МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
МІНІСТЕРСТВО АГРАРНОЇ ПОЛІТИКИ ТА ПРОДОВОЛЬСТВА УКРАЇНИ

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MACHINERY MANAGEMENT

Навчальний посібник

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Розглядаються особливості та методологія управління виробничо-господарською діяльністю інженерної служби агропідприємств, що працюють на госпрозрахункових засадах.

Для підготовки фахівців у вищих навчальних закладів III – IV ступенів акредитації зі спеціальностей: 208 — агроінженерія. Навчальний посібник корисний також для спеціалістів АПК, слухачів закладів підвищення кваліфікації та науково-педагогічних працівників вищих навчальних закладів.

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PREFACE

Agriculture, by right, has a key role in restoring the economy of our country. The most important tasks that should be solved by the agro-industrial complex are sustainable production`s growth achievement, reliable provision of food products and agricultural raw materials by the population. There are 43 million hectares of agricultural land, including 32 million hectares of arable land in the agroindustrial complex of Ukraine, which is compared with a third of arable land throughout the European Union. Half of these lands - black earths - are the most productive type of soil.

In the last decade, grain production has doubled. Ukraine became the world's third largest grain exporter after the United States and the EU. Thus, 64 million tons of grain were produced in 2014, which is by 2.4% more than in 2013, not even taking into account the occupied Crimea (MAPF, 2015). There is a high probability that this year's 2016 record will be beat. Our country has a competitive advantage in grain production due to high soil fertility, low level of production costs and strategic geographical position; The country's potential is estimated at 100 million tons (Hervé, 2013). Ukraine is also the largest producer and exporter of sunflower, the third world corn exporter, the fourth - barley, the sixth - soybeans and the seventh - chicken (MAPF, 2015). 60% of the areas under grains occupy wheat, barley and corn.

At the same time, there is a real problem with the hiring of skilled workers before agriculture. For production, there is a shortage of technical professionals such as agronomists, agroengineers, veterinarians. The existing gap in skills is due to insufficient cooperation between the agrarian education system and the education sector and the private sector. Recent institutional and legal reforms should strengthen the involvement of the private sector in developing curricula that meet existing needs. The implementation`s experience, the leading scientific institutions, the latest high-performance agricultural machines in plant production processes has revealed a number of problematic positions. The major important are the lack of highly skilled management personnel in the engineering and farms technical services and enterprises. In connection with what the master's programs in both research and production direction in the specialty 208 - agroengineering, introduced a new discipline - "Management of technological processes in crop production". In the process of studying, future specialists of the engineering field of agricultural production should master the principles and provisions: system management of production and technological processes of the reformed agrarian sphere; production-technological service; modeling, optimization and introduction into the production practice of new organizational structures for the use of machine systems; inventory management in the logistics system in the agroindustrial complex, as well as world trends in the development of machine systems and the organization of their use.

The discipline`s "Management of technological processes in crop production" aim is forming theoretical knowledge of communication system components and operational management skills interdisciplinary communication with all stakeholders processes and projects related to commodity crop production in the future engineers agrarian. As a result of studying, future specialists should:

- Know - regularities of the farm machinery management and technical service of the village and agrarian service enterprises (configuration and exploitation of vehicle, technical service, etc.);
- Be able to systematically evaluate the resource potential of the economy and the efficiency of the technology in the production processes; to determine the correspondence between technological and technical systems of mechanized production processes, organizational forms and methods of their realization. to substantiate the technological grounds and economical expediency of introduction of the newest systems of machines in crop production, the number and characteristics of the equipment being renewed, as well as the organizational forms of replenishment of the fleet of machinery of the economy; to substantiate the

technological grounds and economic expediency of co-operation of the economy with the machine-technological station and maintenance and repair enterprise; to determine the optimal parameters of the primary production-technical formations (service enterprises) for the centralized implementation of mechanized agricultural works in crop production; to evaluate the effectiveness of the interaction of these formations with farms and to manage their functional structures; to manage personnel, material and material resources of mechanized agricultural production.

The principles and provisions of the technological processes management in crop production is based on the knowledge of general-technical, general-special and special disciplines. This discipline is final in preparing a future specialist in the agricultural engineering field, but big part of its content contributes to the mastering of curriculum in other subjects.

CONTENTS

Chapter 1.

The theory and main theses of process approach to the management of production structures

Would you like to make your life better? This is a rhetorical question for which there is a trivial answer - of course, each of us, often feels the demand to change something in our life for the better. However, not everyone can understand where exactly the best side is. And in general, what essence do we put into the concept - the best side? Further, as a result of which actions and in what way, maybe at least something to achieve? Thus, there are a lot of questions. Let's start with the fact that we are all keen on some kind of activity - "... do our job ..." and we try to get a positive result in this case. But if for the science - a negative result is also a result, in a conscious person the negative result causes negative emotions. Have you ever thought how to streamline your acting’s and how exactly to find the solution for each of the scheduled cases without any problems?

I am sure that everyone knows people who are surprisingly fast and organized to achieve their aim. And we think that he or she is smart and effective. For example, you have never thought about it, but it's very important to know how these people are doing it in practice. After all, by and large, our life is a process.

In fact, every day we do some business - we start the usual procedures in the morning: we consistently, in a hurry to have breakfast, learn from the message on our smartphone and do a lot more than usual. By making in this or that kind of activity, we are resorting to the use of certain processes. And we often accelerate them by performing procedures, operations in parallel and not consistently (for example, we are eating and reading messages) in order to reach the result (aim) faster. That is, we are all participants in the processes we are trying to manage. But if you read these lines - then you are involved in the learning process. The next is the production process and if you couldn`t understand how to manage them, it will lead to dramatic consequences.

That's why; in the first section of this textbook on discipline "Management of technological processes in crop production" we consider the very foundations of the general theory of designing and the choice some of the process. Let's get acquainted with the established definitions and methodology of the process approach, and above all, you must understand at the expense of what and how it is possible to achieve efficiency in the performance of professional activities in our and yours field - machinery used in the plant growing industry.

1.1 Fundamentals of process approach to business organizations.

At the heart of the process approach to the organization's activity lies the theory of variability, that was founded by Walter Shuhart in 1924.

At the base of this theory are formulated by the following definition: all types of products and services, as well as all processes in which they are created and/or transformed tend to deviations from the given values, hence, to variations [3].

Walter A. Shewhart

(1891-1967)

On the basis of the proposed theory of variability a new notion emerged - statistical thinking. Statistical thinking is based on the theory of variability, a way of making decisions about should be or no interfere in the process, and if it necessary, then at what level (that is, who and when) [3]. As a result of Walter Shuewhart's joint work with Edward Deming, a process management technique was developed. Worldwide, this control technology (management mechanism) is known such as the "Shukhart Cycle", or "PDCA" (Fig. 1.1).

W. Edwards Deming

(1900 – 1993)

The PDCA abbreviation is defined as "Plan, Do, Check, Act". In the United States, the other option is used - the PDSA, which stands out as "Plan, Do, Study, Act" [55]. In modern scientific literature, this cycle is often referred to as the "Shewhart-Deming cycle", which embraced both the wording.

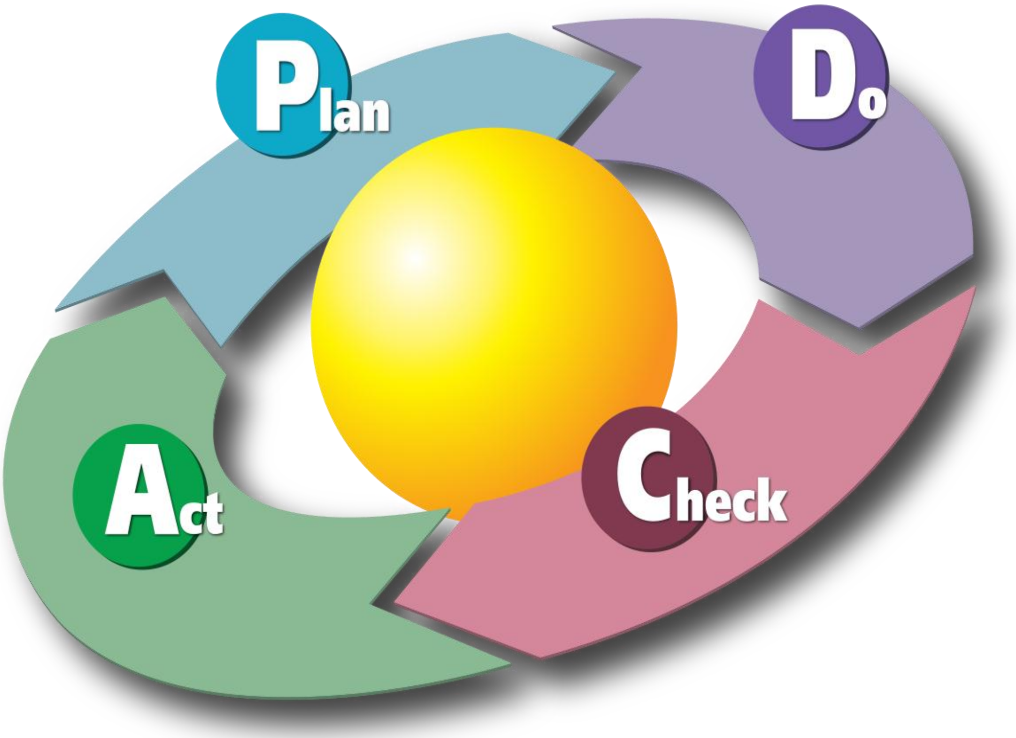
The phases of the Shewhart-Deming cycle are carried out as follows:

1. PLAN - the person in whose management the process is planning is how, how the process should be carried out.

2. EXECUTE - executors subordinate to the person in whose administration the process is - perform the process undoubtedly according to how the process was scheduled.

3. TRANSPARENCY - the results of the implementation of the process of its performers and the person in whose management the process is collecting information (process indicators), the authorized person analyzes it and determines whether there are general or specific causes of variations, a stable or unstable process.

4. ACTION - the person in whose administration the process is based, on the basis of objective information, makes managerial



decisions for the improvement of the process.

Fig.1.1. The Shuhart-Deming cycle (http://www.bulsuk.com).

The Schuhart-Deming cycle does not stop there; management decisions are made to improve the process; the person in whose management the process is being introduced in the next process planning (to some extent, by modifying it for the purpose of qualitative improvement), and the performers perform work already in a modified, improved process. The data is re-collected, and the authorized person analyzes and clarifies whether the management decisions made about the changes in the process of improvement and then continues the regulation - to find options for improving the process. It is no coincidence that this cycle is also called a cycle of continuous improvements.

The formal side of the Schewhart-Deming cycle is not too difficult to understand and perceive. A much more complicated situation is when we begin to directly implement continuous improvements. And the case is not only so much in the natural aspiration of man to stability, but also in the rooted habit, which is expressed by the proverb "In a stranger's eye, and sees the dust, but does not notice the stump". That is, in addition to organizational difficulties in the implementation of continuous improvements in the Shewhart-Deming cycle, there are barriers associated with the peculiarities of a certain society. Recognized academics and practices of operational management such as: Chase, Richard B.; Jacobs, F. Robert; Aquilano, Nicholas J. et al., Distinguish and generalize a number of favorable environment conditions for the implementation of continuous improvements in the Shuhart-Deming cycle. Here are the main:

Condition 1. Process managers (process owners) must identify their shortcomings and / or identify problems that exist in the business;

Condition 2. It is necessary to change the attitude towards problems, first of all from the top management of farms and organizations, and begin to consider all these complexities as an opportunity for further improvement of the economy (organization);

Condition 3. It should be understood that work in the Shuhart-Deming cycle involves operation in a continuous mode, in contrast to the existing stable mode, when little changes in the production process;

Condition 4. The main thing in the model of continuous change is the so-called human factor, which is more focused on stable work than on constant changes;

Condition 5. Activity should be done as Williams Deming mentioned in his "Fourteen Principles" - "Constancy of Purpose - Continuous Improvement of Production and Service".

Condition 6. Important: to overcome the psychological factor - fear of punishment; according to the continuous improvement of the ideology (the Shuhart-Deming cycle), it should be emphasized the problems and disadvantages for which employees were previously punished;

Condition 7. To convince employees that it is necessary to voice pain problems and not to hide them and then they (workers) will not bear the punishment for this.

In conclusion, we can note that the main advantage of the process approach is the enormous potential for improvement of processes. The full implementation of the process approach significantly increases the reliability of the process management system and allows you to effectively use the production potential of the economy. In practice, its use increases not only production capacity, but also the competitiveness of commodity producers.

§1.2. The basic concepts and definitions in process management

The concept is a process that is quite common. In general, the process is considered as a consistent change of states or phenomena - the course. Regarding production, the two paradigms of the word have been rooted in what constitutes a process:

a) – like as the resource organize;

b) – like as the organizational activity.

The need for managers of business units to understand the basics of the functioning of processes is very important for ensuring continuous improvement of the production process, thus ensuring a sufficiently high level of competitiveness of the commodity producer. A process that does not meet the goals of a business organization will permanently slow down its effective operation. For example, let's consider two farms - a producer of crop production: if for the first of these farms the costs of growing and harvesting one ton of winter wheat cost 1200 UAH; and for the second economy, the cost of winter wheat of the same quality is - 1500 UAH/t. then under the same market conditions and the market price per ton of winter wheat, so that it did not do a second economy, but compared with the first one - the second one will lose about one ton of winter wheat - 300 UAH.

Consequently, when designing the technological process of any product of plant production, commodity producers must take into account a number of factors. The main of these is compliance with the adopted technological level of production - systems: crop rotation; plant protection; fertilizer; soil cultivation, etc. As derivatives of the technological level, these factors include - the cost of seeds, herbicides, fertilizers, fuel and lubricants, etc. as well as economic and transport costs associated with the production of goods or services.

What is any process?

In the scientific literature both foreign and domestic authors have a lot of different interpretations of the notion of "process", which relates precisely to production situations. So in the writings of R. Chase, R. Jacobs, N. Aquilano, the process is regarded as a part of the activity carried out by an organization that transforms input factors into end products or services ("output"), By providing these transformations, the acquisition by this organization of greater value than the value of the factors of production introduced. In [8], "the process is a certain logical sequence of related actions, which transforms the input into the results or output." In the work [84], "process - a set of interconnected resources and activities, which transforms the input elements at the weekend." The definition of ISO 9000: 2000 sounds somewhat broader: "the process is a set of interconnected or interacting activities that converts inputs to outputs."

The logical conclusion from the analysis above will be the fact that in the numerous and different interpretations of the paradigm of the word "process" the common definitions of the term "activity" and "work" as the occupations of production - business and business are revealed for most definitions. In this sense, it is often found in literary sources that the term "business process" (or business process) can be used. Thus, in [8], the business process is seen as - "a chain of logical, related, repetitive actions that results in utilizing enterprise resources for the processing of an object in order to achieve certain results for the satisfaction of internal or external consumers." At the same time, the concept of "business process" is quite understandable, but rather broad, which includes not yet one chain of internal processes, including the technological processes that are fundamental in the production of goods or services. That is, there are different types of processes in the middle of the business process. And as a result, all these different types of processes are united by the common principles of conduct; at least there are basic common requirements for the realization of processes [103]:

Processes should be:

- *requirement 1* continuous, consistent, documented;
- *requirement 2* aimed at creating a result that is of value to the consumer;
- *requirement 3* controlled, that is, equipped with dots, methods and means of control;
- *requirement 4* rationally built to exclude "return" or unnecessary and ineffective operations;

- *requirement 5* are provided with channels of information transmission, etc.

The production process is the object of management, based on what requires the availability of: resources, tools and technologies, management procedures - the established procedure of action and decision-making in case of occurrence of inconsistencies or failures in the process.

§1.3. Classification of the processes

To describe the process of designing a process, it is necessary first of all to classify the processes. Learning to attribute the processes that are considered to one or another category, you can quickly identify the similarities and differences between these processes.

The first method of classifying processes is to divide them into one-stage and multi-stage (multiethnic) processes. If the process is viewed as a whole "black box", it should be classified as a one-step process. For the first time, the American mathematical theorist and applied mathematician Norbert Wiener proposed in the middle of the 20th century a model of a "black box" in which there is an “enter” and “exit” (Fig. 1.2.).

At the same time, inputs in the general case are raw materials, energy, executors, documentation and information, tools and equipment, environmental conditions, and outputs are products, services, solutions, information, and more. In this case, all operations associated with the operation of a one-stage process, one could combine and analyze its work using a single indicator - **the cycle time**, which would reflect the speed of a one-step process.

Norbert Wiener

(1894-1964)

Multi-stage (multi-step) process involves several groups of operations, interconnected streams. Based on this, the term stage used in the definition - reflects the fact that for a slightly simplified process analysis, several operations are grouped together into one group (Fig. 1.3.).

In a multi-stage (multiethnic) process, there is a need for accumulation. Under the definition - **accumulation** - should be understood as the manifestation of the process of the process in the interval between individual stages, which is expressed in the formation of the stock of the results of actions ("outputs") of the previous stage, due to the fact that these results are not involved in the next stage because of the workload of the latter. Accumulation will be a consequence of the independent implementation of actions at various stages in the event that the bandwidth of the previous stage is greater than the next. If one stage "feeds" the other without intermediate accumulation, it is assumed that these two stages are interconnected directly. However, when designing the process more often, there are situations with two typical problems between neighboring stages - the block and the idle time. The problem arises in situations where actions in the previous stage are forced to stop because of the inability to immediately pass the result of the previous one to the next stage. A simple occurrence occurs in situations where actions on the next stage are forced to cease due to non-use of the result from the previous stage.

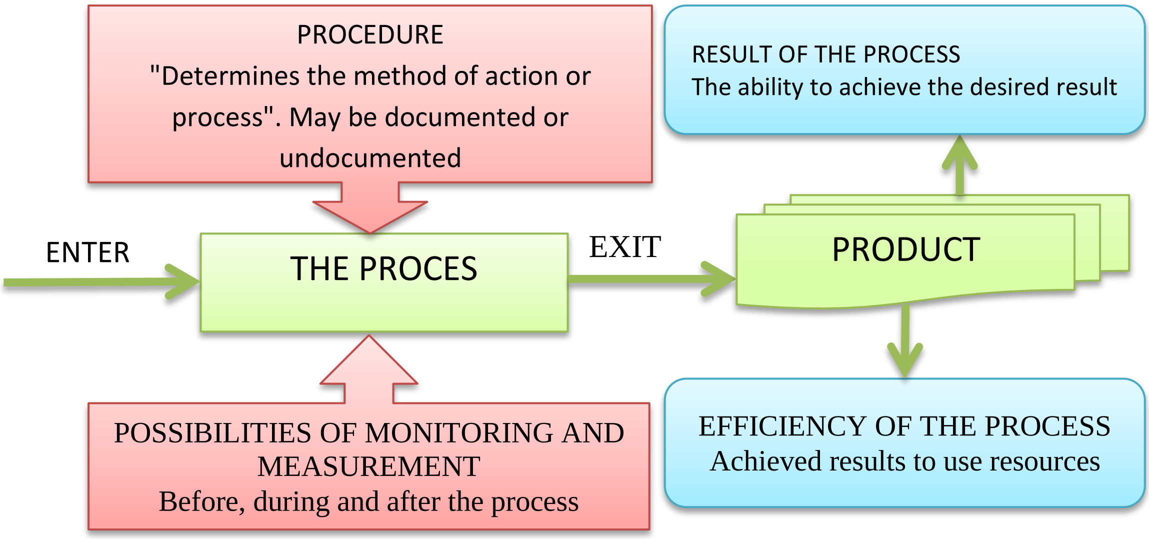


Fig. 1.2. The Model of the process for the Wiener-Adler

By appointment, that is, the degree of influence on the final result of obtaining value added processes are identified by:

a) The main (basic) processes, the direct result of which is the production output or the provision of services;

b) The processes providing the basic (basic), the result of which is the creation of the necessary conditions for the implementation of the main processes;

c) The management processes, the result of which is to increase the efficiency and effectiveness of the main and processes that provide the main.

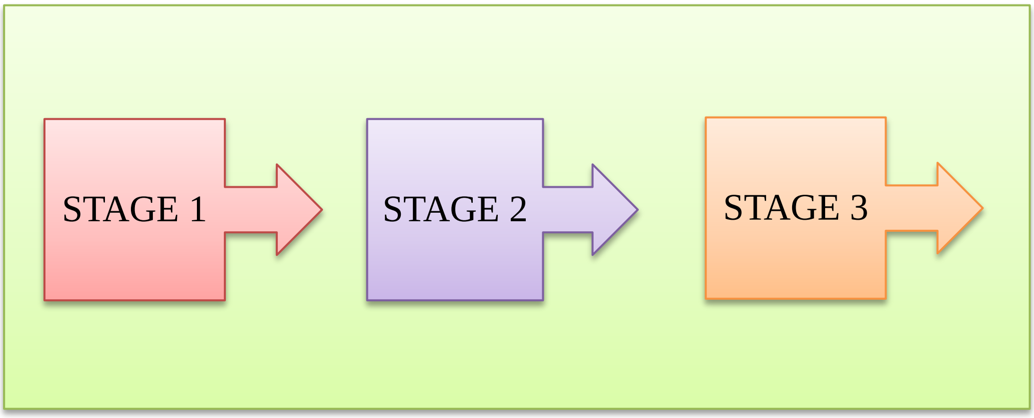


Fig. 1.3. The Model of multi-stage process

The main processes create the output (both the final and intermediate) results of the organization, directly add value (value) of the product. These processes are strategically important for the successful organization of the business and affect the satisfaction of consumers. The main processes are related to the production of commodity products and their implementation, as well as with the after-sales service [109]. Through the main processes, the mission of the organization is realized, on the basis of them an organizational structure is formed, a set of processes is provided that provide the basic processes and processes of management. In relation to the latter, the main processes perform a given role. This role can't be effectively implemented (that is, the maximum added value is provided) unless an adequate set of processes for it is provided, which ensures and processes of management, is designed to solve specific problems of the organization in business. Unlike the main processes that provide the main processes and management processes are in their nature vertical processes, because they reflect the activities of the organization vertically in accordance with its structure and form of interaction between the heads of functional units. In the generalized form, the signs of processes classified by appointment are shown in the diagram (Fig. 1.4.).

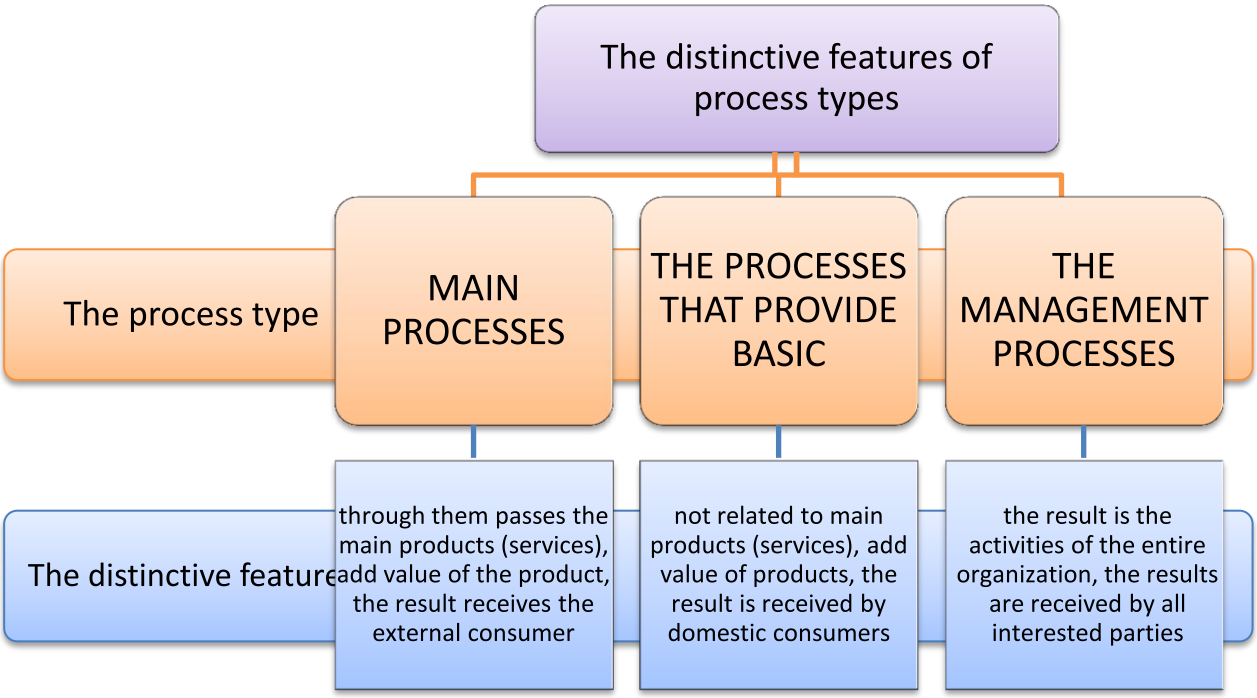


Fig. 1.4. Distinctive features of the process types

It should be noted that the process and activities (functions) organizations have a different essence:

- the process is dynamic and corresponds to a certain result;

- the activities of the organization are closely linked to the norms and laws established in society, and therefore its role is determined by society, which explains its conservatism and less dynamism than the process [127].

However, far from all the processes taking place in the organization, even the main ones, have the same impact on the success of the organization in specific market conditions. In this regard, individual organizations also distinguish key processes that ultimately have the greatest (even decisive) impact on the achievement of the main goals of the organization. These processes can be determined depending on the degree of their impact, first of all on consumer satisfaction, shareholder value of the organization, increase sales, expansion of the market for sales, decrease in costs, etc. The ranking of the key processes can be done on the basis of the analysis of factors that influence the performance of processes. At the same time as the key processes, it is possible to identify critical processes whose inadequate execution may represent actual or potential risks for ensuring product quality. For various reasons, a number of the critical processes can get any process. Detection of the critical processes is carried out in the course of the current activity or the results of the audit. It should be noted that:

- the key processes reflect the external in relation to the organization of influence;

- the critical processes are a reflection of internal influences.

