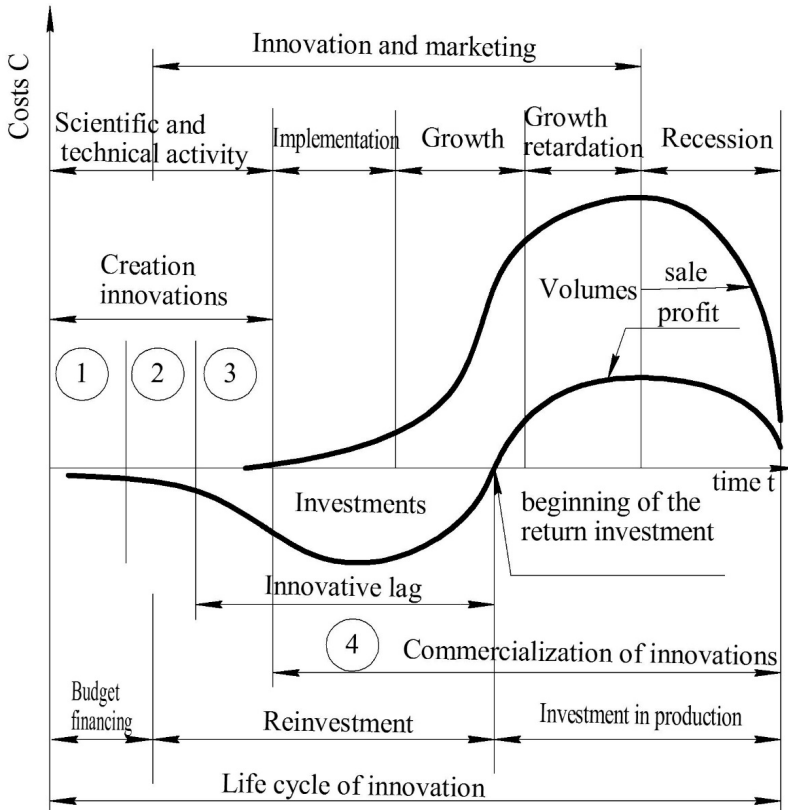
Theoretical (fundamental) research (TR) – aims to discover the essence and action of natural processes for the use in practical developments.

Exploratory research (ER) is aimed at identifying opportunities and conditions for the use of scientific ideas for applied work. The results of **TR** are discoveries and inventions.

Scientific research work (SRW) – applied research, the results of which are the basis for the development of a schematic diagram of a particular product.

Research and development work (RDW) aimed at material implementation of results and recommendations (**SRW**) in the form of samples of a new product and relevant design documentation.

The process of bringing an innovation to market is called **commercialization**. From the moment the decision to commercialize a scientific idea (innovation) is made, the latter is interpreted as an innovation, i.e. a novelty. Innovations include new designs, new technologies,



**Figure 1.4 – The structure of the innovation process:
stage 1 – research; 2 – research; 3 – research and development work**

new materials, new techniques, new services and more. The process of commercialization of a scientific idea requires time and capital (investment). The time from the appearance of a scientific idea to the introduction of an innovation on the market, or, in other words, the duration of the process of transforming a scientific idea (innovation) into a commodity, is called an **innovation lag**. The product from the standpoint of marketing is treated as any product, method, etc. that meets a certain need and can be sold on the market to external consumers.

Changing products, improving its quality and competitiveness, as a rule, are combined with innovations in technological processes, materials used, raw materials, the need to improve the skills of employees, etc.

The duration of the innovation life cycle T_{LCI} can be represented by the sum of duration of the cycle stages in the form of dependence:

$$T_{LCI} = T_{il} + T_{sp} + T_{rw},$$

where T_{il} – the duration of the innovation lag that precedes the spread of the product on the market, i.e. the period between the appearance of a new product and the payback of its development and implementation costs;

T_{sp} – duration of serial production;

T_{rw} – duration of recession and withdrawal of the product from production.

The estimated values of the durations of the stages are rounded to an integer number of months. As the check of the correctness of the choice of static ratios in the determination of T_B can be a comparison of estimated durations of T_{ma} , T_b , and T_{sp} with the projected length of the profitability period (T_{np}):

$$(0,3 \cdot T_{ma} + T_b + 0,7 \cdot T_{sp}) \geq T_{np}.$$

Indicator T_{np} is calculated by the formula:

$$T_{np} = T_{PLC} \cdot \gamma_{np},$$

where γ_{np} – expected specific significance of the profitability period in the structure of the product life cycle, which is determined by the method of three estimates;

γ_{n1} – pessimistic evaluation;

γ_{n2} – incredible evaluation;

γ_{n3} – optimistic evaluation.

$$\gamma_{np} = \frac{\gamma_{n1} + 4 \cdot \gamma_{n2} + \gamma_{n3}}{6}.$$

Value γ_{np} is predicted to the second decimal place.

Usually the parallel-sequential organization of the innovation process is used, which allows to reduce the level of costs and 15-20 percent of the time of work compared to sequential organization. In addition, the parallel-sequential organization of work can significantly reduce the amount of refinements at the stage of manufacturing a prototype.

Based on the specific economic circumstances, the goals of the enterprise in relation to certain products, markets, actions of competitors, etc., it chooses one or another type of innovation strategy (Table 1.1).

Table 1.1 – Modifications of the innovation strategy of the enterprise

Type of strategy	Essence	Terms of usage
Traditional	The company seeks only to improve the quality of products manufactured	Normally functioning enterprise
Opportunistic	The company is looking for a product with low development and research costs to be alone in the market for a certain time	Technical and organizational flexibility
Imitational	Imitation of non-patent innovations, or their acquisition from others. A radical form is the acquisition of a company-innovator	Availability of powerful design and technological departments, capable of imitation in the shortest possible time. Availability of a strong sales system and strong financial potential
Dependent (defensive)	Rapid acquisition of the right to innovations that have already proven their effectiveness	Innovative dependence on the enterprise-innovator. It is advisable to adapt the innovation to the goals of the enterprise
Offensive	Trying to be the first on the market	Large investments in SRW and RDW. High qualification of performers. Willingness to take risks. Large corporations and firms.

It is known that innovation processes require resources and competencies, which are often unbearable for a single enterprise, but feasible for an alliance. Therefore, new forms of innovative activity have recently spread – cluster associations.

Cluster association (cluster) – a geographically localized voluntary association of interconnected enterprises and institutions of a certain sphere with motivated and stable cooperative relations, which direct their activities to the production of world-class products.

The cluster may include specialized suppliers of materials and services, equipment, etc., as well as universities connected to enterprises, standardization agencies, trade associations in certain areas that compete but work together.

Clusters are usually located in a specific region, with easily accessible communications, logistics and human resources, and sometimes in a separate industrial city.

The main goal of the cluster is to increase the domestic and international competitiveness of its members through innovation and research, education, connected by common technologies and skills that complement each other.

Today, cluster associations are one of the most effective forms of organizing innovation processes, forms of regional development, when on the market compete not individual companies, but entire complexes, which reduce their costs through a joint technological corporation.

The application of the cluster approach is a necessary condition for improving the efficiency of the innovation process, the level of economic development and competitively growing globalization and competition, when the possession of a qualitatively new type of resources comes to the fore: innovation, information and intelligence.

Recently, cluster regional policy has become an effective means of economic development of regions and employment growth in Western countries, which is especially important in the context of European integration of our country.

The life of the business world, market relations, fierce competition require a new approach to innovation. From its episodic creation it is necessary to pass to systematic, purposeful development and implementation.

This approach becomes a key element of competition for markets and provides industry leadership and high profits.