Consider the classification of processes of the quality management system (QMS). In accordance with ISO 9001: 2000, the organization for quality QMS must be:

- identify the processes required for a quality management system;

- determine the sequence and interaction of these processes;

- identify the criteria and methods necessary to ensure effectiveness, both in the implementation and management of these processes;

- take measures necessary to achieve the planned results and continuous improvement of processes, etc.

§1.4. Identification of processes

The procedure for identifying an object requires its identification with the selected object model, which in turn is a reflection of the features and regularities inherent in the real object, the original.

The task of identifying processes related to the selection of a notable, simple, and unambiguous identification tool in the form of a digital, graphic or word mark, a symbol, a color mark, etc., on documents from the processes of processes, both paper and electronic media. This allows you to quickly and uniquely identify a specific process in the existing set of processes and determine the order of their execution [59].

Another, not less important step in the process of identifying processes is the creation of a formalized model. The formalized model it`s display of successive or parallel stages and stages of the process, their interconnection and interaction. Such models can be presented both in the form of a simple text description, and in the form of various format for displaying flowcharts, charts, graphs, algorithms, diagrams and the form of their combinations. Formalized models should be as simple and understandable as possible, but at the same time complete and exhaustive. The consider process simulation in the form of flowcharts. The block diagram is a graphical description of the flow of processes. The advantages of the block diagram are that the graphical representation of a complex object is much easier to understand than the verbal description of it. The most common way of graphic representation is the use of different characters to denote different actions. Block diagrams are not standardized, so each designer selects them, as a rule, at their own discretion. Usually the simple geometric shapes are used as symbols (Figs 1.5 and 1.6).

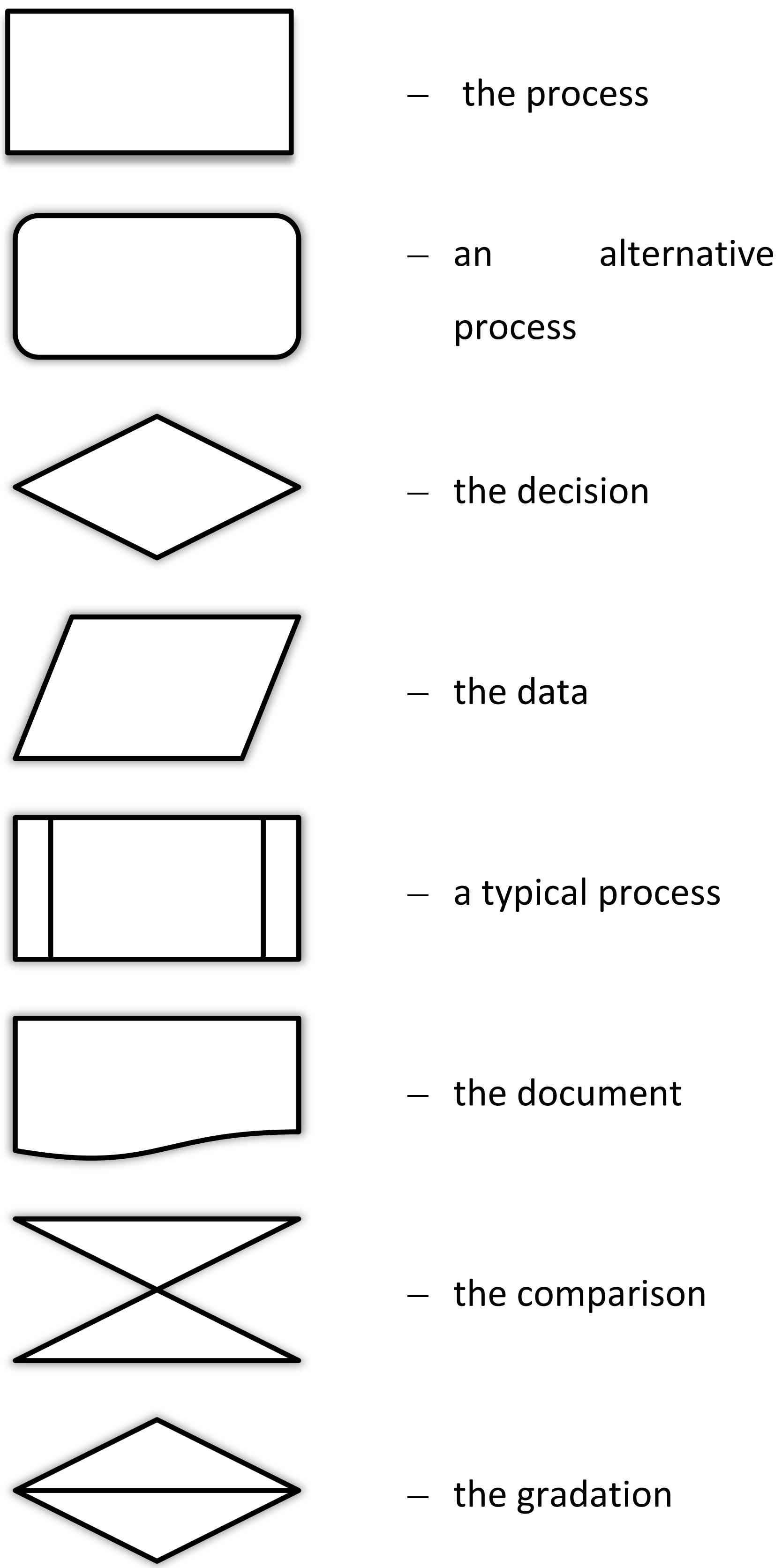


Fig. 1.5. Commonly accepted symbols for graphical representation of the processes.

The alternative ways

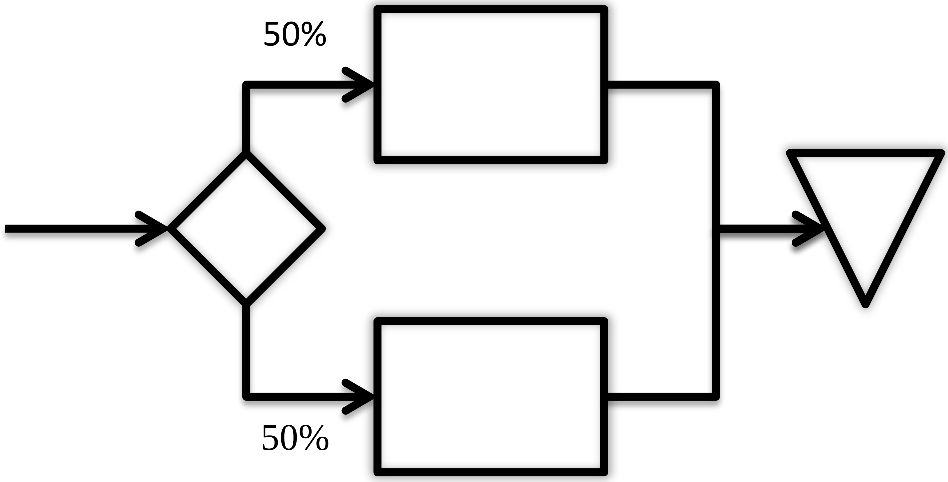
The concurrent actions

The production of various goods

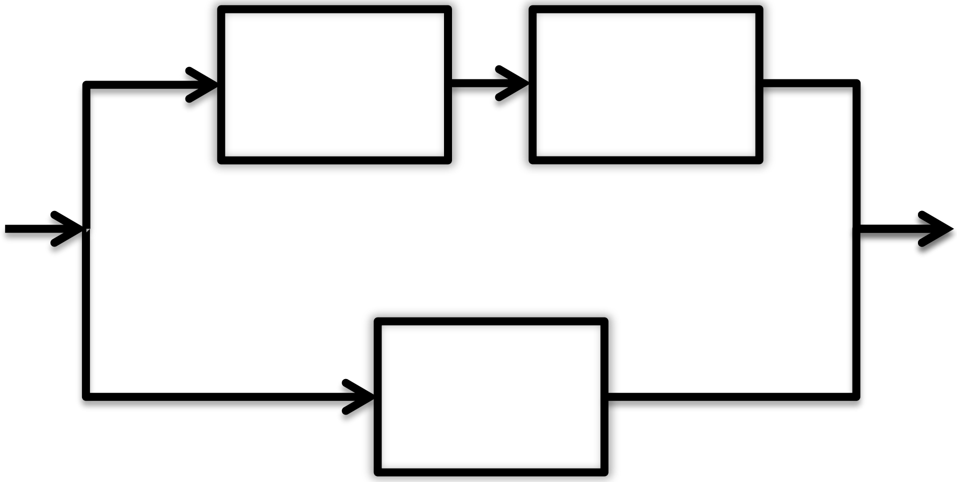
The ideal identification of the process is to create its mathematical model, which establishes the interconnection of input and output parameters and takes into account all the defining conditions.

Analysis of processes is one of the basic skills necessary to ensure the operation of business operations. The analysis of processes is greatly facilitated by the construction of a flowchart, which reflects the flow of materials or information through the enterprise. This flowchart should include all operating elements and show their interdependence. When drawing up a block diagram, it is necessary to specify the storage places of materials and place of formation of queues of orders. Often, up to 90% (and sometimes even more) of the time it takes to service the client, it is spent waiting in queues. Consequently, even a simple elimination of waiting time can dramatically improve the functioning of the process.

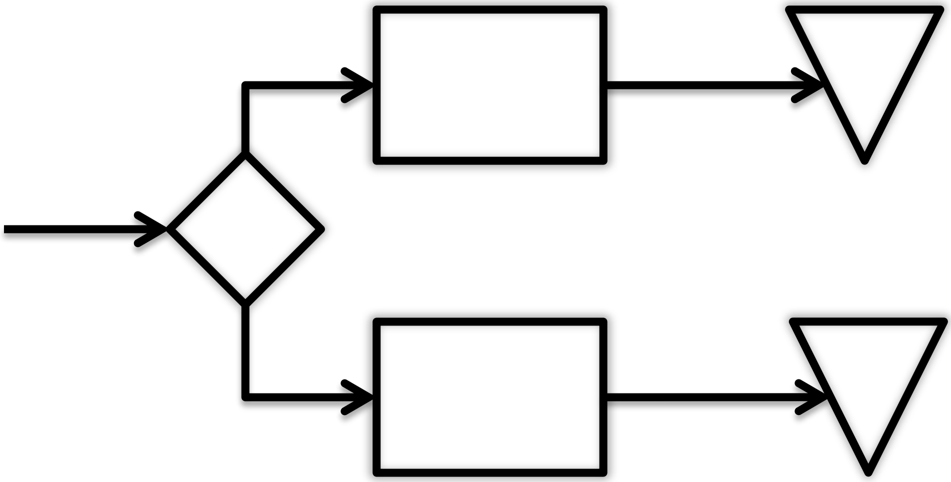
When analyzing any process, you must always keep in mind the following fundamental concept: everything that enters the process input must, in any form, appear at the output of the process and exit from it.



Alternative paths



Simultaneous actions



Production of various goods

Fig. 1.6. The examples of graphical representation of the processes

§1.5. Appointment of processes

A common practice, most of the scientific sources and operating standards distinguish between the five main groups of stakeholders that interact with any production organization (farm):

1) The consumers of products or services;

2) The resource providers;

3) The collective of the organization itself (internal environment);

4) The society (external environment - state, commercial, educational and public organizations, international organizations, etc.);

5) The owners (shareholders, shareholders, founders).

It is quite true that the structure of the appointed stakeholder system depends largely on the ownership of a separate production facility. However, at least all of the interested parties are important for prioritizing the target specific production organization, but the consumer plays an exclusive role in defining the goals of its technological processes. It is the consumer who pays his own finances for products and / or services, thus providing it with the organization of money (finances) for existence and, most importantly, the possibility of its further development. Therefore, it is not surprising to see existing world standards of quality, the requirement to meet the needs of the consumer, considered as a privileged priority in the production activities of any legal form of the manufacturer of goods or services.

From now on, the following question has come to an end: what exactly serves as a source of processes in the organization (economy)? Where do they (in our case - technological, but in general any) are taken and how do they arise? To answer these questions, you must identify the participants and consider parties that are interested in the results of the processes.

There is practically no single production organization related to manufacturing products or services that would not work closely with suppliers. Therefore, it is perceived as natural that the importance of mutually beneficial relations with suppliers of input resources is noted in the principles of quality management of world standards in the series ISO 9000: 2000.

The commandments of business do not fail to interpret that one can`t forget about competitors. However, not always the proper care is given to competitors, as an interested party. In the vast majority of cases, relations with competitors are irreconcilable. Although it should be noted that in recent years, the development of an unusual phenomenon for us, such as partner benchmarking, based on partnerships with competitors, has become increasingly evolving, of course, on mutually beneficial terms (Benchmarking) the process of finding a standard or benchmarked, cost-effective competitor to compare with one's own and take advantage of its best practices).

Further, for the prioritization of priorities, the relationship between the leadership and the staff of the production organization is extremely important. Management processes at all levels of the organization's hierarchy determine the climate of relationships in the team and radically affect the efficiency of work. Each organization, as required by ISO 9001: 2000, should formulate its own opinion on the importance of its processes:

- What processes are or are needed for the organization;

- How can they be correlated with levels of management and ranking?

- Which processes play a major role for the organization, and what is the auxiliary, etc.

For different purposes, structure and level of any processes, they need their approaches to management, methodology and scope of their description. Before describing the processes, it is advisable to wonder how they will fit the process based approach [135]. It is logical to group these questions into planar functions of a process. Thus:

The first group - reflects questions that help identify the processes required for a quality management system (QMS or QMS - Quality Management System):

- What processes are needed for the QMS;

- Who are consumers of each process (internal or external);

- What are the requirements of these consumers?

- Who is the owner of this process?

- Is there an outsourcing process among the processes - the company's transfer of part of its tasks or processes to third-party executors on subcontracting terms? This is an agreement by which the work is carried out by people from an external company, who are usually also experts in this kind of work);

- What are the inputs and outputs of this process.

The second group - reflects questions that determine the sequence and interaction of processes:

- what is the total flow of processes;

- how they are identified;

- which communication channel between processes;

- what documentation should be developed.

The third group - reflects the processes that help to find the criteria and methods necessary for effective work:

- what characteristics should be taken into account in the results of this process;

- what criteria for monitoring, measurement and analysis;

- how to combine them with the planning of QMS and the life cycle of products;

- what economic indicators (costs, time, losses, etc.);

- which methods are appropriate for the selection and aggregation of data (indicators).

The fourth group - reflect questions related to resources and information:

- what resources are needed for each process;
- what channels of communication;
- how to obtain external and internal information about this process;
- how to provide feedback;
- what data should be collected;
- what records should be supported.

The fifth group - reflect questions related to measurement, monitoring and analysis:

- how to monitor the indicators of the process (reproducibility of processes, level of customer satisfaction);
- what dimensions are needed;
- how best to analyze the collected information (statistical methods);
- that will show the results of such analysis.

The sixth group - reflect questions related to implementation, performance and improvement:

- how can this process be improved;
- which require corrective or preventive action;
- how these corrective and preventive actions are implemented
- are they effective?

The sequence of processes will be reflected in the process of detection and description of the process:

Step 1. Identify (specify) a complete system of processes necessary for quality management.

Step 2. Determine the sequence, interconnection and interaction in this system of processes.

Step 3. Identify key processes from the standpoint of strategic goals and plans.

Step 4. Find a staff member who is ready to assume responsibility for this process and give him the appropriate authority, to make the owner, the "master" of the process.

Step 5. Identify the customer or consumer process and describe the output process, that is, the requirements for the quality of the results of its operation.

Step 6. Identify process vendors and requirements for input elements of the process, that is, resources.

Step 7. Identify the criteria for effective management of this process and choose the appropriate measurement methods for them.

Step 8. Plan processes for measuring the quality and process performance.

Step 9. Describe the process itself as a flowchart or flow diagram, taking into account the process management system.

Step 10. Identify the input and output documents in the process stages (eg, regulations, job descriptions, work log, etc.).

Step 11. Provide information flows that are needed to effectively manage and monitor the process.

Step 12. To carry out regular assessment, monitoring and analysis of data related to the process.

Step 13. Systematically carry out corrective and preventive actions aimed at achieving the goals of the process.

Step 14. Determine the order in which the changes are made.

Indeed, the above requirements for production processes can be divided into basic and auxiliary. The main requirements in the form of process characteristics are fixed in the process map:

Step 1. The name of the process (it should be short and expressed by the verbal noun - examples: length of the transfer, the moment of transfer, the rules of acceptance, the act (of) adoption, the approval procedure).

Step 2. Process code. Definition of the process (the wording that reveals the essence and the main content of the process).

Step 3. Purpose of the process (required or desired result of the process).

Step 4. Process owner (it`s a person who responsible for promising planning, resource support and process efficiency).

Step 5. Process participants (persons involved in the process).

Step 6. Process specifications (it`s documentation containing indicators of the standards under which the process is carried out).

Step 7. Process inputs (material and information streams coming from the outside and subject to transformation).

Step 8. Outputs of the process (it`s conversion results that add value).

Step 9. Resources (it`s financial, technological, material, labor and information, through which the conversion of inputs into outputs is carried out).

Step 10. Processes of suppliers (it`s internal or external suppliers - sources of inputs of the considered process).

Step 11. Processes of consumers (it`s processes of internal or external origin, which are users of the results of this process).

Step 12. Measured parameters of the process (it`s characteristics, which are subject to measurement and control).

Step 13. Performance indicators of the process (they are reflecting the degree of compliance with the actual results of the planned process).

Step 14. Process Performance Indicators (they are reflecting the link between the results achieved and the resources used).

Separate positions of the process card require a more detailed consideration. For example, in the paper [59], when describing the implementation of processes, it is suggested to specify the following definitions:

1) what (which object) is the input of this process;

2) the output of which (the previous) process is the object at the entrance;

3) who from the employees of the previous process (position) carries out submission of the given object to the entrance;

4) who (the position) carries out the acceptance of the given object in this process;

5) who participates in the implementation of the process;

6) what (which object) is the output of this process;

7) what algorithm (technology) to convert the input to the output;

8) the input of which (the subsequent) process is the given object at the input. If the output of this process is passed to the input of several subsequent processes, all subsequent processes are indicated;

9) who of the employees of this process (position) carries out the submission of this object (exit) to the entrance (each) of the subsequent process;

10) who (the post) carries out acceptance of the given object at the input of the further process;

11) what actions (control, etc.) and by whom (position) are carried out during the transfer described above;

12) how (the document) identifies the fact of the transfer described above;

13) what further actions (payment, provision of information, claim form, etc.) and in what terms should (or may) be carried out after the transfer described above;

14) how the effectiveness of the process, including added value, is determined;

15) how is the effectiveness of the process determined?

The description of the process in an organization can be regulated, and may be arbitrary.

Process owner. The process is usually teamwork. The process team is characterized by a certain composition of the roles of its participants. At the heart of the effectiveness of the process of controllability lies the choice (appointment) of its owner and the allocation of his necessary powers in the framework of the selected requirements for the process.

The process owner is an official who is responsible for the organization, proper functioning and results of the process. It is possible, taking into account the opinions of some authors of publications, to highlight a number of key qualities that characterize the owner of the process. Consider these qualities:

Quality 1. The process owner must understand and understand the process deeply. Therefore, the proprietor of the process is advisable to appoint one of the employees of the organization, which currently manages (or oversees) one of the key areas of the process.

Quality 2. The owner must be able to influence people and promote change, enjoy the respect of the leaders and specialists of the organization, be a professional in the field of activity, able to solve conflict situations.

Quality 3. Have the communicative ability and leadership quality of changes, to appreciate the staff works like as your work. Be able to share the powers and encourage employees to act.

Quality 4. Be really on your job and cause enthusiasm in the work of the subordinates. See your process not only within the scope of the documentation, but beyond the borders to solve problems at the joints of processes.

Quality 5. Find and create moral motivation for work from participants in the process. Improve remuneration methods at the expense of innovative incentives.

Quality 6. Continuously improve the process. Create quality circles and horizontal creative brigades for setting up and solving problems.

Quality 7. Organize the development of documented procedures for quality management of the process, provide monitoring and analysis of the stability and manageability of the process.

The quality indicators of processes. The management system should ensure continuous improvement of processes in the organization, as this is a direct requirement of ISO 9001: 2000 standard. When fulfilling this requirement, it is necessary to determine the measured characteristics of the quality of the process. In accordance with the requirements of the standards of the ISO 9000 series, two indicators are used to assess the quality of the process:

1) the performance

2) the efficiency.

The work [78] suggests structuring the process quality indicators at three levels:

Level I. The effectiveness of the process;

Level II. Effectiveness of process management;

Level III. The efficiency of process.

The first level. Operational management of processes is usually based on indirect indicators, which mainly reflect the technical component.

Indirect characteristics of the quality of the process, which can be attributed to the performance indicators of the process, may be the following generalized characteristics:

a) the accuracy of the process, which is characterized by the magnitude of the deviation of the product parameters at the output of the process from the nominal values set in the documentation. For the document flow process, for example, the accuracy of the process can be characterized by the number of errors and inconsistencies in the documents developed;

b) the possibility of the process (stability indicator), which is characterized by the size of the distribution of product parameters at the output of the process inside the tolerance field, as set forth in the documentation (specifications);

c) the reliability of the process, characterized by the frequency of process failures that lead to changes in product characteristics, or the process time of the process without fail;

d) the productivity of the process, which can be measured by the time the customer's request is performed (time of service);

e) the harmony of the process, which is characterized by the parameters of product queues at the input and output of the process. As such queue parameters, you can use the average and maximum queue length, the average, and the maximum product availability time in the queue;

e) manageability of the process, which is characterized by the magnitude of the reaction of the process to the controlling influence;

g) the safety of the process, which is characterized by the frequency of failures of production processes, which have implications for employees;

h) the ergonomics of the process, which is characterized by the average time fatigue of workers in the performance of certain processes;

i) the environmental quality of the process, which is characterized by the frequency of process failures, which have implications for the environment.

The degree of compliance of the actual indicators of the planned (normative) process with the risk factor of nonconformity can be accepted as an assessment of the effectiveness of the process. At the same time, in addition to indirect quality indicators, the performance of the process can be estimated directly.

As is known process - a set of resources and activities. As the process progresses, production costs increase and, accordingly, should increase (in the production of high-quality products), the added value of the product. That is, regulatory value corresponds to normative added value. But when output of defective products, the cost of the process grows (exceeds regulatory) due to future costs for the processing or completion of defective products. At the same time, the added value of the product is an increase in the past pace. Then the difference between value and value gradually increases. In fig. 1.7 in the first operation the process did not have deviations; the second and third operations deviation from the documentation took place.

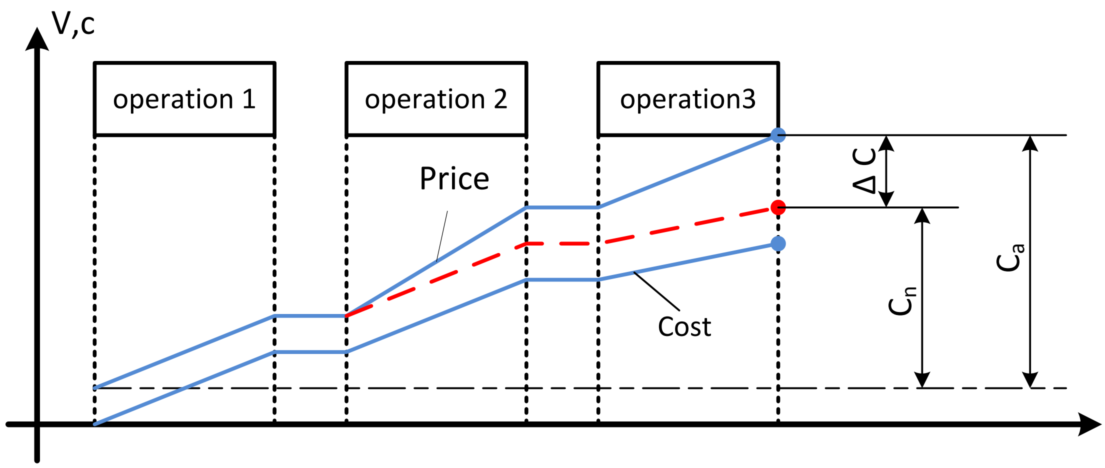


Fig. 1.7. Change in added price (C) and cost (V) of a product as the process passes:

where C_a, C_n - the actual and normative value added.

Consequently it can be assumed that the main task of production is the normative increase of the value added of the product with minimal deviations from the standard costs of the process.

When considering the results of the process shown in Fig. 1.7, it can be noted that, on the one hand, the goal of the process - to achieve normative added value - has been fulfilled, and on the other hand, to spend at the same time as little resources as possible - has not been fulfilled, since the normative (planned) expenses of the C_n are exceeded: actual expenses$C_a > C_n$. Since the standard in question is about degree, then performance in should be given in relative units (percentages). Then we will get.

$$\psi = 1 - \frac{C_a - C_n}{C_n}.$$

The second level. For processes under the management of a quality management system, goals in the field of quality must be formulated. These goals should be in line with the organization's policy in the field of quality and, at a minimum, set goals for increasing effectiveness. The degree of improvement in the characteristics of the process and will be an indicator of the effectiveness of process management.

The third level. The process efficiency, in accordance with ISO R 9001: 2001, reflects the link between the achieved result and the resources used.

It can be estimated as the ratio of input resources to the input process. The efficiency of production is determined by the time and resources expended, which should be minimal (normative). Therefore, efficiency is sometimes equated with the productivity of the process. On the other hand, efficiency is the maximum use of dedicated resources. For example, the unused fund of working time of soil cultivators, simple harvesters, etc.

In the general case, the value added and the money spent on product manufacturing may not be achieved for a commodity product. Then, when evaluating the efficiency, it is necessary to take into account the value of the lost part added price.

§ 1.6. Basic conditions of functioning of processes

The process model of the organization of the economy (enterprise) is significantly different from traditional activities (functional organization of activities). In order to have a clear and understandable vision of the conditions in which a process model of production operates, these conditions need to be the most complete and precisely defined:

Conditions 1) are obliged to define the main elements and categories of the process and to clearly and unambiguously give them a description;

Condition 2) each process must generate values (to be effective);

Conditions 3) are obliged to adhere to the principle of a single standard;

Conditions 4) adhere to the principle of balance of responsibility and authority;

Condition 5) obliged to appoint the owner of each process;

Condition 6) In order to improve each process, a special group of personnel of the organization should be identified.

Let's consider in more detail each of these conditions.

Condition 1. Obligation to formulate the main elements and categories of the process

In order for the functioning of the process to be carried out normally, it is necessary that the main elements of the process and the requirements for them are identified (Fig. 1.8).

We can see from the scheme of typical elements of the process of fig. 1.8, in order for the activity to function as a process, it is necessary to determine the input and resource requirements (which quality and requirements they must satisfy in order to achieve the effectiveness and efficiency of the process); all normative legal acts limiting this activity should be revealed and approved documents, which describe the process itself (regulations, standards, methodologies, documented methods, etc.); as well as requirements for the results of the process and indicators of their measurement (outputs).

Condition 2. The process must generate values

So, it is natural that the resulting assignment of any process - the generation of values (otherwise the process generates only costs). When a product passes through n well the number of processes and turns from raw materials to finished products, the final value of this product has two interesting features [8]:

√ Firstly - the process takes in the organization the cost of materials, labor, energy, etc. (the so-called costs) but the added value of products does not depend on these costs;

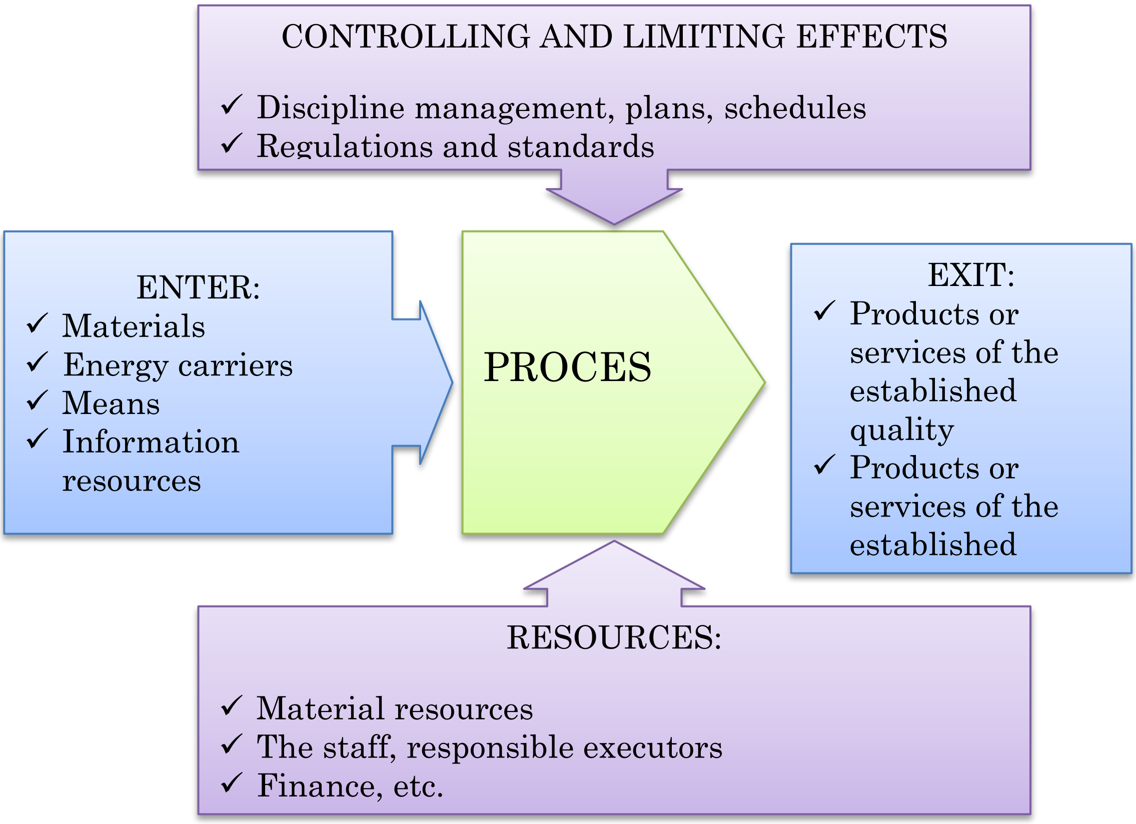


Fig. 1.8. Typical process elements

√ Secondly - if the product is accompanied by innovations, creativity, functionality, aesthetics, branded brand, etc. the value of the product increases.

What makes it possible to sell a product or service at a price is much higher than the total costs that absorbed the production process.

Thus, in addition to generating value, the process also generates costs. Estimates the newly created value of a product is the consumer of a productive process (Fig. 1.9).

Customer satisfaction depends on its perception of the value of the product, as well as on the understanding of the relationship between the results obtained and the expected value. The organization is interested in minimal expenses with the maximum added value that makes it possible to increase its competitiveness in the market.

In the course of production in the organization a lot of operations are carried out. They can be divided into three categories:

Fig. 1.9. Value-added process at the consumer's request

The first is operations that add value to the end consumer. These are operations of the process through which the product meets its functional purpose and acquires the corresponding appearance;

The second is operations that add value to the organization. These are operations of the process, during which from the point of view of the buyer does not add any new value. However, they are needed from the point of view of the organization. This may be the planning of production, maintenance and repair of equipment, personnel management, etc.;

The third is operations that do not add value. These are operations of the process, which do not add any value at all, neither for the consumer, nor for the organization. Typical examples are the forced production, warehousing, processing of products, etc.

The primary task of any organization is to avoid actions, operations, processes that do not add value to the end product. This will make it possible to deprive production of organizational contradictions that increase the mismatch between value and value, while it is necessary to remember the following features:

a) In the processes are used resources to create consumer values;

b) The ratio of costs to increase value to the total cost of the process is a measure of the productivity of the process;

c) The costs of transactions that do not increase the value of products, represent a significant part of the costs that do not affect the quality, especially in large organizations. They are related to organizational contradictions, in particular, with communication deficiencies and inconsistent teamwork;

d) It is possible to minimize expenses that do not increase the value of products, while the structure of the organization is optimized. This is especially true for service organizations as well as government agencies.

Condition 3. Compliance with the principle of a single standard

For nearly a century of Soviet industrial practice, the false policy of the so-called "triple standard" (Fig. 1.10) was rooted in relation to the work with the documentation describing the production activity [82].

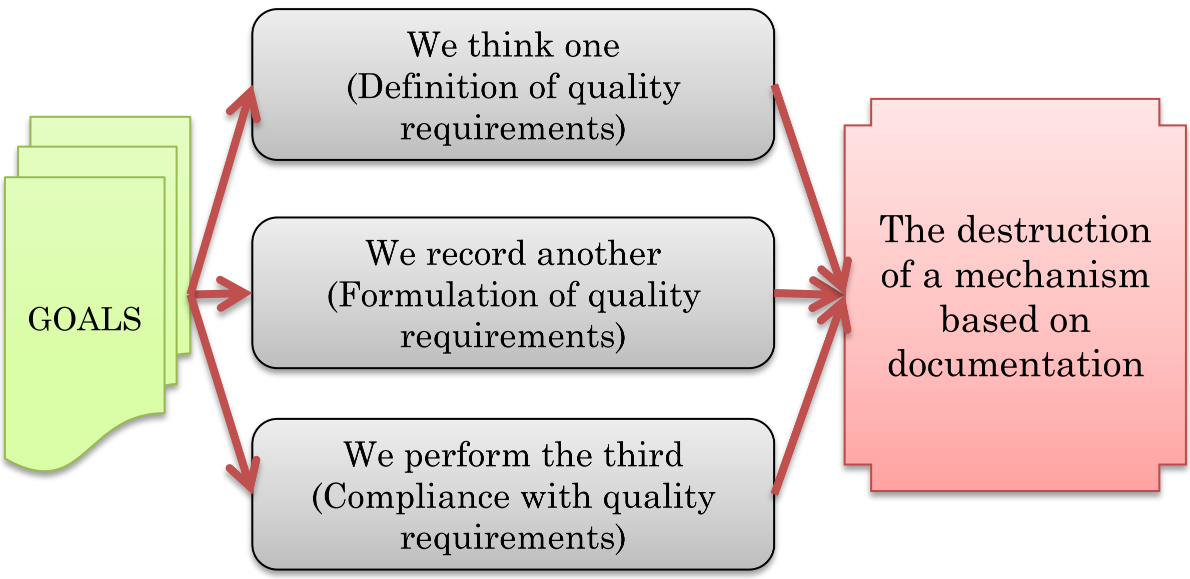


Fig. 1.10. The principle of quality management, based on the triple standard

Earlier, when only technological processes were described - with the true performance of production processes there was a significant gap between the planned actions and the specific specifics of the economy (enterprise). Accordingly, at all stages of the life cycle of the product in the process of development of products were allowed deviation, resulting in a transformation of recorded requirements in the unwritten, which eventually took technologists, manufacturers, quality controllers.

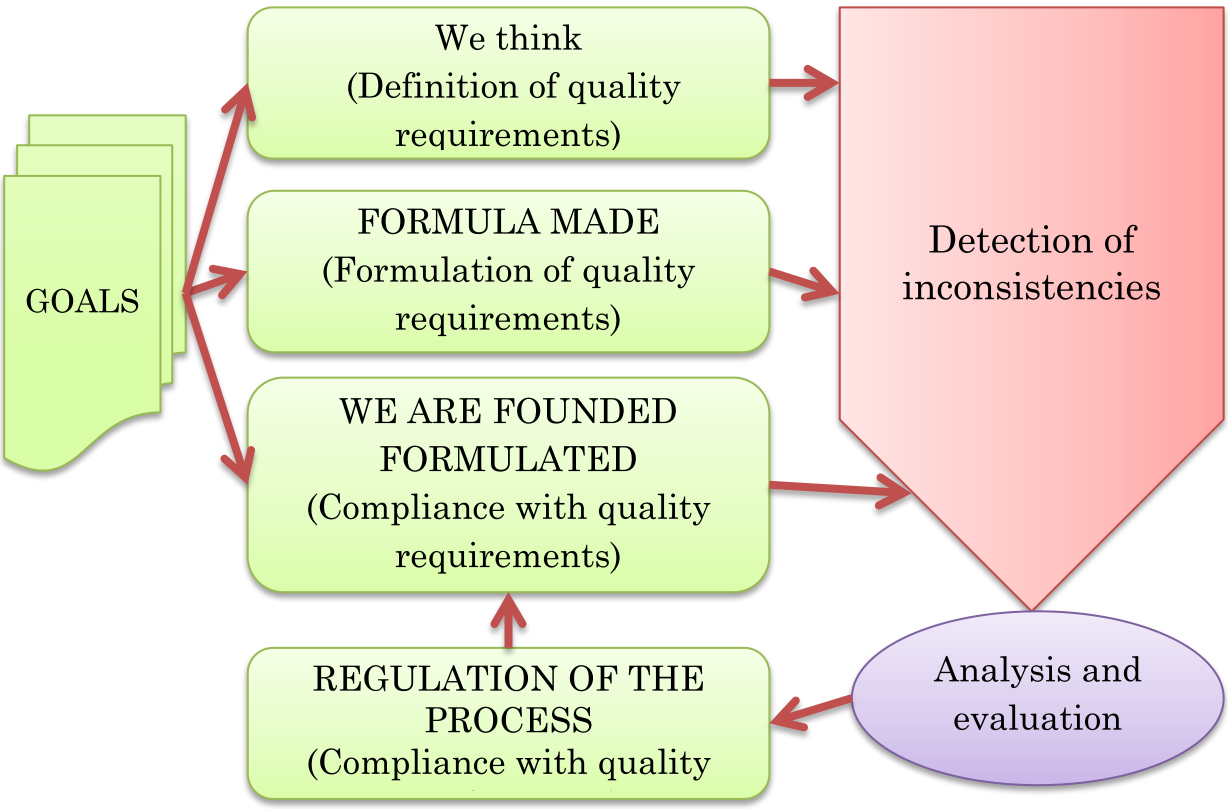


Fig. 1.11. Principle of management, based on a single standard

A significant disadvantage was the fact that other documents regulating the activities of the organization itself - the regulations and job descriptions - were formulated in such a way that it was difficult to understand what and how the employees of the organization should do it.

In the process control system, this approach is unacceptable. As already mentioned, the main condition at the production stage is the exact observance of the standards. Accordingly, the principle of document management should be uniform (see Figure 1.11).

The principle of a single standard should apply not only to technological processes, but also to all others (service processes, management, etc.).

Condition 4. Compliance with the balance of responsibility and authority

Unfortunately, in today's manufacturing practice there is an imbalance in the field of delegation of powers. More often, disturbance of the equilibrium manifests itself in cases of concentration of powers in one's hands, and responsibility - in others. This model can be represented as a right triangle (Figure 1.12) [82]. It is clear that in a sense, responsibility, authority and interaction must be equal to each other. Powers should be as much as responsibility.

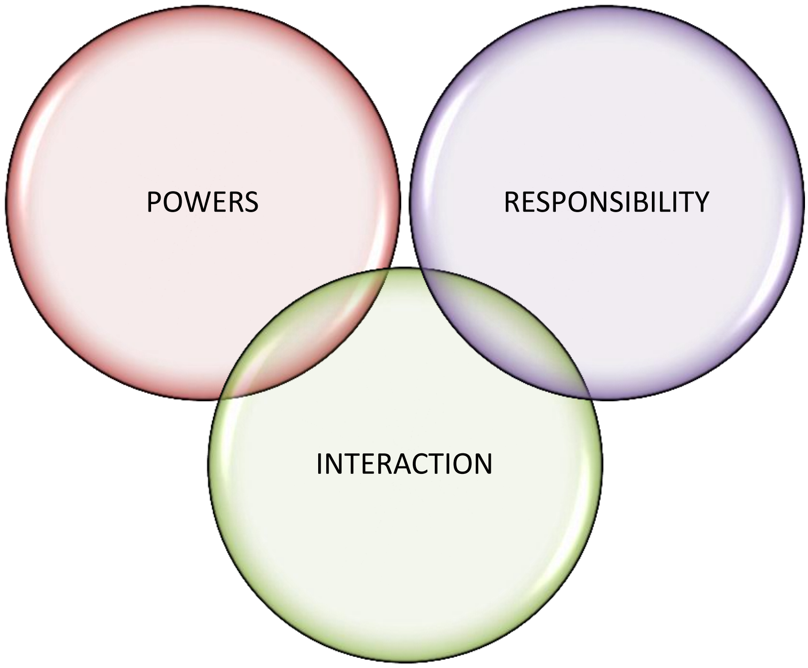


Fig. 1.12. The balance-of-responsibility and authority model, in which powers and responsibilities are separated

If the authority is less than responsibility, then the employee (or manager) falls into a situation where he is responsible for activities without authority, that is, without having the prerogative to influence the process. Managerial decisions are taken by others, and he is punished for the results of decisions that he did not take. The cases of unbalanced distribution of responsibilities and powers are typical of the managers of the middle management.

In cases where authority is more than responsibility - there is a temptation to avoid responsibility by shifting it to the shoulders of other performers. On the other hand, this "classic triangle" - the lack or lack of interactions destroys the horizontal processes of process control. Such a division of responsibility and authority is characteristic for managers of senior management units.

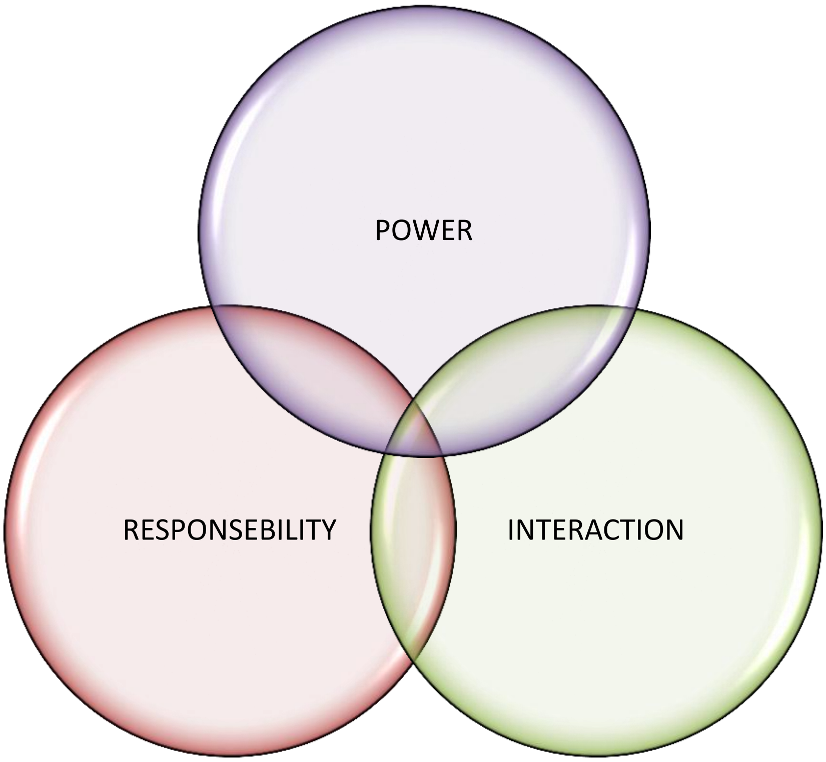


Fig. 1.13. A model of balance of responsibility and power in which powers and responsibilities are united

In a process model of an organization's approach, this approach is unacceptable. It is necessary to maintain a balance of responsibility, powers and interactions. This model can be represented on (Figure 1.13).

Condition 5. Basic requirements for the operation of the business process owner

The content of these requirements in most cases is concentrated on the requirements of managers of the highest level of management processes in the organization [135]. A summary statement can be formulated in the following theses:

Thesis 1) the intervention of senior management in the operational management of processes is strictly prohibited;

Thesis 2) the decision and / or consent of the individual to become the owner of the process must be weighed, and most importantly, it is absolutely voluntary;

Thesis 3) the owner of the process (leader) must be empowered and should be liable, as outlined within the authority given, and formal relations must be clearly defined.

Thesis 4) the owner of the process (leader) must manage resources, including financial ones, without everyday control by the management (however, for a given time period should be reported and necessarily in cases of violations of the established rules of the procedure of execution of the process or the decline of its effectiveness. he did not manage all the resources?);

Thesis 5) taking over the authority of the owner of the process assumes responsibility for the consequences and soberly aware of the risks; in the rest, nobody should interfere or take care of the process in parallel;

Thesis 6) the owner of the process (leader) has to pick up a multi-functional team, which wants to work hard with him over the achievement of common goals

Thesis 7) the owner of the process - the formal manager - should not be a narrow specialist, but should be a professional with a broad worldview and an informal leader.

Condition 6. Requirements to owners of processes of lower level of management

In order to decide on the appointment of the owner of the process, you need to get answers to the following questions - who:

a) who is defines the composition of the functions necessary for the implementation of the process?

b) who is defines the sequence of work in the process and their interconnection?

c) who is defines indicators and criteria for the effectiveness of the process?

d) who is manages resources and process information?

e) who is organizes a system for collecting information on the progress of the process?

e) who is responsible for implementing measures to improve the efficiency of the process?

Condition 7. Team for improving the process

One of the main conditions that enables the regular conduct of production processes in the organization is the participation of the process itself as well as other specialists in the planning of operations, as well as in search of possible causes and problems that hinder the progress of the planned operations. This condition greatly enhances the efficiency in the adoption of managerial and technological decisions, in order to improve the performance and effectiveness of the process.

In accordance with the above, the owner of the process must create an effective team (group of specialists) to improve the main process. The main task is to develop and justify the flow chart of the planned process, as well as - evaluate the results and analyze and develop measures to eliminate probable shortcomings [32]. In accordance with the results obtained, the search and evaluation of possible alternatives, the team proposes an improvement strategy and the main task of regulating or modifying the process, implementing measures and comparing the results with the planned ones.

That is, the team to improve the process, performs an extremely important production mission - transforms the workflow into an effective workflow. So, with the authority and responsibility of the owner of the process: firstly, it is important to pick up the initiative and active, and most importantly, the skilled personnel in the team for the improvement of the process; secondly, to set clear and understandable goals for them to further regulate and improve the process.

It is necessary to warn that there is a danger of situations in which teams for improving the process will begin to work with a high degree of decentralization, without taking into account the interests of the end-user or the common goals and objectives of the organization. In such cases, there are real risks of not achieving the main goals of improving the process. In order not to happen - in order to improve the main process, in addition to its performers, it is necessary to involve: the owner of the process; managers of each functional unit, with which this process is connected; as well as several highly qualified specialists in the field as technical experts to improve the core process. Also (in some cases, if necessary), the team for improving the core process can include consumers, suppliers and system engineers.

The scientific theory and production practice of process management in economic organizations have developed the primary principles of ensuring the effective operation of teams for the improvement of processes, namely:

principle 1) decisions in the team should be taken - collectively, on the basis of consensus, all members of the team have equal rights;

principle 2) should ensure transparency and openness of information flows and communications between members of the team of this process, as well as between the teams of other related processes of the same organization;

principle 3) to ensure fair, equal pay for work of equal value, depending on the effort expended and the level of authority and responsibility in this team;

principle 4) ensuring appropriate conditions and opportunities for individual self-expression.

The exclusive function in respect of the above conditions and principles rests with process owners. They also play a key role in all project improvement processes and are personally responsible for their results. Owners of processes have wide powers in choosing and approving changes, which include:

1) selection of participants of each team;

2) distribution of works and the procedure for the coordination of changes;

3) coordination of efforts of the team for improvement of processes;

4) choice of terms and forms of team reporting on the results of work;

5) provision of financing and interconnection between improvement projects;

6) analysis of the results of work and approval of plans for its continuation;

7) providing assistance and support to team members;

8) elimination of disputes within the team and problems between other units.

The principal obligation of the owner of the process associated with his improvement teams is to achieve optimal efficiency of the underlying processes. This includes maximizing the effectiveness of the organization by reducing the cycle time, minimizing costs, reducing the variability of output, adjusting procedures, viewing work operations and their automation. In addition, the performer is obliged to optimize the performance of his process, including compliance with the requirements of external consumers for the initial results of the main process.

Section 2.

Fundamentals of the methodology of organizational design of management structures

§2.1. Features of designing management structures

In the context of growing competition and globalization of markets, the sustainable development of the enterprise depends on its ability to transform structurally and functionally. Organizational management structures undergo radical changes related to the need for deep and timely adaptation to a rapidly developing market environment. The vector of these changes is due to the transition from a rigidly determined multilevel hierarchy, built on vertical administration, to flexible ("unfrozen") innovative models based on horizontal interconnections.

On the background of the transformation of organizational structures, the design methodology shows significant transformations that have a significant impact on the construction and functioning of modern organizations. Consider the main content aspects of the evolution of the methodology of organizational construction.

Formation of the management structure is provided in the process of organizational design - the leading method of formal organization of integral systems. Different researchers the essence of this concept is treated differently. In the traditional statement, organizational design is reduced mainly to the statics of the management process, that is to build the structure of the organization, as a rule, within the hierarchical design. For example, Maksimtsov and Komarov indicate that: "... organizational design is a modeling of an enterprise management system that is carried out before its construction or on the eve of significant transformations ...". Such an approach appears to be limited-conservative, since it takes into account only the local (unidirectional) aspect, ignoring the dynamics of the internal and external environment, which does not correspond to the rapid changes and requirements of the business environment, which significantly complicates the task of management.

A number of modern researchers determine the essence of organizational design quite widely. Thus, Parachin, Fedorenko noted that the products of organizational design are any organizational innovation structural and process nature.

Dr. Khokhlova [129], the capacity and depth of this concept are revealed etymologically in the origins of the term: "design" from the Latin. projectus - thrown forward. Thus, at first this concept has a deep dynamic content, with a sufficient degree of detail, the essence of the design process organization is disclosed in the following provisions:

- Raduga said, that organizational designing is the process of finding the right balance between the key elements of the organization (structure, people, tasks, decision-making and incentive systems, informal organization and culture) and its strategy for success;

- Vikhansky, Naumov points out that organizational design should take into account not only the change of internal factors, but also the state and development of the external environment of the organization. The structure of the organization is situational and is modified when the situation changes.

- J. Galbraith defines the design of the organization as a constant search for the most effective variables. Factors influencing this process, according to numerous studies, are manifested situational.

The dynamics of organizational modeling emphasizes V.L. Doblaev: "... in the framework of organizational design, the real and potential functions of the organization are investigated, the goals are determined, the structure is projected ...".

According to B. Miller, organizational design as a function of the organization is to develop such organizational elements and relationships in a simulated system, the implementation of which the emerging organizational entity has gained high reliability, sustainability and efficiency. Designing an organization is necessary in order to create an effective management mechanism. It is emphasized that at the same time it is necessary to take into account the influence of all external and internal conditions of the organization's functioning in their development and changes. These conditions are interrelated situation situations (environment, technology work in the organization, strategic choice, behavior of employees).

Consequently, organizational design is a management tool that achieves a balanced structural and process unity of the enterprise. Basic organizational innovations are primarily organizational design products.

It is important to emphasize that the methodological design of an organization should be considered in two aspects:

- static - as a creation of a management structure;

- dynamic - as an accompaniment of processes occurring in the organization.

It follows from the conclusion that it is necessary to adhere to the principles of flexibility and adaptability of the design process of a production organization, taking into account both internal changes and external influences. In addition, many formal factors should also be taken into account in the informal aspects of organizational interaction (sociocultural, moral, socio-psychological, cross-cultural, behavioral, competitive, innovative, risk, etc.).

Thus, the content of the design of the organization should be system analysis, process and situational approaches, which are guided by the comprehensive and profound account of internal and external variables of the market space. All these conditions, organically integrating in the control system, determine the multidimensional dynamic nature of the methodology of organizational design.

The analysis and modification of the organizational structure of the production organization at all its levels is a continuous process that requires the manager of the continuous research work with the appropriate powers, monitoring of the current activity with the purpose of creative search of the optimal organizational form. However, as practice shows, the leadership of many enterprises does not pay due attention to the assessment and redesign of the organizational structure of the organization, with often there are attempts to combine progressive changes with an outdated structure. Due to this organizational development program does not lead to planned organizational effectiveness, and unsuccessful attempts to use them reduce the competitiveness of the firm, reduce the loyalty of employees, lead to loss of financial, material and other resources.

Foreign experience shows that in successful companies minor adjustments to the structure are carried out annually, and fundamental changes in the organization are carried out at intervals of 1 time every 4-5 years. Redesign provides openness to advanced technologies and achievements, increases flexibility, adaptability, readiness for innovations, market stability, which in general determines the progressive dynamics of organizational development.

§2.2. The Development of approaches to the design of production organizations

The transformation of the methodology of organizational design, in its essence, reflects the evolution of management concepts, which would mean the abandonment of technocratic rationalism in favor of the modern innovation management paradigm.

In the scientific papers of most modern researchers, two approaches to the organization of the organization are indicated:

a) mechanistic;

b) organic.

Frederick Taylor

(1856-1915)

According to Khokhlova, the process of forming the methodology of organizational design should be structured more deeply with the allocation of the following stages [129].

1. **The mechanistic approach** (often used term - technocratic, instrumental) - is based on the concept of scientific management (F. Taylor, G. Gant, and Gilbert couple), characteristic of the industrial era of the beginning of the twentieth century. It is characterized by a rigid determination of the organizational structure, a clearly defined conservative system of

hierarchy, resistance to change, an authoritative and authoritarian type of leadership, unidirectional (downward) character of communications.

Scientific Approach to Management (Scientific Management), developed by Frederic Taylor. is the best expression of these ideas. He argued that work can be performed most productively, if you break it into simple elements while people, especially workers, are distributed by managers and specialize in a particular piece of work. He also believed in the important role of governance. "... Only by means of full standardization of methods, accelerated implementation of the best achievements and working conditions, as well as the strengthening of cooperation can provide faster execution of work. And the duty to adhere to standards and to increase cooperation lies only with heads ... ". The natural consequence of these views was the proliferation of functional organizational structures. The mechanistic approach was intended to provide the creation of a model of such an enterprise, which is capable of a clear and uninterrupted activity like a well-established mechanism intended for productive operations. The management system was guided by the establishment and analysis of technical and economic relations and dependencies of various factors of production in order to increase the efficiency of work due to material and material components.

This approach contributed to the formation of the first functional (the first functional organizational structure was created in 1902 in the company "Du Pont"), and then linear control structures that can be effective in using routine technology in a simple and non-dynamic external environment.

The positions of the mechanistic approach are critically appraised by modern science and practice due to their incompatibility with the market requirements of organizational design. This leads to known limitations in the use of the mechanistic model of the organization with its narrow view of management and efficiency, assessed only by technical and economic parameters.

2. **Rationalist approach** (bureaucratic) - based on the concept of rational bureaucracy (M. Weber, A. Faiol, L. Urvick) in the first quarter of the twentieth century. It is characterized by the formalization of rules and procedures, the centralization of decision-making, the narrow specialization and regulation of the activities of each performer, a clearly defined responsibility and a strictly fixed management hierarchy.

Max Weber

(1864-1920)

Functional specialization was also the central theme of Max Weber (Mach Weber), the author of the verbal expression and the theory of bureaucracy. He believed that bureaucracy is the most effective way of managing complex organizations and argued that bureaucracy surpasses any other means in terms of accuracy, stability, discipline and reliability. Weber believed that there are six components of the bureaucracy, the first of which is the functional specialization. Bureaucratic principles of organizational design allow to streamline the management process, ensure order, adhere to the necessary discipline, maintain the necessary level of control and responsibility, which in general determines the positive component of this approach. However, one should distinguish between the theoretical concept of rational bureaucracy and the negative consequences in the management system, which are due to errors in the process of its implementation (procrastination, conservatism, incompetence, absurdity of rules, formalization, etc.).

Henry Faiol first declined to view governance as the "exclusive privilege" of top management. He argued that administrative functions exist at any level of the organization and they are performed to some extent by the workers. Therefore, higher the level of the organizational hierarchy, the higher the administrative responsibility, and vice versa. Functions are mandatory elements of the management process. The loss of one of these elements leads to a violation of the entire management technology. While the principles embody the subjective experience of the manager, they can be replaced and supplemented.

In his general book "General Industrial Administration" (Fayol H., "General and Administrative Management", Putman, London, 1916), A. Faiol summed up management experience and systematically created a systematic management theory. "... The leader is able to develop the initiative of the subordinates, giving them the opportunity to fully realize their position and ability, at the cost of individual errors, the severity of which can be significantly reduced with proper control. He can quickly transform a person with implicit abilities into a top-notch specialist, without performing all his work for him, and acting through a tooltip. True, for this the head will sometimes have to quell their pride ... ".

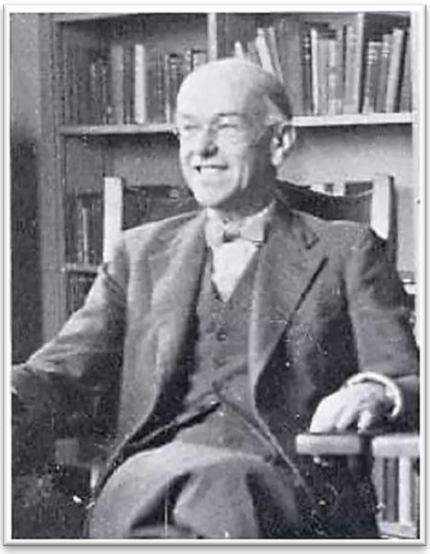
Rationalistic approach contributed to the practice in the organizational design of linear-functional, linear-staff, divisional and other types of structures hierarchical type. They provide organizational effectiveness in a stable organizational environment that does not have high dynamism and complicated structure, predictability of external and internal changes, the acceptability of clear management algorithms.

However, in the context of turbulent changes in market situations, growing competition, the variety and complexity of factors characteristic of modern global markets, the model of a bureaucratic organization is unable to respond adequately to the aggressive challenges of the environment. In addition, it does not take into account the role and significance of the human factor in achieving the effectiveness of the organization, which collectively determines the limitations in the widespread use of this approach.

3. ***Humanistic approach*** (focused on human relations) - based on the achievements of the theory of human relations and behavioral sciences.

A certain breakthrough in the field of management was made at the turn of the 30s of the XX century, which was marked by the emergence of a school of human relations and behavioral sciences, which underpin the achievements of psychology and sociology (human behavioral sciences). (E. Mayo, F. Rotisserberger, C. Barnard, F. Selznik, D. McGregor, C. Adzhiris, etc.), which was formed in the 1930s, as well as developed in the humanistic management concept (S. Bir, P. Wyll, P.E. Land, et al.) In the middle of the twentieth century, the center of attention of the researchers of the school of "human relations" is transferred to the system of relationships, to a person who is already considered as a social being. The theory of human relations enjoyed enormous popularity in the West, but could not answer all the questions that faced the organization. So soon it was supplemented with new insights and approaches to behavioral concepts. Among other scholars in this area, you can identify Mary Parker Follett, who analyzed the leadership styles and developed the theory of leadership and conflict in the organization.

This approach is considered by a production organization, which is constructed primarily as a team of people engaged in joint activities on the basis of division of labor. At the same time, the most important factor of productivity at the enterprise is a person as a social activist. These provisions have become significant in the writings: O.O. Bogdanova, AK Gasteva, O.A. Ermansky, N.A. Vetka and others.



Elton Mayo

(1880-1949)

The humanistic approach to organizational design is based on modeling a system for maintaining human relationships within the organization, based on such important elements as the attention of managers to staff, real and effective motivation of performers, extensive communication, loyalty, participation in decision making. At the same time, in the process of achieving the objectives of the production organization, special attention is paid to the style of management and its impact on performance indicators and employee satisfaction with their work.

The criterion for evaluating the humanistic model of an organization is taken to increase the efficiency of its functioning through the improvement of human resources. Thus, this approach has limitations related to focusing only on one internal component - the personnel - and subordinating to it all other factors of production. In addition, the influence on the effectiveness of the organization of external influences is ignored, which is unacceptable in the conditions of openness of modern control systems. The uniqueness of this approach is due to its limited use in the practice of modern organizational design.

The organic approach (flexible, adaptive) is based on carrying out an analogy of an organizational model with a living organism that has the ability to relatively easily modify, adapting to new conditions and fitting itself organically into a new, complicated habitat.

For the first time the concept of "organic approach" was introduced by T. Burns and D. Stalker in the 60 years of the twentieth century.

According to their definition, organic is a structure that is more based on brigade work, is flexible and less related to the rules typical of the traditional hierarchical construction of governance.

An organic approach represents an organization in the unity of its constituent parts, which are inextricably linked with the outside world (Table 2.1.).

This corresponds to the theory of systems (L. von Bertalanffy, A. Chandler, P. Lawrence, J. Lorsch, Ye.G. Yudin, V.V. Druzhinin, VN Sadovsky, etc.), the main idea of which is recognition of interconnections and interdependencies of elements, subsystems and systems in general with the external environment.

The organic approach is characterized by moderate or unobtrusive use of formal rules and procedures, balanced decentralization of the management process, direct involvement of personnel in the development and decision-making, broad responsibility and autonomy, flexibility of the structure of power, reduction of the number of levels of management hierarchy, branching of communication.

This approach rejects the need for a detailed division of labor by type of work and guides the management system to the relations between the participants in the management process, dictated not by the structure, but by the nature of the problem being solved. The organic model of an organization is characterized by a high level of horizontal integration among workers, the orientation of the culture of relations on co-operation, openness, mutual awareness and self-discipline.

The above-mentioned approach determined the transition from a rationally designed structure to flexible "defrosted" forms of an organic (adaptive) type. The main ones include: design, matrix, program-target, etc.

The organic approach ensures productive design of organizational structures of enterprises with intensive innovative processes that are oriented towards solving strategic problems and are capable of functioning effectively under the conditions of rapidly developing markets. The driving factor of the work of the personnel is not a formal control system, but self-motivation, internal reward and a desire for self-realization. In aggregate, these factors contribute to the accelerated implementation of complex programs and projects within the framework of large companies, industries and regions. Typically, these structures are formed on a temporary basis, that is, for the period of solving the problem, achieving the goals set or the implementation of the chosen strategy.

This approach demonstrates its effectiveness in conditions where non-standard technology is used; there is a complex and dynamic external environment. The main achievement of this approach should be the confirmation that the internal dynamics of the organization is formed under the influence of external events. At the same time, the effectiveness of the organization is assessed as systemic expediency, taking into account its ability to self-regulation and self-organization, as well as to achieving goals when changing external conditions and circumstances.

According to an organic approach, the key success factors of the organization are in two interrelated areas:

a) internal - resources of the organization, which create its strengths and weaknesses;

b) external - opportunities and threats to the environment, which determine the conditions for obtaining and transforming resources into products or services.

Modern studies confirm that an organic approach should be considered as a model that positively influences the development of the economy in a turbulent environment.

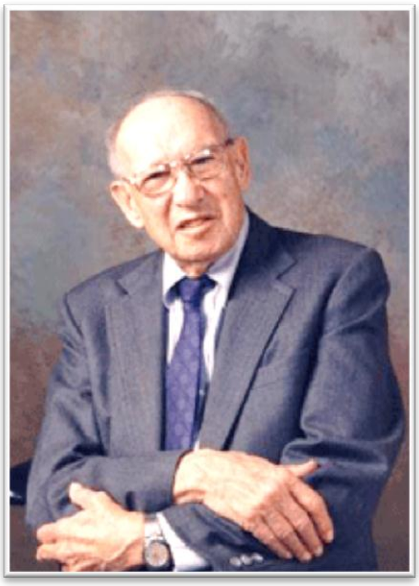
Table 2.1.

Comparative characteristic of mechanistic and organic structures of T. Burns and J. Stalker

Parameters	**Characteristics of organizational systems**	
	Mechanistic (closed, stable)	**Organic (open, adaptive)**
The general environment	calm	turbulent
The prediction of environmental changes	good	not enough
The technology is and	stable	dynamic
The impact of the environment on the organization	weak	strong
The emphasis in the organization's work	on doing work	on solving problems
The process of	the program-bath	isn`t subject to

decision-making		programming
The general organizational values	efficiency, predictability, safety, risk prevention	performance, adaptability, risk perception
The procedures and rules	numbers, often formalized, written	few, often informal
The number of hierarchical levels	many	small
The source of power	the position in the organizational hierarchy	the level of knowledge of the individual
The responsibility	determined by post	taken by the individual
Interpersonal relationships	formal	informal
The motivational factors	lower levels of consumers	higher levels of consumers
The style of leadership	autocratic	democratic
The content of communication processes	impersonal transmission of decisions and	advices and informal communication

	instructions	
The control processes	the use of rules and regulators	interpersonal contacts, beliefs and support



Peter Drucker

(1909-2005)

5. **Innovative approach** (progressive) - connected with advanced scientific and practical developments in the field of management and management technologies of the end of the XX - beginning of the XXI century (P. Drucker, T. Peters, R. Waterman, I. Ansoff, V. Deming and etc.). Companies had to admit that they spend huge amounts of money and time managing their functional hierarchy. For most managers, this is the sole purpose of their working life. But work does not move up and down the functional hierarchy, it "flows" through the organization in the form of a set of business processes, which in most organizations are unmanaged, no one answers for them. The business process is seen as a flow of work that goes from one person to another, and for large processes, obviously, from one department to another. Processes can be described at different levels, but they always have a beginning, a certain number of steps,

and a clearly defined end. There is no standard list of processes, and organizations must develop their own. The links and relationships that were ignored or not understood suddenly turn out to be key to the effective functioning of the entire organization, not to mention the processes they are dealing with. This approach asserts that the organization's construction and functioning in the post-industrial era are mostly influenced by intangible assets that determine innovation readiness, openness to advanced technologies and achievements focus on reengineering business processes and implementing business strategies. Business process reengineering comes from two articles written in 1990 by Hammer (Davenport and Short). Although the very term "reengineering business processes" for quite a few years, most of the theories on which it is based, are much older.

In the 1980s, in many organizations, a “Total Quality” system was introduced. It was this system that was the founder of the idea of managing processes. Many methods of the Total Quality system make a new look at work and its purpose, and these methods provide valuable information for managing business processes (Business Process Management, BPM). These are:

- Process analysis (Method for Analyzing Processes, MAP);
- In-Department Evaluation of Activity (IDEA);
- Perception Process (Process Perception Analysis, PPA);
- Process Quality Management (PQM).

All of them play an important role in any large-scale business reengineering project.

This approach is a modeled object as a public organization whose activities are aimed at wider groups of individuals both inside and outside of the country (staff, consumers, suppliers, competitors, investors, society as a whole). It focuses on the mobilization of all organizational resources to achieve the structural and functional evolution of the organization.

The decision of the tasks of organizational design is achieved on the basis of ensuring the effective interaction of the organization with a dynamically changing environment. The management system is guided by the informal components of the organizational process:

a) behavioral;

b) social;

c) intellectual;

d) creative;

e) cultural;

e) moral and others.

The basis of constructing innovative model organizations is the following factors:

a) decentralization of management;

b) de-bureaucratization of the organizational structure;

c) the democratization of relations and the effectiveness of horizontal links between structural units. This caused a final rejection of rigidly determined ("frozen") structures in favor of soft control models, the dominant feature of which is the parity of staff interaction based on the allocation of autonomous working groups - teams.

Innovative approach has led to the emergence of structures of a fundamentally new type:

- networking;
- virtual;
- multidimensional;
- participatory;
- circular;
- business
- corporate
- individualistic;
- edchocratic;
- intellectual;
- modular;
- integrated;
- conglomerate;
- self-adjusting;
- self-study;
- global;
- customer oriented and others.

The basis of their design is the dynamic horizontal structure, which allows you to turn a fixed management pyramid into a flat, mobile design.

Achievement of organizational efficiency in the indicated structures is ensured in the presence of such factors as:

- Innovation;
- intelligence;
- values;
- culture;
- knowledge;
- ability to learn;
- creativity;
- teamwork, etc.

The success of the organization is formed at the level of measurements of the new generation:

- conducting fundamental researches;
- diversification of operations;
- expansion of innovations;
- effective integration processes;
- global information systems;
- modern computer technologies and telecommunication facilities;
- thinking of network and global scale.

Along with using the criteria of socio-economic efficiency, the organization's work is evaluated in such areas as the policy of consensus of personal interests with the interests of business partners, the compliance of socio-cultural policy with the norms and values of staff, contact audiences and society as a whole.

Thus, in the dynamics of approaches to organizational design, we can trace the evolutionary process of deepening the content of methods, techniques and models of organizational construction, the essence of which reflects the following transformations:

- the transition from closed models of construction of organizations, where the focus is on the construction of internal variables subsystems, to open models, the performance of which depends primarily on interaction with the outside world;
- rejection of the monocentric approach in determining the organizational effectiveness (technocratic or humanistic elements) in favor of a large-scale polycentric vision of the factors of the success of the organization in a diverse market space;
- replacement of bonds and bureaucratic type with flexible team forms of organization of work;
- the transition from the recognition of the priority of material and material components of production to the intangible values of the organization (intellectual, informational, socio-psychological, cultural, behavioral factors, etc.);
- the transition from authoritarian, formalized approaches, built on a strict hierarchy and centralization of power, to democratic, participatory organizational models that develop self-organization, initiative, creativity, and self-control;

- the transition from accentuated attention to the problems of the operational (current) nature to the development of methods of long-term strategic management;

- reorientation from standard design methods, acceptable to most organizational entities, to alternative methods of organizational building, including non-traditional creative techniques ("settings for the situation", organizational design), allowing to take into account the uniqueness and unique peculiarity of the organization;

- rejection of one-dimensional assessment of the organization's performance as a comparison of the number of products released with expended resources (results to costs) and the transition to multidimensional - socio-economic, socio-cultural, political evaluation criteria, which allows to assess the compliance of the organization's performance with the norms and values of clients, partners and society. in general.

Thus, in the conditions of modern, global transformational processes of the world economy, the evolution of approaches and methodologies is being developed to design organizations and organizational structures, which in essence is a reflection of the dynamics of market transformations. However, real experience shows that in modern manufacturing practice, there are no organizations that would build their activities in full compliance with any one model. Of course, the choice of a rational approach to organizational design depends on many situational factors that take into account the entire set of temporary, directionally directed effects of external and internal conditions (norm-forming factors), within which a specific production organization operates.

§2.3. Development of content components organizational structures

The main product of organizational design - *the organizational structure* - should be considered as one of the forming elements of the management system of production processes in the organization that is in development and needs constant quality improvement equivalent to the unstable socio-economic conditions, rapidly changing business situations, updated business strategies and prospects. market transformations.

The management structure is an organizational form based on the division and cooperation of management activities, in which the management process is carried out to achieve the goals set. Relationship structure with the key categories of management (goals, functions, process, staff, etc.) indicates its enormous impact on all aspects of the organization.

In the classical concept of management, the approach to the analysis and evaluation of organizational structures was clearly deterministic, and the structures themselves were treated as a set of levels and management units that ensure the achievement of the goals. Thus, as the main components of the traditional organizational structure, the linear and functional units are traditionally allocated, which now causes a number of criticisms due to the limitations of the above approaches to organizational design.

The modern paradigm of management, which caused the transition to innovative models of organizational structure, led to a revision of traditional views on the essence of organizational structures. Most scholars under the organizational structure understand the orderly set of interrelated elements that are in a rationally stable relationship and provide the necessary level of organizational effectiveness on the basis of productive internal and external integration. Consequently, the key components of modern management structures should be considered not structural units, but the relationship and relationship elements that provide a stable in time functioning and development of the organization as a whole, based on the general objectives and objectives.

To design a very effective rational management structure - means to determine the ratio of its organizational elements, in which the most mobile and timely meet the requirements of the object of management, and also provides fruitful interaction with the environment. In the process of building an effective organization it is necessary to proceed from the position that the organizational structure is a behavioral system in which people and their groups formed constantly enter into different relationships for solving common problems. Among the many internal and external conditions that directly affect the development of effective organizational structures, in addition to the technology of work processes, external conditions, market dynamics and other influential factors, it is imperative to take into account organizational activities - the behavior of the workers of the model being modeled.

For the modern conception of organizational building characteristic is the refusal of attempts mono centric approach to the typology of management structures that determines their development in an innovative direction (for example, intellectual, individualistic, entrepreneurial, self-studying, etc.). The innovation of the conceptual apparatus (organizational drawing, fabric, design, architecture, configuration) attracts attention, which also reflects the transformation of the meaningful foundations of organizational design.

An important essential feature of transformation processes is the modification of the scheme of an organizational structure: the usual pyramidal contours are reconfigured and replaced by fundamentally new structural structures such as, for example, multidimensional, circular, "inverted" structures, or they may not have a formal structural definition as virtual organizations at all.

In particular, in multidimensional organizations autonomous units independently and simultaneously carry out specialized functions in several interrelated directions:

- providing production activities with the necessary resources;

- production of a product (service) for a particular consumer segment or regional market;

- distribution (distribution) of manufactured products.

The interaction of these functional areas defines a three-dimensional dimension of the organizational structure (Figure 2.1).

The main indicator of the efficiency of the specialized divisions is the profit generated, which allows you to program and algorithmize the analysis and control of their activities and contribute to optimizing the management process.

One of the contemporary developments that develop the idea of an innovative approach to organizational design is the construction of an organization in the form of an inverted pyramid, the top of which brought out highly skilled professionals, while the leadership of the organization is on the lower level of the hierarchy. Such structures allow to fully realizing the key competencies, high professionalism, experience and knowledge of specialists in the process of independent and operational solution of the tasks of the enterprise.

Varieties of such structures are entrepreneurial organizations, whose activities are based on the ideology of marketing management. The main priorities of their activities are market orientation and customer satisfaction. It is these factors that determine their structural construction, as well as the system of incentives, compensations; criteria for assessing the effectiveness of work in general (Fig. 2.2.).

For modern large diversified companies, a plurality of structures is characteristic in which the activities of individual divisions of firms (branches, branches) are built on different organizational principles. For example, in holding companies and conglomerates, the management of a parent company exercises financial control over affiliated companies and provides the necessary assistance, but does not affect their strategy and organizational structure.

In the process of structural transformation fundamental changes undergo internal organizational communications and relations. In particular, the establishment of equilibrium communications of entrepreneurial type, based on the principles of market relations within enterprises, is characteristic, which leads to the emergence of organizations with "domestic markets".

This approach applies to all linear, functional, marketing structures and senior links of the management apparatus. They participate in intercompany and inter-firm relationships, united through a single information network, financial systems and entrepreneurial culture. The system of business relations, formed as a result of the interaction of all functional and regional divisions, forms the "internal market economy".

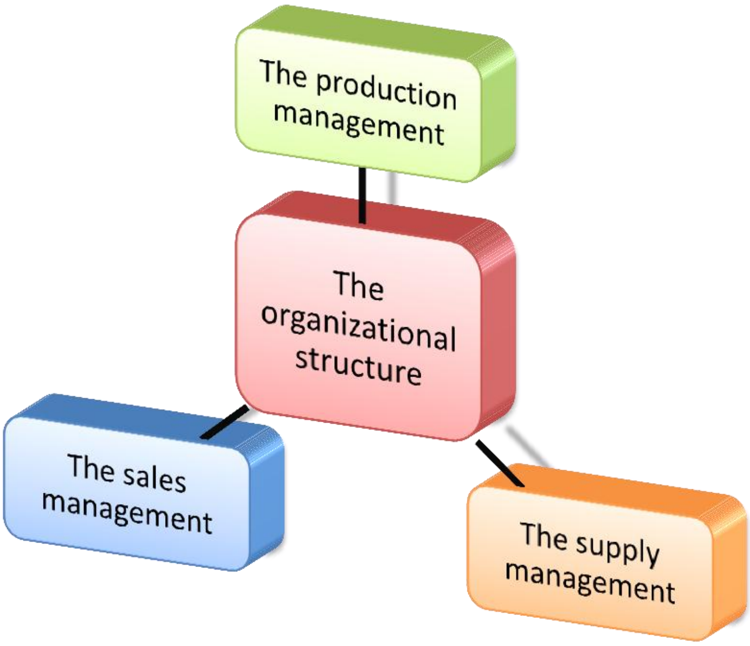
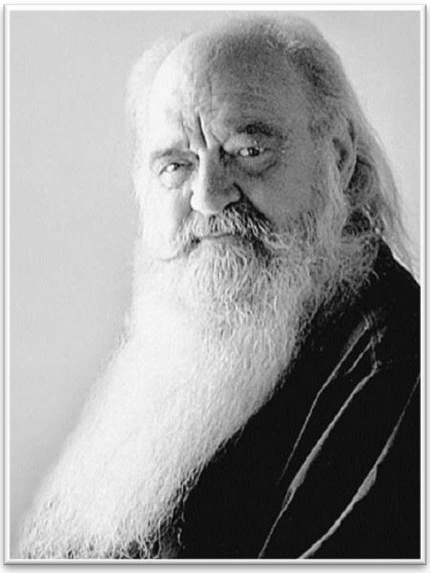


Fig. 2.1. Multidimensional type of organization

Global changes undergo the essential parameters of structures in the conditions of virtual corporations, based on the maximum use of modern information technology and telecommunication processes. The virtual corporation is a strategic alliance of partner organizations with widely distributed autonomous links operating on a system of contracts based on integrated and local computer networks.



Stafford Beer

(1926-2002)

In the latest organizational structures of a virtual nature, the formal limits of a production organization are mostly situational ("blurred"), which often acquire characteristic features of higher-level systems. In order to take advantage of small organizational forms, increase flexibility and adaptability, virtual organizations conclude subcontracts with external structures. Taken together, these relationships form an organizational structure with a wide spatial branching and duration in time.

The embodiment of the information-oriented approach to the definition of organizational structure is the model of a viable system developed by the British cybernetics Anthony Stafford Beer (Viable Model System - VSM). The structure is a model of control system for an autonomous organization. Its main purpose is to ensure the viability of the organization, that is, the behavior in which it retains its identity by reacting to changes in the construction of the external environment.

The theorist and practice in the field of operations research, notes that the structure of the human nervous system is a suitable model for reflecting the organizational structure, which should remain viable for a long time. The scientist substantiates this by the fact that the human nervous system has evolved over hundreds of millions of years and is the best known information and analytical tools. In a viable system model, there are five structures or functions that provide its work at all levels of the organization. The organizational structure of this model is repeated at each level, which determines a unified approach to the functioning of all units and provides conditions for the successful and sustainable development of a viable system, and hence the effective organization of the organization for any changes in the external environment.

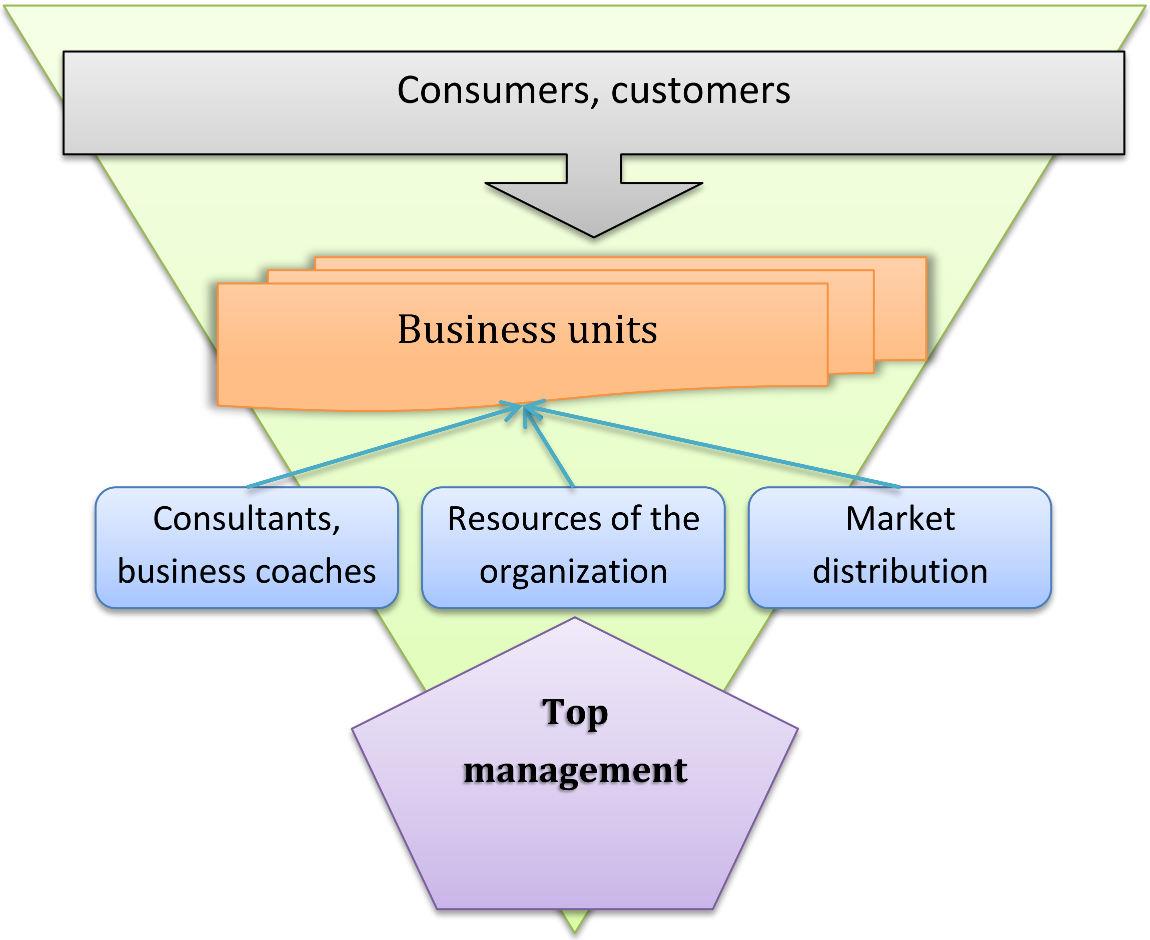


Fig. 2.2. The entrepreneurial type of organization.

The structure of VSM is shown in Fig. 2.3, in the form in which it was presented by the author, with some unprincipled simplifications. It is represented by five interacting subsystems, which Beer did not give any names, only by designating them with numbers from 1 to 5. The functions of these internal systems were distributed as follows:

System 1, located at the lower level of management, is responsible for the main functions of the organization, for the sake of which the latter is the last. In general, an organization may have an arbitrary number of systems 1. In this case, the internal structure of system 1 itself is constructed on the basis of the VSM model: the specified recursive embedding, Stafford Beer gave the name - cybernetic isomorphism;

System 2, intended to support channels of communication between Systems 1, short-term (tactical) regulation, dynamic balancing of resources and the solution of other urgent tasks.

System 3 is a tool for planning operations, as well as establishing rules of interaction, rights and responsibilities of lower subsystems.

System 4 serves as surveillance and long-term (strategic) planning, which includes both possible structural adjustments to maintain the viability of the organization.

System 5 provides self-identification, balancing between tactical and strategic planning and communication with the super system.

The model is successfully used by General Motors, which enables it to effectively integrate a number of production lines (Chevrolet, Pontiac, Buick, Cadillac, Oldsmobile, etc.).

Thus, a viable system model contributes to the achievement of organizational efficiency by improving the system of relationships and relationships within the organization.

In modern scientific research, trends are developed, based on conducting analogies between processes occurring in live and interactive computer systems (for example, Groupware). They relate to electronic information systems, local dialog networks and their support tools, which provide distributed work of large groups of people in direct access mode.

Similarly, in living organisms, the nervous system operates on the type of complex interconnected structures and neural networks between sensory and motor elements (cells), many types of functions of which are determined by the level of complexity of the organism, its ability to learn, memorize, expedient behavior.

The nervous system helps to increase the level of coordination of subsystems and components of living organisms, extending the range and types of its interaction with the external environment in providing a rapid and directed transmission of perturbations in the body. Like the human nervous system, it can be argued that the quality of coordination of activities and relationships between individuals in an organization is determined by the possibilities of its organizational infrastructure.

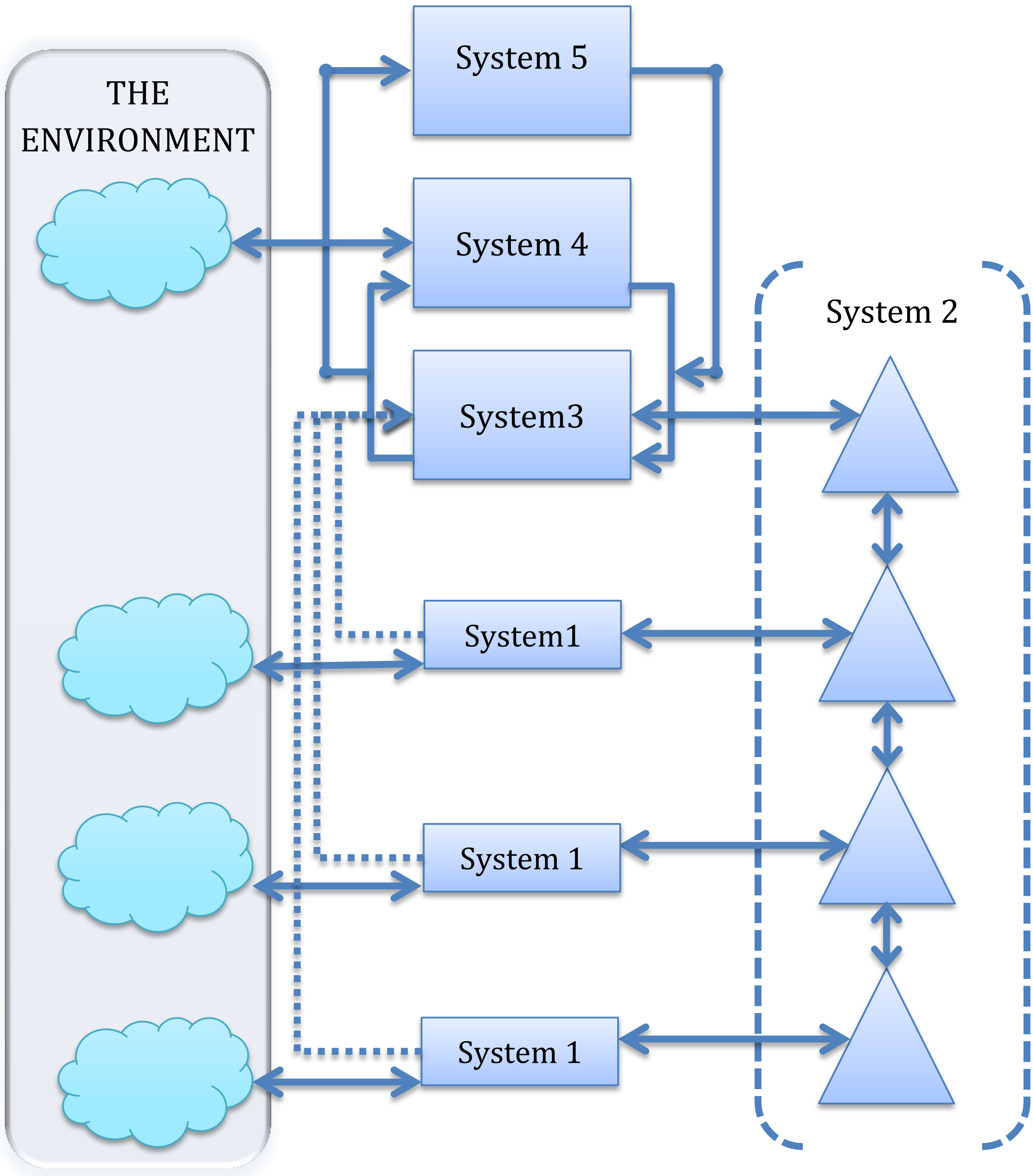


Fig. 2.3. Stafford Beer's Viable System Model (VSM)

The result of such a scheme is similar to how a person accidentally touched a hot object and shrinks his arm to prevent further damage to the tissues of the hand.

The structure, the identical nervous system, can be considered a network of computer interactive systems (ICDs), which allows groups of people to coordinate their actions both with each other, and with the environment.

The speed, breadth of the range and a variety of functions, interactions and actions in the computer network cause them to analogy with the functioning of the nervous system, and the whole organization - with the behavior of a living organism.

Thus, modern developments fundamentally re-represent the essential components of the organizational structures of the new companies. Organizational infrastructure of a complex organization can be a prototype of the nervous system of living organisms, if it is properly designed and maintained by electronic dialogue management tools.

In general, the transformation of the substantive foundations of modern organizational structures reflects innovative changes in the development of organizational management. The unconditional imperatives of the transformation process are: organizational humanism, team approach, "situational adjustment", knowledge management, client-centered approach, organizational culture, innovation in managerial technologies, informatization and management intellectualization, internationalization and globalization of management.

These evolutionary changes are transformative in nature, and this gives grounds to argue that organizational design is now shifting to a new quality - horizontal structuring.

§2.4. Horizontal structuring in process management

In modern conditions, the defining characteristic of organizational design is a horizontal model as the basis for structuring the organization. It is known that organizations based on vertical administration today cannot adapt to rapid changes and simply break up or modify in order to adequately configure for effective interaction with the external business environment.

Horizontal organization is characterized by reduction of levels in the management hierarchy, expansion of the control range, delegation of organizational powers and coordination of horizontal activities. These factors contribute to the structural decentralization and flattening of the organizational structure, opening opportunities for individual initiative and self-control, the establishment of equilibrium communications, independent decision-making, reducing the likelihood of distortion and the transfer of inaccurate, inaccurate information. Flat horizontal structures allow realizing the advantages of de-bureaucratization, increasing the degree of satisfaction with the work of staff, and providing personal growth and experience in decision-making, involvement in the management process. Ultimately, they form a new type of corporate thinking based on the philosophy, strategy and policy of organizational leadership.

A distinctive feature of the horizontal model is the involvement in the development and solution of the tasks of employees from different structural units. It destroys the traditional division of the organization into isolated subsystems with its target objects and interests. The basis of the functioning of horizontal structures is the effective team interaction of the personnel, which allows the fullest possible use of all resources of the organization and external opportunities for achievement of strategic goals and successful implementation of innovative projects.

In new models, new dimensions of the organizational environment are brought to the fore: free search, creativity, innovation, risk, agility, initiative, flexibility and situational. A similar nature of labor does not accept rigid regulations and administrative-bureaucratic orders. Together, these factors form the basis for the formation of competitive advantages and determine the structural component of the competitiveness of the organization.

All modern organizations, ranging from matrix to network and virtual, emphasize the advantages of horizontal structuring compared to the traditional vertical.

The guiding principles of a horizontal approach to designing a production organization can be summarized as follows:

1) building the organization around the process, and not around the task, when - instead of creating structures based on a set of relevant functions and departments - the company is structured around 3-5 core processes with specific goals based on a combination of fragmentary tasks;

2) the formation of the heterarkous structures - by reducing the vertical administration provides the prevalence of horizontal links, decentralization and minimization of levels of management, which leads to the emergence of flattened management models;

3) de-bureaucratization of the management process - the abandonment of routine technologies, formalized procedures and regulations, which ensures the replacement of tight bureaucratic bonds with flexible ties and relationships and achieves productive interaction between management and staff;

4) the development of echocratic relations (the term "edhokratiya" literally means the power of knowledge, competence), where, through the development of initiative, activity, autonomy and responsibility, maximum use is made of the creative potential and competence of the staff, its involvement in the management process;

5) organization of teams - the allocation of autonomous highly professional teams (brigades) that combine a few groups of equal specialists who have complementary (complementary) skills

to achieve goals based on partnership, high cohesion, group self-organization and joint responsibility;

6) the orientation of the organization to the client (customer orientation) based on the ideology of marketing management, where the purpose and criterion for evaluating the work is the market orientation and satisfaction of requests of various groups of clients (under the clients understood all consumers of organizational culture and products of the organization - personnel, suppliers, buyers, intermediaries, partners, shareholders, investors, the public, the state);

7) the formation of "internal markets" - the principles of entrepreneurship and market relations are transferred to the relationship within the organization, and as a consequence, there are business units that interact with each other on the basis of market principles and form an "intra-firm economy";

8) creation of the infrastructure of decision-making - a uniform system of ensuring the given "organizational economy" (reporting, communication, incentives, politics, culture, etc.) is formed;

9) the allocation of strategic business entities - specialized structures that coordinate and provide activities for the development and implementation of business strategies;

10) expansion of innovations, search of new markets and diversification of operations - development of activities focused on

the production and promotion of new products and technologies on the basis of the principles of "risk financing";

11) outsourcing - part of units or functions in which this organization does not possess the key competencies is excluded from the organization based on reasons of economic feasibility;

12) the formation of a new corporate model - the expansion of contacts with suppliers, consumers, competitors, based on strengthening internal and external integration, co-operation of resources and efforts to use market opportunities;

13) development of group competence - on the basis of training and development of personnel the awareness and training of employees on command interaction skills and effective decision-making increases;

14) modification of the system of incentives for staff - assessment and system of remuneration oriented to the team, rather than personal achievements, encouraging the development of skills and mastering a variety of professional skills instead of narrow specialization;

15) the formation of a new corporate morality - as a result of the formation of an atmosphere of mutual trust, responsibility and partnership, the thinking of employees becomes transformed, corporate culture and egalitarian environment is formed, which is reflected in the ideology and philosophy of the company;

16) optimization of the management process - by eliminating ineffective management operations and procedures, streamlining

activities within each process achieved change in the role and functions of management, improving the effectiveness of the organization as a whole.

Thus, horizontal structuring allows the fullest possible use of organizational resources for effective interaction with a dynamically changing environment, business process improvement and the realization of strategic goals.

The horizontal model is the basis for building many successful foreign companies: Motorola, Xerox, Ryder, AT & T, etc. Flexibility and creativity of horizontal interconnections provides these organizations with high innovative readiness, adaptability, and enhancement of competitiveness.

Thus, in the conditions of modern transformation processes, new approaches and models of the organizational structure reflecting the dynamics of market transformations should be used. Horizontally oriented structures that embody a new approach to organizational design are the most promising models of organizations that are used in all areas and areas of social production. According to experts, they can crowd out all the traditional organizational forms and take a leading position among the organizations of the future.

Chapter 3.

The fundamentals of the system approach to production management

§3.1. Basic concepts and definitions of the general theory of systems

It so happened that the existence of man has always been associated with the satisfaction of its diverse life needs. Beginning with trying to get food for yourself and ensure your safety for trying to change the world making all people happy. Moreover, in our noble activities, we are always trying to achieve a certain goal, which is, in essence, a reflection of our desires. Consequently, META is something that arises immediately with our needs-desires and immediately disappears or loses relevance in their satisfaction-performance. At the same time, given that human desires, as sadly sounding, can disappear only with the disappearance of the person himself, then the goal is a category that always determines the direction of human activity. In other words, we can say that any of our activities is aimed at achieving some of our goals.

Given that our desire-goals are met, unfortunately, not instantaneously - the goal, emerging, first exists as some kind of virtuality (the reflection of the desired reality), to which we immediately begin to lay the same virtual path - drawing in its imagination the steps - actions from surrounding objects. And around us there is such a great world, which consists of a plurality of objects, which we are assessed by the degree of their usefulness or harm in satisfying a certain range of life needs. Then, building (planning) the way to achieve the goal, we include in the virtual list and a number of items of transformation which, in our opinion, will help to achieve the desired goal. Thus, we provide a sequence of actions (functions) and a list of necessary objects (resources), which are isolated in our imagination in a certain integrity, the plural (objects, actions, sequence, structure, connections, etc.) which we can define as some system.

At the same time, controlling our way to the goal, we actually manage it. That is, the management is considered by us as coordinated actions, the impact on the elements of the system as a result of which we are trying to achieve a predetermined goal. Like actions when we take a hammer to split the walnut and get its core, managing the components of the system is an instrument in our pursuit of the goal. At the same time, following the analogy, it is also a "tele-lens", which allows us to focus on problems that need to be addressed to make effective decisions. Consequently, the methodology (toolkit) in which we achieve the goal of managing the elements of the system outlined by us is commonly called the system approach.

The concept of the system is widely used in many different spheres of human activity. After all, satisfaction of our needs (achievement of goals) occurs as a result of a chain of transformations, operations (activities, primarily of production - operational functions) to create new or improved properties of existing and already marked objects. In this case, this system is simply a set of plural elements or subsystems. Not the main property and condition of the existence of existing systems is the property of their integrity. The integrity of the system is identified by the presence or absence of certain features and properties of its elements or subsystems in conjunction with the assessment of their interaction according to the criteria previously chosen by us. Thus, summarizing some of the definitions of concepts proposed by scientists, we must formulate the following definition of the system: ***a system - a certain integrity that exists in a certain time and space and consists of interdependent, similar, distinctive features of elements, each of which has its own influence on the state and characteristics of integrity and in turn may also be a system.***

Formalized morphological description of the system can be represented by the following function:

$$C_i = \{\sum_{a\in A}^{A}, \vartheta, \delta, \varepsilon\}, \tag{3.1}$$

where $\sum_{a\in A}^{A}$, - is the set of elements and their properties; ϑ - is a plurality of bonds; δ – is a structure; ε - is a composition.

Of course, the system by which we are going to make our own let the most far-reaching desires still have boundaries. After all, outlining its (system) circle, we involve it in the most influential, useful elements for achieving the goal (the most effective from our point of view). And if we assume that there is the most effective element of a system then the logic is the existence of elements of efficiency or the impact of which is sufficiently small to be considered as part of the system that is already outlined by us. That is, by and large, the boundaries of the system under consideration are outlined by us based on the reasonable expediency (limited rationality), namely, the proportion of the applied effort spent on resources to the significance of the purpose-desire in meeting the needs, taking into account the consequences of their implementation, or it is the market value of the produced outputs (goods), divided by the total value of expenses in the system on expended inputs (resources) (Figs 3.1 and 3.2).

Consequently, in the above-mentioned cases, the structural-logical scheme of the concept of the system may look like this: due to certain changes in our state or the environment that surrounds us, there is an internal need and the purpose (target) is generated for the achievement of which the resources are attracted and the actions (operational functions) that are defined sequence, structure and communication (operating system).

The last - resources (the main ones - the budget and time as well as material, energy, information, personnel, etc.) and actions with them, having a definite sequence, structure and communication are identified by us as PROCESSES (Fig. 3.2.).

Thus, the process (resource → action → target) is what, due to what our desires become the reality of the same, the latter, allows us to achieve the goal of the general system, the boundaries of which we have identified, part of which (the subsystem) it is.

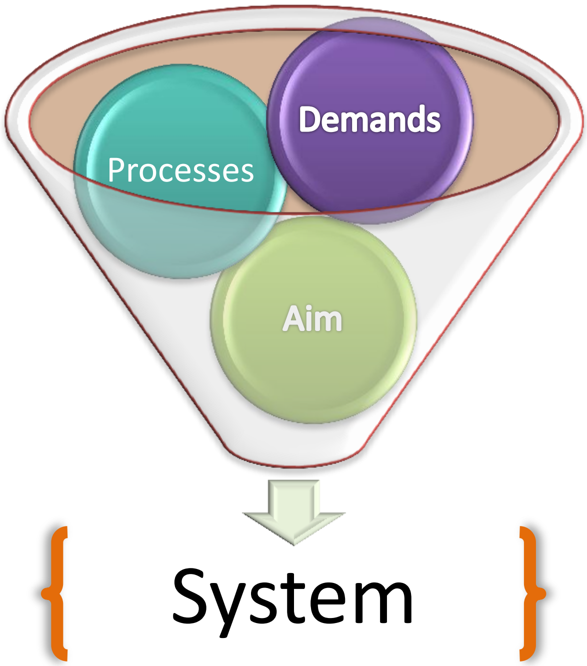


Fig. 3.1. Structural-logical scheme for the concept of the operating system

The notion of "resources" is generally summarized by scientific sources as "means, values, stocks, opportunities, sources of funds, income". In turn, the concept of "enterprise resources" is treated as "means, opportunities, values, stocks of the enterprise, sources of income, which ensure the stable operation of the enterprise in the direction of the chosen activity and profit."

The production system of farms traditionally includes the following resources: agricultural land; technological resources; technical resources; human resources; spatial resources; resources of the organizational management system; information resources; financial resources. Each of these types of resources represents a combination of opportunities for achieving the objectives of the production system.

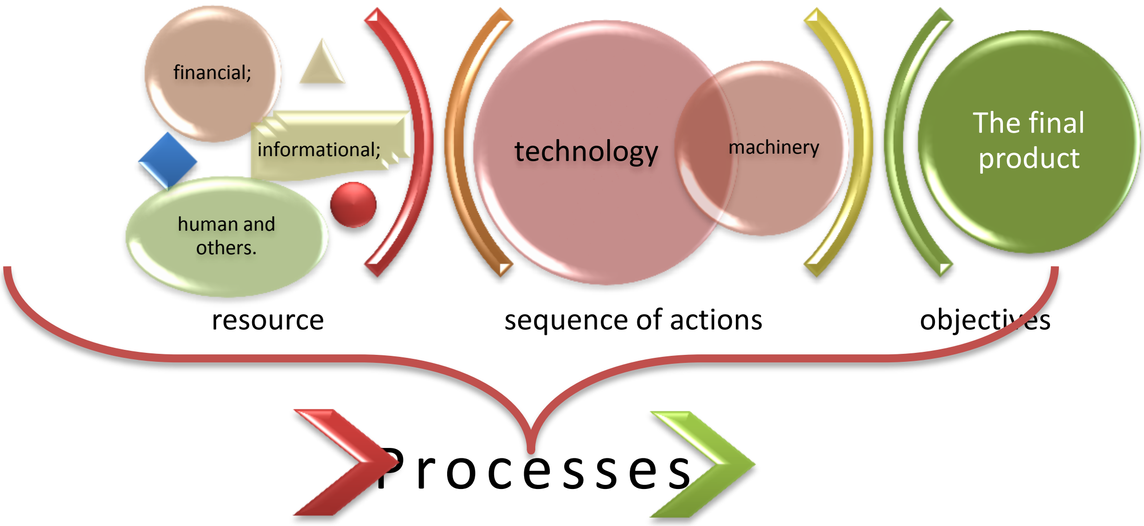


Fig. 3.2. The structural-logical scheme to the concept of the process.

§3.2. Basic concepts and definitions of the operating system

The process, the goal of which, however, is to generate profits as a result of the implementation of the product or service provided, is customarily referred to as a producer. At the same time, those actions that result in the production of goods and services supplied by the organized system (organization) in the external environment is an operational function. The operational function is inherent in all, without exception, producers of crop production because these organizations, otherwise, could not exist. Here, the definition of terminology "operation" and "production" are interchangeable. However, while using the term "production" we basically understand this - the release of goods and processing of raw materials. The term "operations" is wider, it includes not only the production of goods, but also the provision of services.

Most organizations differ from each other by the nature of specific activities included in the operational function. In our case, production refers to the cultivation and harvesting of crops, the production of food products and the processing of raw materials of crop production. The term "operations" can be applied not only in relation to the production of crop production, but also the provision of technological or, for example, technical service of agricultural machinery.

An operating or production system is a system that uses the operating resources of an enterprise to convert the input factor input into its product or service (output) (Fig. 3.3).

"INPUT" can be represented by technological materials (organic fertilizers, seeds), by the customer (for the enterprise that applied to the financial institution for granting a loan) or finished products obtained from another production system (agricultural machines, tractors, vehicles, see Table 3.1.)

Operational resources in the crop field of agricultural production, as a rule, contain five main elements:

a) labor force, directly or indirectly engaged in the production of crop production or services;

b) agricultural and agro-industrial production and service enterprises in which products and services are produced or grown;

c) materials and component products that undergo transformation in the production system;

d) processes (including technological ones) that cover the stages of production of products and services;

e) planning, control and management systems are the procedures and information used in the operation of the operating system.

Table 3. 1.

Examples of the relationship "input → transformation → output" in the typical operating systems of plant growing

System	The main "entrance"	Resource	The main transforming function	The main expected "exit"
Private agricultural enterprise	Fertilizers seeds, agricultural	Agricultural land, workers	Growing and harvesting of agricultural	High-quality agricultural

	machinery		products	
Fodder Plant	Grain	Machines for grinding grain, workers	Grinding of grain	Fodder for animal husbandry
Service center for servicing agricultural machinery	Agricultural machinery that needs maintenance	Machines, equipment, workers	Repair and maintenance of agricultural machinery	The agricultural machinery is ready for work
Wholesale base of agricultural machinery	Units of inventory accounting	Agricultural machinery, spare parts	Storage and redistribution of stocks	Fast delivery, availability of stocks

The manufacturing transformation can have the following character:

1. Physical transformation as a result of the production process, for example, the cultivation of agricultural products.

2. Changing the location as a result of transportation.

3. Exchange as a result of a retail transaction.

4. Warehouse storage as a result of warehousing service.

5. Information transformation as a service (recommendations, technical projects).

Undoubtedly, the above transformations are not mutually exclusive. For example, the market simultaneously allows the buyer to compare the prices and quality of the goods offered to them (information transformation), to store certain goods in stock until they have a need (storage), and sell goods (exchange).

In Table 3.1 is examples of interconnection "input → transformation → output" in typical operating systems of plant growing are presented. Note that it only mentions the main system resources. A more complete description would also include managerial and auxiliary functions.

The complete system of production activity of an agricultural enterprise is an operating system and consists of three main subsystems (Fig. 3.4.).

For an example of each of the subsystems we use the ones given in Table 3.1. data for a private agricultural enterprise engaged in the production of plant products.

The transforming subsystem of a complete operating system performs productive work, directly related to the transformation of input resources into output results. For an agricultural enterprise engaged in agricultural production, the main results of the activity are usually products of plant origin, which, as food, feed or as raw material for further processing, comes to consumers.

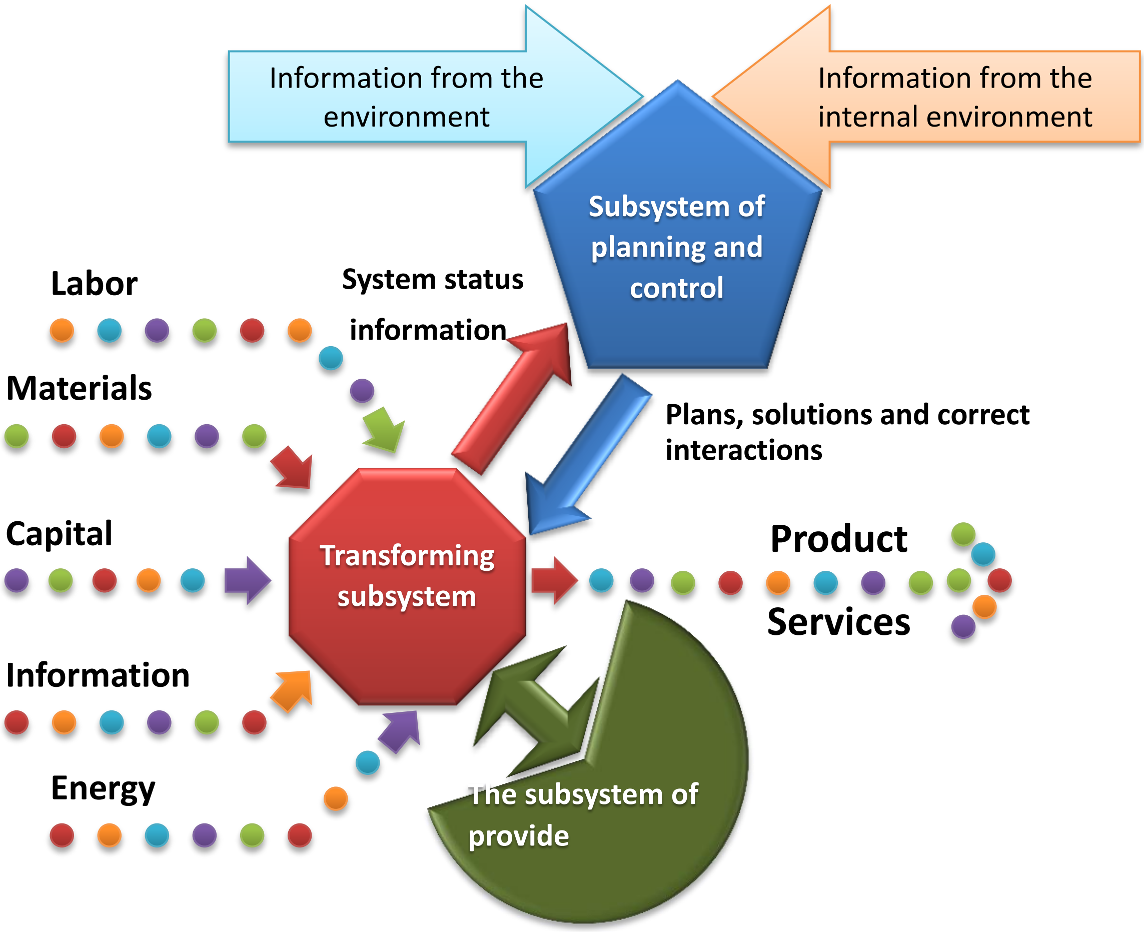


Fig. 3.4. Structural-logical scheme to the concept of subsystems - components of the operating system.

The main role of the human factor manifests itself in the creation of these results due to the rather tight work of the workers of technological and engineering services of these farms.

The materials in this example are seeds, fertilizers, remedies, etc. consumed by the transforming subsystem. Of course, the necessary investments in the form of agricultural machinery, workshops, machinery yard, industrial premises, barns, hangars, equipment, equipment, etc. It is constantly necessary to receive information on changes in tax legislation, market situations, to analyze consumer needs, to have an understanding of scientific and technical and technological achievements, to study the best practices of growing and harvesting agricultural crops. You need the most diverse sources of energy, starting with traditional ones - fuel for lubricants for the work of the machine-tractor park, electric energy for the equipment operation and ending with alternative energy sources - biogas for the heating of industrial premises, solar energy, wind, etc.

The subsystem of provide is not directly related to the release of the full operating system, but performs important and necessary functions of providing a transforming subsystem. For an agricultural enterprise engaged in agronomy to the subsystem of support, it is possible to relate primarily the repair and maintenance base of the engineering technical service, the transport shop, the services of the chief power engineer, the laboratory of quality, the service of the crop protection, and others. serving technological lines and processes of the department of the economy.

A function that is considered part of a subsystem of provision in one farm may be part of a processing subsystem in another. For example, a mechanized field team in a conventional agricultural enterprise serves a transformation subsystem - plant growing. Then, the mechanized brigade of the machine-technology station is the main transforming subsystem for providing car services to customers.

The subsystem of planning and control receives information from the main processing subsystem on the state of the system and work in progress, and in connection with it, performs management functions aimed at the efficient use, maintenance and storage of mechanization facilities that produce and process agricultural products.

Modern, both cooperative farming and industrial development of agriculture demonstrates new increased requirements for the management of domestic production. In order to effectively manage plant systems in the crop, engineering and technical specialists of farms must have a thorough knowledge of the methods of economic management, develop and implement economic measures for the high-performance use of machinery.

Information on the demand for crop production, the cost of resources, trends in technology development, government regulations and other factors, as already noted, comes from the environment. The subsystem of planning and control should handle all this, of course, a large amount of rather complicated information and decide how the processing subsystem should work. Specific issues to be addressed, as a rule, include planning of production capacities, dispatching, inventory management, quality control.

At the farm, these functions of planning and control are carried out by specialists-managers in both technological and engineering direction, including the chief engineer (technician) on the mechanization of labor-intensive processes in livestock, the engineer (technician) - electrician, the manager of the repair workshop, engineer (technician), etc.

They are developing plans for the introduction of new technology, advanced technologies for the mechanization of production processes; calculation of the need for machinery, repair vehicles, petroleum products; drawing up schedules for car repair and maintenance; substantiation of the main planned indicators of machine use; development of measures for the provision of mechanized personnel.

The quality of execution of operational functions is controlled in the process of operational management of technological processes in crop production; inspection of the technical condition of machines and the quality of mechanized works; checking the performance of the task by mechanization personnel, etc.

§3.3. Fundamentals of system management

Numerous responsibilities of management personnel operating systems are usually divided into three main groups:

I) development and implementation of the general strategy and directions of the operational activities of the agricultural enterprise;

II) the development and implementation of the operating system, including the development of a system of crop rotation, production process, decision on the location of production capacities, enterprise design, product design, the introduction of standards and norms for the implementation of mechanized works.

III) planning and monitoring of the current operation of the full operating system.

Science is distinguished by the notion of "system management", "system improvement" or "change methodology"; "System design". Common in these concepts is that they all plan the system as effective. That is, such that reaches its goal, gives the desired result, satisfies the need. However, there are differences in the methodology of achieving the result.

The main components of production processes are the majority of scientific sources: technology, technology and organization. Again, based on the concept of a systematic approach, these components of the general system in turn are systems (subsystems), which include smaller systems on their elements.

It is believed that the improvement of the system, the methodology of change, based on analytical methods, methods of deduction, analysis and reduction. This methodology has an introspective direction. That is, improving the system look for the causes of deviations within the system itself, not seeking to expand its boundaries.

Design of systems is based on the methods of induction and synthesis and has an extrospective direction. The problem is determined and solved by taking into account the interconnection with larger systems (over systems), the constituent part of which is the system being designed. Here, the designer tries to eliminate legislative, tax, territorial and other fundamental obstacles.

The methodology of system management is generalized by methodologies of process, system and situational approaches to scientific management. These approaches to system management are based on the application of methods used in designing and improving systems. In addition, due to well-known components of management, system management involves the accumulation of experience that absorbs negative impacts or trends and provides feedback material for further design and improvement of systems. It should be noted that if during the design, implementation and improvement of systems when created, the structure, connections, etc. are improved; the specified processes have certain time constraints that are of a definite nature of the actions that management is considered as a permanent process of systemic influences, actions, functions aimed at achieving the goal.

Thus, a specialist in operations must possess and be able to use a wide range of knowledge and skills in the field of analysis, system engineering, technology, as well as behavioural and social sciences.

Section 4. Operating conditions of production plant growing processes

§ 4.1. The general terms and definitions

The mechanized technological process is based on the system of technological lines (in a certain sequence and the corresponding interconnection). It includes the whole set of expedient operations performed by machines, mechanisms, equipment at optimal operating modes in agrotechnical terms for obtaining a given quantity of high-quality products (Fig. 4.1.)

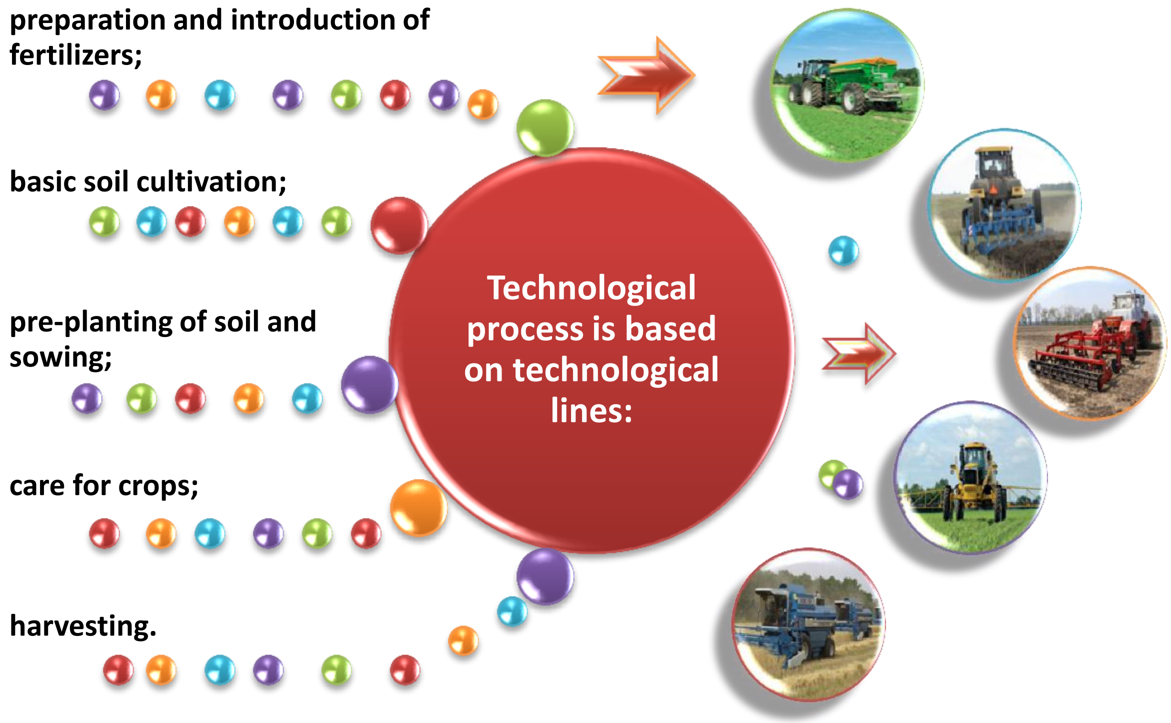


Fig. 4.1. The technological processes in plant growing

Process the technological process based on the laws of technology and technological operations.

It includes a list of energy and transport vehicles and agricultural machines in the rational organization of their use.

Consequently, the mechanized technological process shows what kind of means (subject) and at which technology (method) is achieved the goal - the production of products.

This process is an integral part of the overall production process, which is an interconnected and interconnected coordination of technological processes with the work of all services of the economy (scientific organization of labor, economic service, construction and repair, etc.).

Typical mechanized processes of cultivation and harvesting of crops are developed by research institutes. Technological documentation of a typical mechanized process includes:

a) agrotechnical operations of cultivation and harvesting of agricultural crops;

b) the schedule of the technological process;

c) operational maps of major technological operations;

d) the composition of machine complexes for the production of plant products.

Technological operations are generalized on the basis of agronomic science research, taking into account the long-term introduction of high-yielding crops in agricultural production and the obtaining of sustainable yields.

The schedule of the technological process is consistently presented all production operations and terms of their execution; the composition of machine aggregates for performance of operations is determined taking into account their highly efficient use and the minimum need for maintenance personnel.

Operating charts detail the modes of execution of major operations; characteristics and productivity of aggregates are given; calculation of the balance of time of use of aggregates; instructions are given on the calculation of the seed rate, the correct selection and establishment of working bodies, the organization of the use of aggregates (field marking, the choice of the scheme of aggregates, the division of the field into blocks, etc.).

A typical mechanized technological process, when planning it in each individual economy, needs to be specified in accordance with the specific local conditions of the economy, taking into account the recommendations of local research institutions (regarding the composition of aggregates and terms of operations, duration of work, aggregates productivity, etc.).

Technology - a set of biological, chemical, physical and agrotechnical techniques and patterns of obtaining a particular product.

The very term "technology" means: téchne - art, skill, skill, and logos - the doctrine, the notion.

Johann Beckmann was the first to apply this term, naming the discipline taught at the University of Gettys, and published the scientific work "Introduction to Technology".

Johann Beckmann

(1739-1811)

In general, I. Beckman considered the concept of "technology" as a "collection of craft art, skills, tools, production operations, etc."

Progressive technologies are aimed at achieving the programmed end results with the effective use of natural and other non-renewable resources.

Intensive technology of growing crops ensures achievement of programmed results by effective targeted influence on production facilities in accordance with phases of plant development.

With intensive technology, the increase in yield is achieved through a combination of progressive agrotechnical techniques with timely and qualitative conduction of technological operations, taking into account the needs for plant development in each phase of organogenesis. In particular, with the intensive technology of growing crops, nitrogen fertilizers are introduced partly for 3 4 receptions in different phases of development of plants, which provides a significantly higher fertilizer use rate.

In addition, according to the requirements are made necessary trace elements, growth regulators, operations are carried out on the protection of plants from weeds, pests and diseases.

For example, to obtain a fiber of flaxen flax, it is necessary to grow flax, to assemble it, to thresh it, to spread it out, to pick up a trust, to rebuild the trust on the fiber. At the same time perform technological operations, that is, a number of actions, which result in a change in the property, condition or position of the processed material.

Resource-saving technology aims at achieving programmed results with the minimum necessary costs of non-renewable resources. Implementation of resource-saving technologies leads to qualitative changes in the economic activity of enterprises. At the same time, resource-saving technologies' require a scientifically substantiated system of technological operations aimed at obtaining the maximum amount of crop production at a minimum cost for its production. Such technology is based on the integrated use of recent research in science and technology. In plant growing, this applies to the selection of optimal precursors for this culture, the definition of methods of soil preparation; use of the most promising varieties and high quality seeds; application of necessary doses of fertilizers, herbicides; performance of all agrotechnical operations with the help of modern technology on the basis of rational forms of organization of labor.

A separate option of resource-saving technologies is energy-saving technologies, in which the main attention is paid to saving energy resources. These technologies include reducing the number of operations, minimizing the cultivation of soil, the use of combined and complex aggregates, local fertilization, tape and band spraying, reducing the rates of cost of technological materials through improving the quality and accuracy of operations. Energy-saving technologies require a clear sequence and organization of agrotechnological measures taking into account the characteristics of cultivated crops, as well as a certain set of agricultural machinery and equipment, progressive organization and labor remuneration.

Soil protection technology provides for increasing or maintaining soil fertility by eliminating the causes of machine and natural degradation of soils (compaction, erosion, humus and other components of fertility).

Each of the following technology options has its own characteristic means and means of achieving the goal. At the same time, modern technologies have signs of intensive, resource-saving, and ground-breaking technologies. Choosing a technology option, justifying rational means and resource requirements is a multivariate task. Its solution requires the cooperation of specialists in agronomy and engineering. At the level of technology, the systemic unity of such elements as technical means, technological materials, environment and organization is clearly revealed.

In European countries, the most popular of soil protection technologies are:

1) Low-input technologies - mainly pesticides, especially when growing the most widespread crop of winter wheat;
2) Integrated maintenance farming - on average about 50% of fungicides and herbicides, 40% of insecticides and 20% of mineral fertilizers in comparison with standard values;
3) zero cultivation - (no-till, no-tillage or zero tillage) - planting seeds in untreated soils by cutting the groove of the desired width and depth sufficient for seed embroidering. Other types of cultivation are not used. It is allowed only the cultivation of the subsoil in the event of its overdevelopment, but such cultivation

is carried out with special implements and the soil vegetation cover is not violated at this time. A compulsory element of the zero technology of cultivation is a permanent vegetation on the soil surface from living or dead (sturgeon or mulch) plants;

4) direct sowing - direct sowing directly to the untreated soil. It differs from zero technology in that it is periodically interrupted by plowing or surface treatment;
5) conservative agriculture - land-use technologies aimed at maximizing the conservation of biodiversity, soil composition and properties, protection against degradation processes (erosion, loss of humus, overpowering, etc.) [87].

Operations of growing and harvesting field crops are divided into: technological (fertilization, plowing, cultivation, sowing, care of crops, harvesting); transport (transportation of fertilizers to the field, grain from a combine, etc.), which are closely related to the implementation of the technological process, and auxiliary (splitting the field into blocks, assembling machine-tractor units, loading and unloading operations, etc.).

The processes can be mobile (traction) and stationary.

Mobile processes are carried out by machines that constantly move across the field by different traction means, and stationary - without the constant movement of machines on pre-allocated areas for this (currents, farms, etc.).

Depending on the destination, the mobile processes are divided into technological lines:

1) soil cultivation;
2) fertilization;
3) sowing and planting of crops;
4) care of plants;
5) harvesting;
6) transport work;

7) development and improvement of agricultural land and field preparation;
8) ameliorative, road and other works;
9) field-protective measures;
10) irrigation fields.

Stationary processes in their destination are divided into four groups:

- field production processes (grain handling, loading, unloading, etc.);
- food preparation;
- caring for farm animals;
- primary processing of crop and livestock products.

The list and number of technological operations depend on biological characteristics of agricultural crops, agricultural techniques of their cultivation, natural and climatic conditions and organizational forms of execution of works.

The size of the crop and its quality to a large extent depend on the timeliness and quality of carrying out of technological operations - cultivation of soil, sowing, care of plants and harvesting. Lacking a crop, reducing its quality is often the result of poor performance of field mechanized work. Therefore, for the timely detection and, if possible, the rapid elimination of the disadvantages assumed in the field work, strict control over their quality is required.

The quality of work in crop production is regulated by special indicators, based on agrotechnical requirements for the implementation of mechanized technological processes.

The technological operation is estimated by parameters, that is, indicators that characterize the quality of the work (depth of cultivation, seed rate, number of destroyed weeds, grain loss during harvesting, etc.) due to agrotechnical documentation.

Parameters are divided into nominal, actual (current) and marginal.

Nominal parameters are provided by the technological documentation and determined on the basis of functional dependencies (their optimal values).

Actual parameters are obtained as a result of measurement with permissible error.

Boundary parameters are the largest or least permissible values of parameters that meet the requirements stipulated by the technological documentation.

Agro-technical requirements for a mechanized process are a set of norms and rules for the implementation by the machine aggregate of the effect on the subject of work for the achievement of indicators that provide the optimal conditions for the growth and development of plants or the receipt of products of the established quality for acceptable labor costs and costs.

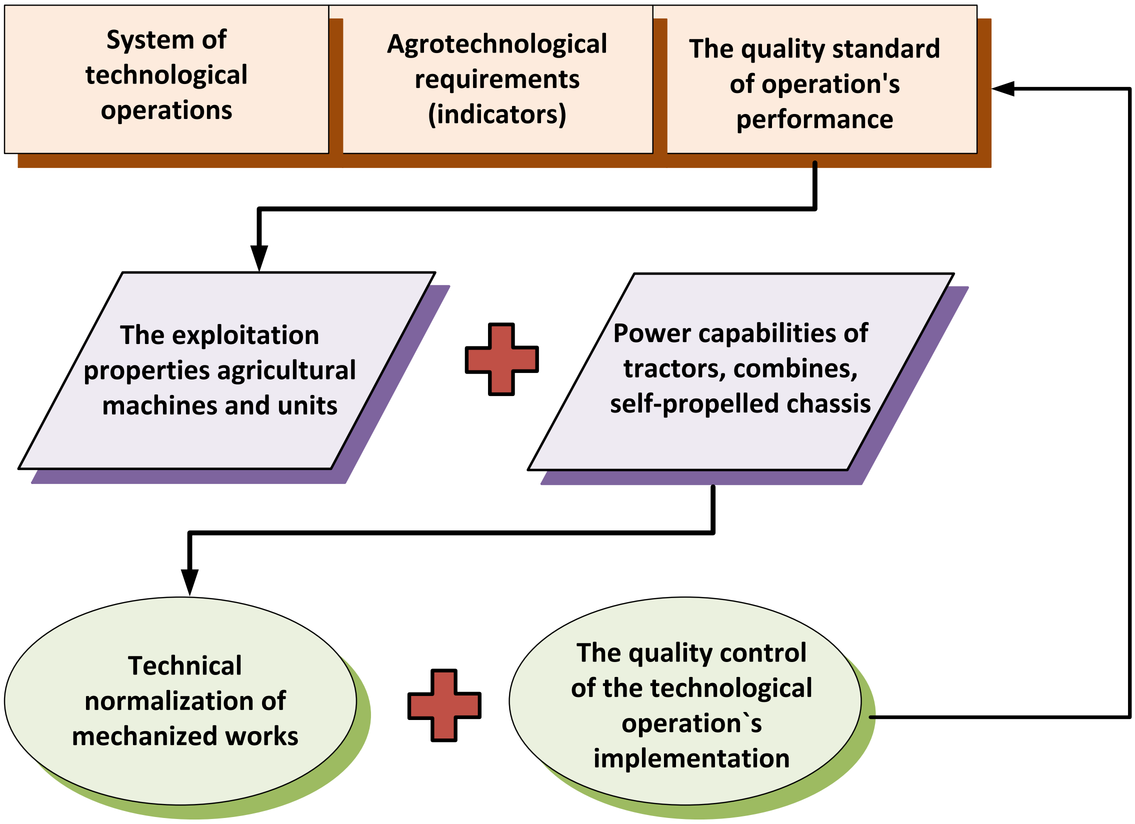


Fig. 4.2. Technology, technology and organization in the use of machines

One should pay attention to the completeness of the presentation of agrotechnical requirements, so that on their basis it was possible to adjust the machines and check the quality of the operation of the given operation (Figure 4.2.).

Quality Scores are divided into three groups:

- the first - the terms and duration of the mechanized works;

- the second - quantitative norms and tolerances, qualitative characteristic of the required state of the environment (soil, seeds, plants);

- the third - indicators that reflect the regulation of machines, tools for a given mode of operation.

In most literary sources, under the operational technology of mechanized agricultural work is understood a set of methods and rules for the implementation of all major and auxiliary operations, their consistency and regularity depending on the working conditions of the machine, that is, a detailed description of the technologies of each individual mechanized agricultural operation. Operating technology of mechanized agricultural work includes the following sections:

a) working conditions;
b) agrotechnical requirements to it;
c) preparation of the unit for work;
d) preparation of the field;
e) operation of the unit in the unit;
f) quality control of the implementation of the technological operation;
g) safety equipment.

If a technological map of cultivating and harvesting agricultural crops answers the question "What needs to be done to get production", then the operational one - on the question: "how to perform a mechanized technological operation qualitatively". The purpose of the operating technology is to prevent a shortage of work, to execute it in optimal agrotechnical terms with high quality at minimum labor costs and costs. For each agricultural work, scientific institutions develop an operational-technological map. This document is required for a mechanic - a worker, an agronomist, an accountant and auxiliary staff.

§ 4.2. Features of enterprise management agro-industrial complex

An important task of the crop production industry in Ukraine is to ensure the food and energy security of the state by substantially increasing and stabilizing the production, processing and marketing of competitive products that are in demand both in the domestic and foreign markets, and the integration of domestic agricultural production to the world.

The management system of the agro-industrial complex of Ukraine is organically linked with radical transformations and reforms of all aspects of our society's life. In this sense, only a holistic, efficient system of management of production organizations in Ukraine can ensure the effectiveness of economic development, while complying with two main conditions:

- first, it should take into account the features of the previous development and the current state of the economy, the mentality and behavioral characteristics of the population, the duration of the period of transformation and other factors and conditions that shape the features of the country;

- second, it should be based on the principles and mechanisms governing the management of other countries with a market economy.

This will allow integration of the national economy into the world economic system, occupy a place worthy of Ukraine and its people.

Engineering management in the agro-industrial complex of the country is one of the types of production management. Therefore, it includes both general properties and attributes of management, as well as specific methods characteristic of agricultural production. Management of socio-economic processes of agricultural enterprises has its own peculiarities, which should be taken into account when using management in the practice of management. These features determine the construction of a mechanism for the functioning of engineering management, its characteristics and specifics of application in the areas of management decision making; realization of the basic functions of management: planning, organization, motivation, control and coordination; management of labor resources

The specificity of the functioning of engineering management stems from the peculiarities of agro-industrial production, which are as follows.

Production in agriculture is influenced not only by labor and labor, but also by natural and climatic conditions, which is absent in other sectors of the national economy. In this case, environmental factors in many cases are the most significant in the final results of the activities of agro-industrial formations. The natural and climatic conditions for the zones of the country are significantly different and for their production efficiency it is necessary to consider them. This approach is realized in zonal systems of economy.

1. Land in agriculture is not only an object of labor, as in other branches of the national economy, but also the subject of labor, acts as the main means of production. For agricultural production characterized by its territorial dispersion, the remoteness of structural units from the center, which impedes the collection and processing of information. And this leads to a delay in the adoption of operational decisions. It is virtually impossible to directly control a single center.
2. Production cycles (sowing, crop maintenance, harvesting), their duration is largely associated with natural biological processes. The seasonal nature of production, the sharp fluctuations in the use of material, labor, financial and other resources for periods of the year requires managers to find ways to equalize their use, especially workers.

3. Adoption of managerial decisions is an extremely complex process, which takes place depending on weather conditions, subject to increased uncertainty and risk.
4. The duration of the agricultural production cycle, which can be several years (when planting perennial plantations), affects the duration of their exit from the crisis situation (more than two years) and the complexity of managing it.
5. The structure of government is greatly influenced by the diversity of forms of ownership and management. At the same time, horizontal coordination contacts for the solution of general issues on the territory of enterprises (general service, social and cultural-household sphere, etc.) are developing. A significant role in solving the food problem is played by private farms that need to be fully supported.
6. Objective differences in the way of life in the city and the countryside, traditions, customs require a unique solution to many management issues, including those related to the social sphere.

Agro-industrial production is realized through one of the most important national economic complexes - agroindustrial complex (APC), which combines three production spheres:

1) machine building industry;
2) branches of plant growing and animal husbandry;
3) food, textile and leather and footwear industries.

For the effective functioning of the branches of agriculture, as noted by S.O. Shevelev, agricultural managers need to ensure balanced and balanced development of all its spheres. In this case, it is necessary to allocate the following groups of proportions of the spheres:

I. Value of development of 1 and 2 spheres of agrarian and industrial complex. Increasing labor productivity and reducing the cost of agricultural products is impossible without providing agricultural production with efficient high-performance machines. But the real situation is evidence of the lack of parity of prices for agricultural products and agricultural products, since not every farm can buy agricultural machines, not to mention the farmer. Therefore, at the macro level, it is necessary to manage the system of agrarian and industrial complex, which is aimed at stopping uncontrolled rise in prices by monopoly enterprises and establishing a reasonable correlation between prices for agricultural products and prices for agricultural products.

II. The correlation between the 1 and 3 areas consists in the provision of new equipment for the food industry in the processing industries of the agroindustrial complex.

III. The 2 to 3 spheres ratio. The proportionality between them is characterized by a balance of agricultural raw materials, which goes to the processing and production capacities of light, food and other industries of the processing industry. The disproportion in the development of 2 and 3 spheres is the lack of raw materials for the uninterrupted functioning of processing enterprises. The growth of prices in all sectors of the national economy has created fundamentally different conditions for the formation of the cost of production. Thus, in Ukraine in recent years, the production of various types of agricultural products for many agricultural producers is unprofitable (milk, meat, vegetables, fruits, etc.), while the processing industry and retail trade have profits from the sale of products of processing of this agricultural raw material. Thus, management at the macro level should ensure the formation of prices for food products that would form a interconnected system, that is, the purchase prices for agricultural raw materials, wholesale for products of processing enterprises, retail for food products in retail trade should be formed on a single methodological basis, providing each branch of the agroindustrial complex is profitable functioning.

The productial agro-industrial infrastructure is an integral part of the functional and sectoral structure of AIC and includes:

- material and technical support of branches of agrarian and industrial complex;

- procurement of agricultural products;

- storage of products and packaging;

- trade;

- information support;

- research work and others.

Social infrastructure is equally important, without which it is impossible to increase the productivity of agro-industrial production.

§ 4.3. Features of production management and technological processes in crop production

Management of technological processes in crop production has a number of features primarily related to the specifics of agricultural production. Most clearly these differences are felt in the field of machine use. Thus, machine aggregates and machine complexes in the process of cultivating and harvesting crops are used in a variety of climatic, soil, and production environments. This is connected with the fact that the implementation of technological processes in the crop farming sector has a number of distinctive marks:

- firstly, the implementation of technological operations is combined with certain influences of the working bodies of agricultural machines on the objects of wildlife - plants, seeds, microorganisms and other biological objects located both in the soil and on the surface of the soil. In the processes of interaction, these biological objects can be damaged or even destroyed, which may cause undesirable consequences for production. Even micro-damage to the grain surface - reduces seed germination; damage to tubers, roots, fruits or fruits leads to their infection and decay; the cutting or filling of cultivated plants by land, in technological operations of inter-row cultivation, - leads to their death and decrease the density of cultivated plants, and, as a result, to reduce the yield of agricultural crops. Overlapping with the mechanisms of machine aggregates of the rootland layer of soil entails negative changes in the course of biochemical processes, which inevitably affects the quality of growth and development of cultivated plants. Thus, the total surface area of the soil from the traces of machine guns may exceed the total area of the land plot almost twice. One and two-way passage of the machine aggregate in the sediment makes it possible to reduce the indicator of the permeated ability of the root-forming layer of soil in 50 ... 100 times, and the future yield of agricultural - by 8 ... 25%.

- secondly, the long technological cycle of growing and harvesting crops is tightly linked to the implementation of various technological operations conducted in regulated agro-technical requirements in time terms and in large areas. Thus, the technological process of winter wheat production according to traditional technology involves implementation of up to 40-45 technological operations; Growing and harvesting legumes - 30-35, perennial grasses until the first harvest - 15, and the technological processes of flax production can account for about 60 operations. The average mechanization operator has to perform up to 15 different types of mechanized works in a year, which requires the restoration of appropriate management skills and leads to time-consuming adaptation to work.

Failure to comply with the agronomic terms of mechanized works leads to significant loss of crop production. For example, in Ukraine, one of the most urgent tasks in the organization of plant production processes is the task of ensuring harvesting of early grain crops in agrotechnical terms, which make up - 7 ... 10 days and thus avoiding significant losses of grain material and deterioration of its quality. Due to agronomic science and production practice, it is known that the largest biological harvest of grain is achieved at the end of the wax and at the beginning of complete ripeness. But, after 4 ... 7 days after the onset of full ripeness, depending on:

1) the natural and production conditions zone's, the characteristics of grain crops and their varieties;

2) agrometeorological conditions, the period of grain penetration comes.

The main natural and climatic zones, which determine the choice of a technological process and machinery systems in it, include: Polissya, Forest-steppe, Steppe, mountainous and foothill areas of the Crimea and the Carpathians. In turn, in the natural-climatic zone of Polissya two sub-zones are allocated: it is western - which includes the Polis districts of the Volyn, Rivne and Lviv regions, and the eastern part of the territory of Zhytomyr, Kyiv, Chernihiv and Sumy regions. The forest-steppe zone has sub-zones of the western and eastern forest-steppe. The steppe zone is divided into the northern and southern subzone.

Under these conditions, whole grain material irreversibly loses its biochemical, mechano-technological and flour-milling qualities, is easily self-digestible, and in conditions of excessive moisture it begins to sprout in the ear. At the same time - direct irreparable loss of grain material from self-propagation, 20 days after the onset of full ripeness - reach 18.4 ... 20.2% [72].

The third feature of commodity production in the crop production is the high degree of influence of meteorological conditions on the resulting quality of technological processes and direct impact on crop yields, which varies considerably in different climatic zones and may even differ within a single agricultural area. For example, the optimal agronomic terms of sowing are determined by the biological characteristics of the agricultural crop and agro meteorological conditions, primarily the temperature of the soil. The temperature of the soil also depends on the length of the growing season, the effectiveness of mineral fertilizers, the start of individual agricultural work. For spring crops, the temperature of seed germination is of great importance, as well as the ability of the ladder to counter possible spring frost. Germination of seeds of most agricultural crops begins at a temperature of 3 ... 5ºC, heat-loving at 13 ... 15ºC, which is considered to be the optimum temperature for these crops, respectively, 10 ... 12ºC and 20 ... 25ºC.

Unfavourable spontaneous meteorological phenomena include:

- strong wind (squalls, hurricanes, tornadoes);
- heavy rains (50 mm or more in 12 hours);
- large hailstones (diameters of hail 20 mm and more);
- February frost (air temperature -40 ° C and below);
- heat (air temperature 35 ° C and above);
- prolonged precipitation and excessive wetting of the soil during harvesting;
- intense snowfall;
- glazed frost; dust storms;
- frosts;
- drywall and so on.

The fourth feature of the crop production industry is seasonal production processes, including mechanized agricultural work for the annual cycle of solar radiation, air temperature dynamics and rainfall. The seasonal nature of agricultural work is due to the cyclical agro-climatic resources.

Common signs of agro-climatic resources include the start and end term, the duration of cold, warm, vegetative periods and the period of active vegetation (Table 4.1.).

Table 4.1.

Seasonal agricultural production
for the annual flow of agrometeorological conditions [123]

Seasonal features		Agrometeorological and agro-climatic conditions and their indicators
Agrofitotechnologies	Development of vegetation	
1	2	3
Pre-sowing and sowing periods (March-May)		
Pre-sowing, early sowing and heat-loving crops	Restoration of vegetation. Stairs and the beginning of the development of field crops	Melting of snow cover, thawing and warming, accumulation of heat, humidity, freezing, dry heat
Period of care for grown and industrial crops, colza harvesting (June - August)		
Multi-row cultivation, feeding, fighting pests and diseases, harvesting cereals, vegetables, early fruits, hay mowing	Active vegetation, maturation of early grains, fruit bearing of garden and vegetable crops	The highest consumption of solar radiation, heat, moisture, the most sensitive to frost, drywall, waterlogging, etc.
Period of sowing of winter crops, harvesting of cultivars and technical crops (September October)		
Completion of crop care, crop harvesting, technical, fruit, vegetable crops, winter crops sowing, post harvest tillage, plowing of the hay	Achievement of medium- and late-threshing crops, wintering stairs, yellowing of leaves of trees	Reducing the need for solar radiation, heat, humidity, gradual completion of the vegetation by passing the temperature of air through 15 ° C, 10 ° C, 5 ° C. Frosts
Period of cessation of the growing season for wintering (November - December)		
Completion of harvesting, caring for wintering, harvesting, cropping	Rooting and hardening of winter crops. Defoliation of trees.	Reducing the amount of heat, increasing humidity, changing the temperature of the air through, installing snow cover, freezing
Period of plants anabiosis and preparation for spring field work (January - March)		
Snow removal, ice crushing, seed preparation, plant protection, machine park preparation, crop storage	Wintering of winter and fruit trees	Temperature at the depth of the nesting plant, conditions wintering of winter and fruit crops,, rainfall, humidity, thaw

They are determined by the duration of sunshine, the intensity of heat accumulation and the amount of precipitation in the relevant periods.

Climatic data are of interest to agriculture only when, along with them, there are known plant requirements for the climate. That is, quantitative indices of the needs of cultivated plants in heat, moisture and other agro-climatic factors are established for agricultural climate assessment, comparing these quantitative indicators with predicted climate resources, and establishes the degree of favorable climate data for crop production in different regions (Table 4.2).

Fifthly, the agricultural production sector of Ukraine still has a number of features in placement and territorial specialization. Under the notion of territorial specialization in crop production, it means - the orientation of a certain region for the production of certain agricultural crops. Specialization in the field of crop production enables commodity producers:

1) to concentrate the bulk of production resources on the most effective direction of commodity production;

2) supports the most complete use:
   - favorable natural and climatic features of separate territories;
   - labor resources;
   - the land;
   - means of production;
   - opens wide scope for implementation of achievements of scientific and technological progress;
   - creates conditions for intensification of crop production.

Table 4.2.

Water consumption (mm) of field crops by natural areas [123]

Field culture	Vegetation cycle	Biological optimum of precipitation, mm	Total demand for field crops in the year, mm				
			Polissya, Forest-steppe, west	Polesie Center, East	Forest-steppe center, East	Steppe, North	Steppe South
1	2	3	4	5	6	7	8
Winter wheat	September-July	550 - 750	635	630	625	613	605
Winter rye	September-July	500 - 700	585	580	575	563	555
Spring Barley	March-July	250 - 390	450	420	420	415	410
Oats	March-July	280 - 400	480	450	450	445	440
Middle-aged Corn	April-September	280 - 480	390	365	370	370	350
Millet	April-August	280 - 500	435	410	415	415	385
Buckwheat	May-August	270 - 470	485	455	460	455	465
Pea	Jun-July	270 - 470	510	480	480	470	455
Sunflower	April-August	220 - 340	380	350	355	355	325
Sugar beets	Sugar beets	400 - 720	470	450	450	455	470
Potatoes	May-September	300 - 570	470	445	445	440	440

Hence the sixth feature - a large variety of soil and production conditions. Field work is carried out both on large plain soils and on slopes, on light sandy loams and heavy loamy or rocky soils.

The size and configuration of the fields is different from a complex shape and a small square to the right rectangles and a large area. Fields can have obstacles: yards, power lines or communications, individual trees or shrubs.

In view of this, machine aggregates must meet the established agrotechnological requirements and meet the conditions and characteristics of agricultural production. Namely: a considerable amount of space in the space associated with the accumulation of solar energy. Thus, for normo-forming factors (length of a race, slope angle, field configuration, obstacles, stony, altitude), land districts, in plain districts of Ukraine, are divided into 7 groups. I groups include fields with a length of more than 1000 m; to the second - 600 ... 1000 m; the third - 400 ... 600 m; the fourth - 300 ... 400 m; the fifth - 200 ... 300 m; the sixth - 150 ... 200 m; seventh - 100 ... 150 m.

The following is set:

- production, technological processes are carried out in certain agrotechnical terms, depending on the climatic conditions of the corresponding zone, and associated with the phases of plant development and biological characteristics;

- the working conditions undergo continuous changes under the influence of biological processes, changes in soil condition and metrological conditions;

- Soil-climatic and organizational-economic conditions of use of machine aggregates are very diverse, and therefore the number and designation of works in the same technological processes are not constant;

- the terms of use of many machines throughout the year is not significant.

§ 4.4. Analysis of material on characteristics agricultural enterprises the main natural and climatic zones of Ukraine

Features of the natural-production characteristics of the Polissya area.

The climate here is relatively warm and humid. The average annual air temperature ranges from +7 ° C in the west to +5,6 ° C in the east. In the western regions, the average monthly air temperature is 17 - 18 ° C, and in the central and eastern regions - 18-19 ° C. The minimum temperature in January and February may be minus 33 - 36 ° C, and in other areas - minus 22 - 28 ° C. The duration of the vegetation period in the western regions when the average daily temperature is changed through +5 ° C is 210-215 days, while in the eastern it decreases to 190-195 days.

Ukrainian Polissya - a zone of sufficient moisture. In most areas, an average of 550 - 650 mm falls per year, in the extreme southwest zones of the zone - 700 - 740 mm of precipitation. During the growing season the average rainfall is 360 - 530 mm. For the vast majority of the Polesie meteorological stations, the value of the hydrothermal coefficient (SCC Peasant) for the periods May-July and August-September coincide.

The total area of agricultural land in Polissya reaches 6 million hectares, among which the arable land occupy about 4 million hectares. The level of cultivation of lands is 67%, which is too high for the area, the cultivation of environmentally friendly areas in the United States is 35.9%, while the UK, Germany and France ranges from 40 to 54%.

Soil is a function of environmental conditions and biological factors. We know more than 100 indicators of soil properties. The ground cover of the Ukrainian Polissya (19.5% of Ukraine's area) is characterized by a considerable spread of sand masses, which resulted in the formation of an extremely diverse soil cover within it.

Characteristic feature of landscapes of Polissya is their inherent and clearly identified mosaic, complexity of structure and high environmental vulnerability.

Granulometric composition is one of the most ancient elements of agronomic characteristics and classification of soils. In the soil cover of Polissya, soils of rough granulometry (sand and sandy soils) predominate,. They account for 3.3 million hectares (55% of agricultural land).

Soil is the subject of research both for soil scientists and engineers. The State Standard of Ukraine - DSTU 3980-2000 defines the soil as: "An independent natural-historical organ-mineral body that arose on the surface of the earth's crust due to the long interaction of biotic, abiotic and anthropogenic factors, has specific genetic-morphological features and properties, the main which is fertility. "

The term "natural and historical organo-mineral body" prompts an analysis of the soil environment from the characteristics of Polissya, a zonally determined physical and geographical region, which occupies a special place among other plain natural zones of Ukraine.

As a result of a large-scale soil survey, scientific research institutions received detailed information on the soil cover of the Ukrainian Polissya. So the Institute of Soil Science and Agrochemistry named. Sokolovsky O.N. (authors Polupan M.I. and Solovey V.B), the method of organization of rational use of land resources has been developed. Six consecutive soil-ecological levels of territorial differentiation of soil cover have been established. This ensures the zoning is consistent with natural realities and its representativeness. The presence of a detailed spatial differentiation of land resources provides an opportunity to evaluate its agro-ecological potential on an objective basis.

Three basic types of soil formation were found: sod-podzolic, soddy podzolic and sod-glued (Table 4.3.).

Loamy soils are distributed on an area of 1.7 million hectares, organogenic (peat) - on an area of 820 thousand hectares. The most fertile ones in Polissya include sod-carbonate and forest loamy soils. However, this group, although it holds compact arrays, but is distributed on a relatively small area - 750 thousand hectares. Soils with an acidic reaction (pH <5.5) and high calcium deficiency in Polissya about 3.5 million hectares.

Table 4.3.

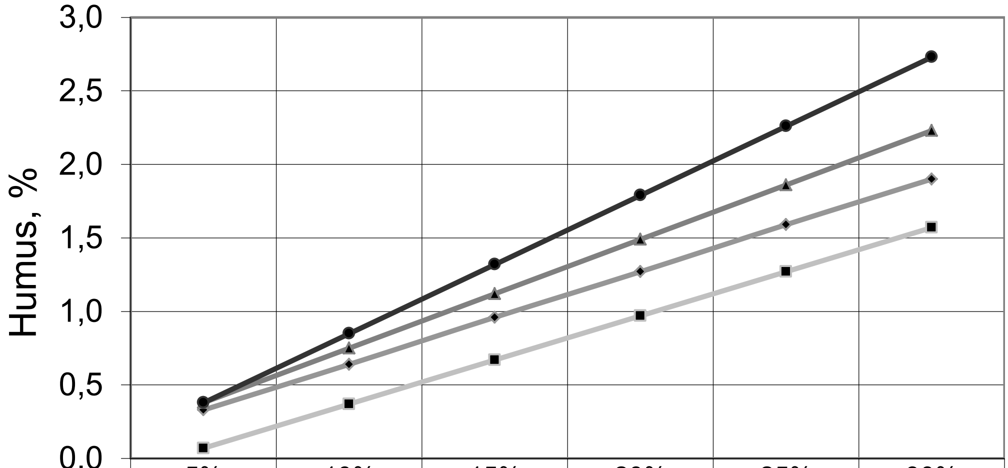
The classification scheme of mineral soils in Ukrainian Polissya

Soil class *by granulometric composition (% of physical clay)*	Type of soil formation *by parameters of the relative humus accumulation coefficient*	Subtype of soil formation *by the degree of humidity, by the coefficient of humus`s relative accumulation*
Sandy		Amorphous
(0—5%)	Sod-podzolic	1) < 0,55;
Linked-sandy		2) 0,96—1,15
(6—10%)	(0,35—0,95)	
Lightly sandy-loam		Lightly gley
(11—15%)	Soddy podzolic	1) 0,56—0,68
Hardly sandy-loam		2) 1,16—1,35
(16—20%)	(0,96—2,00)	
Sandy- loamy sand		Gley-like soil
(21—25%)	Soddy gley	1) 0,83—0,95
Loamy sand		2) 1,61—2,00
(26—30%)	(> 2,00)	3) 2,00—2,8
Lightly loamy sand		
(31—35%)		Heavy gley soil
Medium loamy sand		1) > 2,8
(36—40%)		
Clay-loam (41—45%)		

The soddy-podzolic type of soil formation developed in conditions favorable for forest vegetation. In this connection, soil formation was accompanied by a low accumulation of humus (Figure 4.3.).

Humus, or organic matter, is an integrated index of soil fertility. Humus reserves determine the agrophysical properties of the soil, including its density, moisture content, aggregation, anti-erosion resistance.

The humus-eluvial horizon (HE) with the capacity of 15 - 20 cm in arable soils coincides with the depth of plowing. The main feature of turf-podzolic soils is the clear texture differentiation of the profile.



	5%	10%	15%	20%	25%	30%
1	0,07	0,37	0,67	0,97	1,27	1,57
2	0,33	0,64	0,96	1,27	1,59	1,9
3	0,38	0,75	1,12	1,49	1,86	2,23
4	0,38	0,85	1,32	1,79	2,26	2,73

Physical clay,%

Fig. 4.3 - Humus content in sod-podzolic soils depending on the amount of physical clay and moisture content

Derny podzolny type of soil formation is characteristic of a location with less favorable conditions for forests and, accordingly, better for herbs. They have the power of a humus (NE) profile. 13 - 18 cm, Color - Dark Gray. Typical podzolized typical soil formation is characterized by more accumulation of humus not only in the upper part in comparison with sod-podzolic, but also throughout its profile. In general, soddy podzolized soils are characterized by significant fertility, especially normally developed species.

Dry-gley type of soil formation is characteristic of reduced areas with shallow groundwater levels, which are unsuitable for forests and were occupied with grassy, mainly meadow-bog, vegetation.

Dead gley soils have a humus profile of 2 - 40 cm. The number of humus in the 0 - 20 (25) cm layer varies from 1.0 to 3.2 in sandy to 10-14% in medium loamy. Soils of turf-glued soil formation are characterized by low fertility due to their excessive moisture.

The agro-ecological state of the soil of the Polissia area became acute. There was a need to reform the agricultural system on an adaptive-landscape basis. The Institute of Agriculture of Polissya developed the foundations of the soil protective contour-agroecological system of agriculture, which is a zonal modification of adaptive-landscape farming. The system solves a number of problems.

First of all, it is an optimization of the structures of lands and crops. The agroecological way of organizing the territory involves ensuring the maximum correspondence of the land with the soil cover, despite the fact that the Polissya landscapes are characterized by variegated and finely contouring. Thus, the Land Fund of Polissya is divided into 10 agroecological groups:

I. Land suitable for all crops that are zoned in the zone. Here projected crop rotations of fruit-changing type with the alternation of crops according to the classical scheme: sprout, spring crops, perennial grasses, winter cereals.

II. Land suitable for all crops under cultivation and sowing across the slope (steepness of 1-3 °).

III. The lands are mainly suitable for spring crops. Overgrazing limits their suitability for winter crops, it is more appropriate to use crop rotation with a high percentage of perennial grasses.

IV. IV. Land suitable for regional crops, except flax, lupine; not suitable for potatoes. Here, field and feed crop rotation with growing of grain crops, root crops, corn, clover and annuals are projected.

V. Land suitable for continuous sowing (the slope inclination3-5 °). The land of this agroecogroup should be used for grain-grass field and forage soil protection crop rotations.

VI. The lands are mostly suitable for lupine, oats, winter rye, potatoes. This group includes poorly grown sandy sod-podzolic soils. Field crop rotations with a limited set of crops are recommended.

VII. Hayland destination land. This group includes regularly flooded soils, as well as meadows, peat bogs, peat bogs and turf soils.

VIII. The lands of the slopes that require constant engagement. The group includes soils, which lie on slopes with a steepness of more than 5 °.

IX. Pasture lands. This group includes turf-podzolic with strongly stony abandonment, as well as meadow-boggy and densely granulometric composition of sod gley soils.

X. Land for forestry purposes. The group includes turf weakly developed soils on thick sandy depressions occupied by forest.

The average value of the coefficient of plowing of the Polissian agro-landscapes should not be exaggerated by 0.33, that is, the ratio between the amount of arable land and forage lands (hayfields and pastures) should be 1: 2.

There is a geoinformation system (database) "Degradation of soils of Ukraine", authors Medvedev V.V., Laktionova G. M., Breus N.M, development is used to assess the ecological state of soils and land resources in Ukraine.

Agro-ecological factors are certainly important for planning of the structure of the land and zoning of the crops of the land fund of the average economic unit, but from the standpoint of substantiation of initiatives in the application of integrated mechanization of soil cultivation, the technical and economic indicators of land stands are equally important.

Table 4.4

Classification of soils by specific resistance (according to N.V. Shchukhin).

Soils	Specific resistance of soils, kPa
Light-textured soil	till 30
Mid-textured soil	30...50
Soil of moderate severity	50...70
Heavy soil	70...120
Extremely heavy soil	>120

The fact that for the scientifically substantiated determination of the operating parameters of machine aggregates, it is necessary to take into account the technical and economic characteristics of the plot of the field, substantively and deeply proved by the founders of the research of properties of agricultural machines and tools in their interaction with the environment.

Scientific institutions carry out constant monitoring of the land fund. On the basis of research and observation, scientifically based norms and norms of production on basic field work, taking into account specific soil-climatic conditions of farms are developed.

The energy intensity of soil cultivation is expressed by the specific resistance (Table 4.4.). Specific resistance is calculated by the rational formula of acad. Goryachkina V.P. to determine the traction resistance of plows.

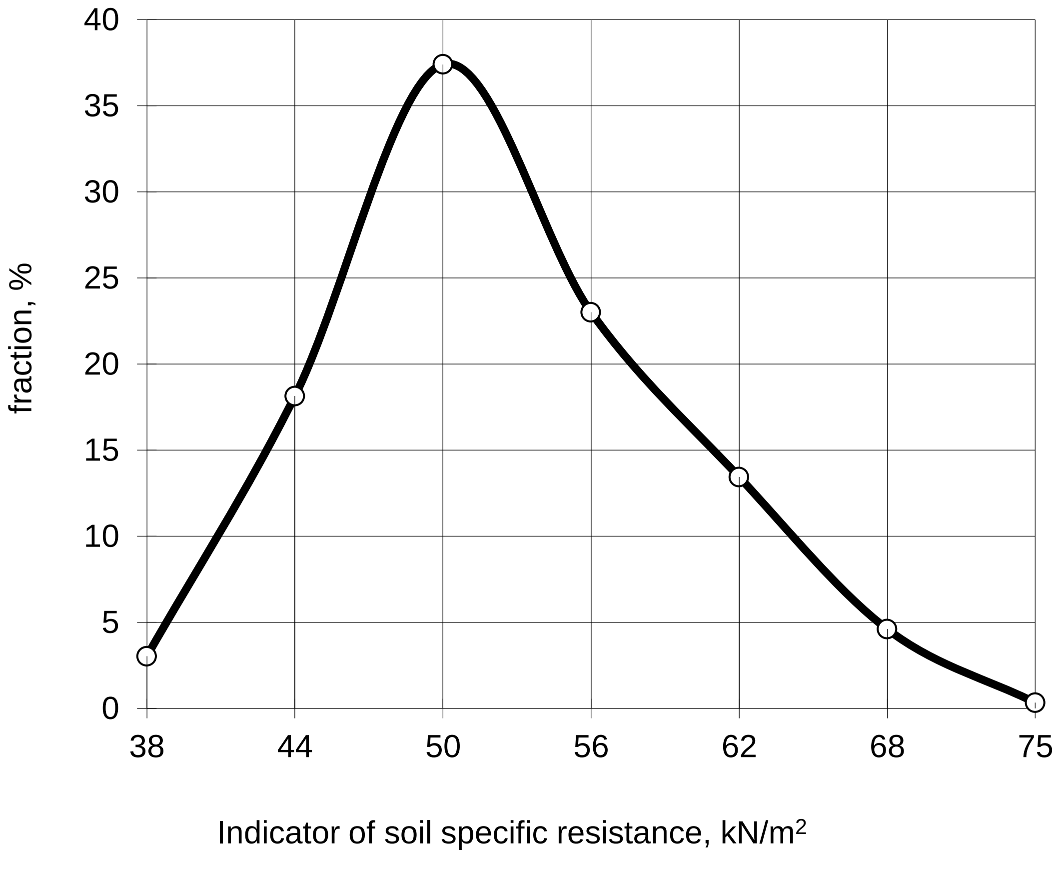


Fig. 4.5 - Allocation of Ukrainian Polissya region land areas by the indicator of the specific resistance of the soil

From the one hand, some soil scientists refer to the specific resistance that arises when plowing to the soil, and from the another hand famous engineers - to the plow. This is due to the presence of two concepts: the specific resistance of the soil and the specific resistance of the plow. This is an important indicator for determining the objective conditions for the use of soil aggregates, for the Polissya area of Ukraine the distribution of land areas is presented in Fig. 4.5.

The following are equally important natural factors that have a direct influence on the efficiency of application of soil cultivation complexes and which, of course, must be taken into account are the length of the runners (length of the working area of the field) and the angle of inclination of the relief of the field.

During machining, the machine unit performs work moves, when the working bodies are deepened, as well as idle moves when the useful work is not performed.

The size of the coefficient of work moves depends on the general working path of the soil-working unit, that is, the length of the stack. As distributed arable areas along the length of the unit is shown in Fig. 3.6.

The greater the length of the ranch of the land, the higher the coefficient of workflow, and the more efficient the machine aggregate.

Analyzing the given distribution of land. One can conclude that the greater part of them, the part has a length of 600 ... 1200 meters, which causes better possibilities for the use of wide-reaching aggregates. It should be noted that the work of machine aggregates at elevated speeds is accompanied by a decrease in the coefficient of workflow.

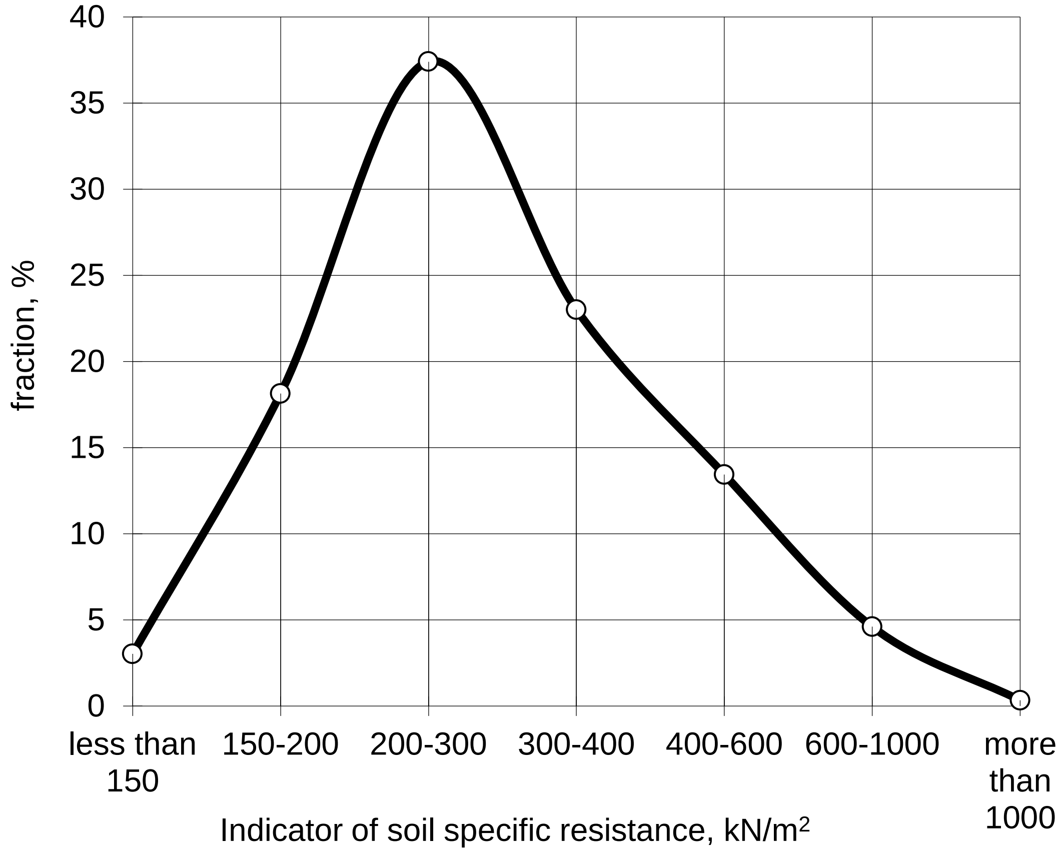


Fig.4.6 Allocation of Ukrainian Polissya region land areas by the length of races indicator

For objective planning of mechanized works, the distribution of areas at an angle of inclination is important (Figure 4.7.).

In terms of energy costs and the impact on productivity and specific fuel consumption, the angle of inclination of the relief of the field is directly related to the motion resistance. The higher the angle of inclination, the greater the traction resistance of the soil tillage machine or gun and the greater the power reserve of the power tool should be foreseen when assembling the machine aggregates.

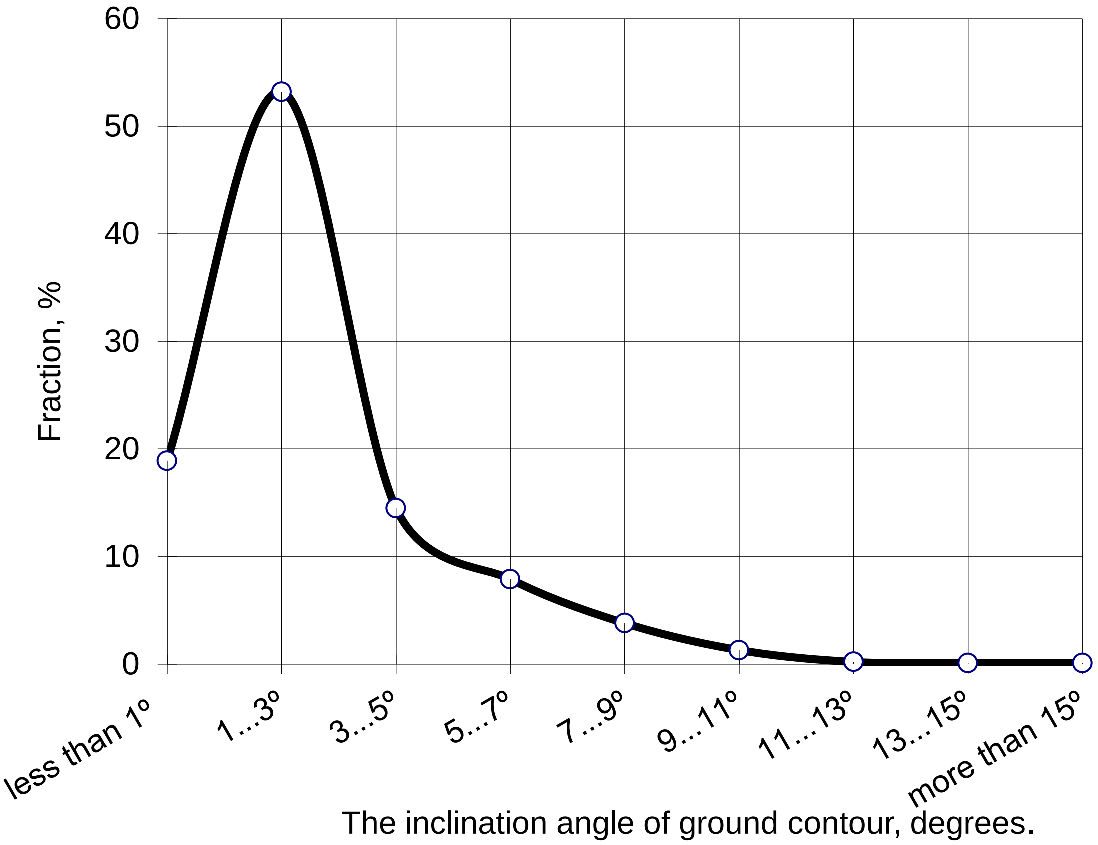


Fig. 4.7 — Allocation of Ukrainian Polissya region land areas by the indicator of the inclination angle of ground contour

From the point of view of compliance with agroecological requirements, the angle of inclination of the relief is decisive in the choice of production processes and mechanized soil cultivation technologies as a means of deterring destruction in agrolandscapes. Most of the land plots of the Polissya zone are 72.1%, the land is suitable for all crops under cultivation and sowing across the slope, another 14.5%, - suitable for continuous sowing and which should be used for soil protection crop rotation, 13.4% of land need constant engagement.

Agroecosystem is summarized as an agro-landscape in the form of a landscape. Not always a landmark has a rectangular configuration. The uniqueness of the Polissian zone of Ukraine lies precisely in the fact that the soil cover is often finely mosaic.

Distribution of areas of landslides according to the complexity of conditions is shown in Fig. 3.8.

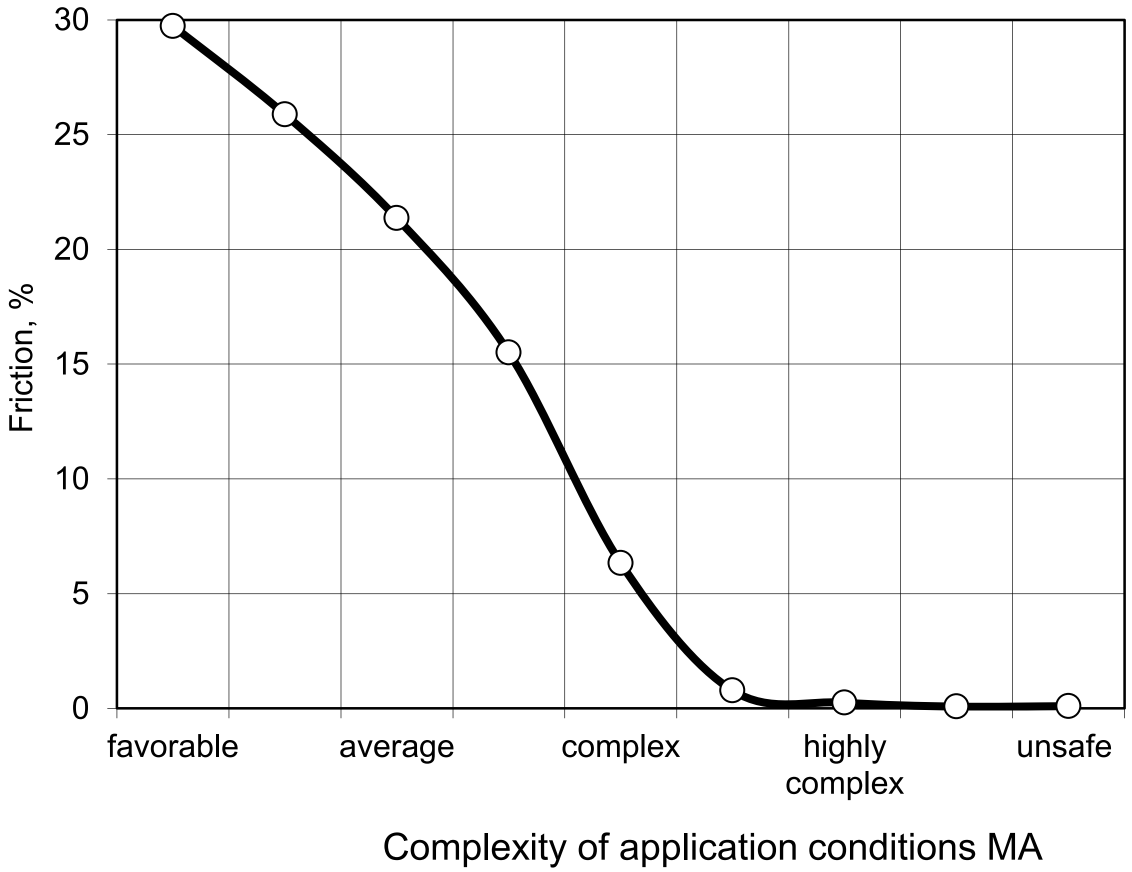


Fig. 4.8 — Allocation of Ukrainian Polissya region land areas by the indicator of the complexity of the configuration and the conditions of application

From the position of scientifically grounded definition of the composition of machine aggregates, the use of agricultural machinery is differentiated according to the conditions of the movement of aggregates, depending on the configuration of the field and obstacles to: favorable; normal; average medium-complex; complex; very complex; extremely complex; almost impossible; dangerous.

Among the set of factors that directly affect the state of a complex dynamic system, which are machine aggregates and machine complexes, the natural and production production conditions of their application are one of the main normo-forming factors. As we see a fairly significant part of land allocations, more than 75 percent, has not a complex configuration, the conditions for the use of machine aggregates, in the majority of them can be attributed to the normal.

The scientifically substantiated calculation of optimal parameters and regimes, the work of soil-working machinery complexes directly depends on the generalized average indicators that characterize their conditions, their application in the Polissya area of Ukraine. The average values of the parameters of the specific resistance of the soil, the length of the runners, the relief of the field, the complexity of the conditions are determined from the given distribution of values of areas of land stands. Fig. 4.5, 4.6, 4.7, 4.6.

$$x_{mid} = \frac{\sum F_n \cdot x_n}{\sum F_n},$$

where x_{mid} —	is the average value of the parameter of the normo-forming factor characterizing the working conditions of the machine complexes;
x_n—	***n***-is not the norm-forming factor that characterizing the working conditions of the machine complexes;
F_n—	the n-th value of the parameter of the norm-forming factor characterizing the operating conditions of the machine complexes.

Summarized averages are given in Table. 4.4.

All these features significantly differentiate agricultural production from other industries and create unique and specific conditions for the use of agricultural machinery. In accordance with these features, it is scientifically grounded to complete the machine aggregates and complexes of machines in order to ensure their rational use.

Table 4.4.

Significance of indicators characterizing the conditions of application of machine aggregates and machine complexes in the Polissya area of Ukraine

Normo-forming factor	Indicator value		
	Average value	-2σ	+2σ
Specific Resistance, kN/m^2	51,8	45,8	57,8
Length of working area, m	788	588	988
Angle of inclination, degrees	2,2º	1,2º	3,2º
Terms of use, category	normal	favorable	averages

Under these conditions, the decisive role in the conduct of technological processes and, in particular, in the high-efficiency use of modern high-yielding and high-technology machinery and the development of intensive technologies for the production of crop production belongs to the specialists of farms. From their qualifications, readiness for professional self-development, practical experience, knowledge of technology and technology depends on the success of agricultural production.

Features of the natural and productive characteristics of the agricultural enterprises of the forest-steppe zone of Ukraine.

The forest-steppe zone is located in the central part of Ukraine and covers Vinnytsia, Kyiv, Poltava, Sumy, Khmelnytsky, Ternopil, Kharkiv, Cherkasy and Chernivtsi regions. Some northern regions of Kiev, Sumy and Khmelnytsky regions are attributed to the Polissya area. Relatively mild winters, moderately humid and warm summers and fertile soils create the most favorable conditions in Ukraine for obtaining high and stable crops of almost all heat and moisture-loving crops. Crossing the wide band from the west to the east, the territory of the country between the Polissya in the north and the steppe in the South, the zone is marked by heterogeneity of soil-climatic and weather conditions.

When planning and implementing measures for further development and intensification of agriculture, it is necessary to take into account the agro-climatic conditions of the territory. This will make it possible to maximize the use of natural resources and to mitigate the impact of adverse weather conditions on crops.

The forest-steppe physical and geographical zone covers an area of more than 205 thousand km^2, which is about 34% of Ukraine's territory. Its natural conditions are heterogeneous in geomorphological, climatic, hydrological and lithographic-granulometric aspects, which is adequately reflected in the features of soil cover and its agro-industrial qualities.

One of the leading factors in the differentiation of natural conditions - relief. The Volyn Upland is located in the extreme northwest of the zone - within the southern part of Volyn and Rivne and north of Lviv regions. It is mostly a wavy plain, dissected by shallow gullies with mostly waterlogged bottoms and terraced river valleys. The relief in the southern part of the hill is replaced by a very hilly with the predominance of sloping territories. Volyn Hill is bordered by the so-called Small Polissya - a lowered plain of varying degrees of drainage, which is located mainly in the center of the Lviv region. Its characteristic feature is the proliferation of wetlands, which alternate with weakly wavy plains. The nature of the surface varies in the Field Boughs by alternating parallel passes in the width of 3 ... 4 km and the relative height of 30 ... 40 m with wide (up to 2 km) marshy valleys. Small Polissya borders on the south with Roztochya and Opil'em - an elevated area in the south of Lviv, north of Ivano-Frankivsk and southwest of the Ternopil region with various forms of relief, among which the most popular are hills with a relative height of 80-100 m. The slopes occupy places up to 60 % of area. Humpy ridges gradually toward the west and south are replaced by wavy plains. To the east of this territory, mainly within the central and southern parts of the Ternopil region, the Podilsky plateau up to 400 m is distributed - a plain area in the form of parallel flat underserved inter-ripe spaces and shallow canyon-like valleys of rivers. The plateau borders on Toltovym ridge - a chain of hills with a relative height of 40 ... 60 m to 100 m with flat vertices and steep slopes with limestone outcrops, which extends from Zbarazh to Kamyanets-Podilsky.

On the southwest of the forest-steppe in the rivers Prut and Dniester in the north of the Chernivtsi region is the Khotyn Hill.

The mentioned features of the relief cause the necessity of introducing a set of methods of reclamation and ecological agriculture in the technological processes of cultivating agricultural crops.

In the coldest month, January, the average air temperature ranges from minus 7-8ºC in the east of the zone to -40ºC in the west. The average temperature in February is almost the same as in January. Absolute temperature minima are minus 33, 38 ° C and occur once in 50-60 ° C. Minimum temperature minus 20 ° C and below is every year.

Winter is characterized by long and intense thaws with rising temperatures in some years to 12-14ºC. A characteristic feature of the thermal regime in winter is relatively small changes in temperature from a month to a month.

The summer period is marked by high stable temperatures without significant changes in the territory of the zone. In the warmest month - July - the average temperature is + 20 ° C in the east of the zone, falling to + 18 ° C in the west. The temperature in August differs from the temperature in July by 1-2 ºC. The greatest temperature drop occurs during October-November.

In the forest-steppe distribution of rainfall is marked by large unevenness. The best part is provided by them, the average annual precipitation here is 600-650 mm and more. The extreme east of the zone falls no more than 500 mm.

The zone of the Forest-steppe on the structure of soil cover is one of the most difficult ones - in the structure of its land fund, clear-gray forest (3.8% or 590.4 thousand hectares), gray forest (1786.6 thousand hectares or 11.3 %), dark gray podzolized (2054.9 thousand hectares, 13.0%), chernozems podzolized (3418.7 thousand hectares or 21.6%), typical black earths (5779.8 or 36.5) , meadow chernozem (450,7 thousand hectares, or 2,8%) and meadow (559,3 thousand hectares, or 3,5%) soils. The most widespread soils in the zone are black earth and gray pine forest. With high natural fertility, they are the main object of agricultural use.

In the southern strip predominate chernozems typical. The heavier granulometric composition of the soil, the higher the humus content. The deep humus horizon with a granular-laced structure causes the favorable water-air properties of chernozem soils - good permeability and aeration.

Chernozems predominate in the soil cover of the Left Bank Forest-steppe of Ukraine, and in the Right-bank large areas occupy gray forest soils with acid reaction. Among them are light-gray, dark gray, black earths podzoleny.

Gray, podzolized soils are common in the forest-steppe and Polissya. According to the degree of oxidation they are emitted weakly, moderately and strongly podzoleny. Due to the low structural and unfavorable water-air properties during the plowing, bricks are formed. They quickly settle down after treatment and swim easily.

The content of nutrients in these soils is low. Nitrogen is not enough, its amount depends on the content of humus. The degree of soil content of phosphorus and potassium is medium.

Regarding the natural resource potential of the forest-steppe agro-industrial complex, its quantity and quality are sufficient in order to radically change the crisis economic situation in agrarian production under certain conditions and to solve the problem of increasing the efficiency of its branches. However, as a result of high cultivation of agricultural lands (83.9%), the ecologically permissible ratio of arable land, natural forage lands, forest and water resources has increased, soil degradation has intensified, their fertility has significantly decreased, areas of acidified saltines, saline soils have increased, erosion of arable land has become significant lands.

The main component of the resource potential of agriculture in general and the branches of plant growing in particular are land resources. Under water, swamps and hydrotechnical structures there are 1000.4 thousand hectares, which makes 4.9% of the total area of the lands of the forest-steppe zone.

In farms of all categories of the Forest-Steppe zone there are 20289.3 thousand hectares of land, including 14571 thousand hectares (71.8%) of agricultural land, 11771.5 thousand hectares (58.1%) of arable land, 307.5 thousand hectares (1.4%) perennial plantations, 2401.2 thousand hectares (11.8%) of grasslands and pastures (tables 3.5 and 3.6). The largest agricultural area is concentrated in Kharkiv (2422.5 thousand hectares), Poltava (2875.0 thousand hectares), Vinnytsia (2649.2 thousand hectares), and the smallest in Chernivtsi (473.5 thousand hectares) and Ternopil (1054.9 thousand hectares) areas.

Table 4.5

The composition of land in the forest-steppe zone (by administrative-territorial distribution), ths ha.

Region	The total area	Agricultural land	Of these:				Forests and forest covered areas	Other land
			arable land	perennial plantations	natural forage lands	long-fallow land		
Vinnytsa	2649,2	2018,1	1730,6	49,1	238,2	0,2	376,3	254,8
Kyiv	2895,7	1681,5	1370,1	43,9	253,0	14,5	687,1	527,1
Poltava	2875,0	2185,0	1760,3	30,0	350,1	44,6	272,7	417,3
Sumy	2383,2	1708,2	1245,1	24,5	438,2	0,4	451,8	223,2
Ternopil	1382,4	1054,9	852,0	15,0	169,2	118,7	198,5	19,0
Kharkiv	3141,8	2422,5	1941,2	50,0	425,3	6,0	416,0	303,0
Khmelnytsky	2062,9	1570,3	1254,2	41,0	273,2	1,9	284,7	207,9
Cherkassy	2091,6	1457,1	1278,8	28,2	145,5	4,6	337,1	297,4
Chernivtsy	809,6	473,5	339,2	25,8	108,5	-	256,8	79,3
Total: in the forest-steppe	20291,4	14571,1	11771,5	307,5	2401,2	90,9	3281,0	2439,3
In Ukraine	60354,8	41800,4	32544,1	912,8	7938,7	404,8	10438,9	8115,5

Table 4.6

The lands distribution of the forest-steppe zone (by administrative-territorial allotment) by ownership form (to the total area)

Region	State property			Private property			Collective ownership (according to state acts)		
	Total lands	Incl agricultural land	Of them, arable land	Total lands	Incl agricultural land	Of them, arable land	Total lands	Incl agricultural land	Of them, arable land
Vinnytsya	47,2	31,7	22,3	52,4	67,9	77,3	0,4	0,4	0,4
Kyiv	55,9	26	19	43,3	73,2	80,4	0,8	0,8	0,6
Poltava	47,7	32,1	19,3	52,2	67,8	80,7	0,1	0,1	0,0
Sumy	48,2	28,6	21,7	51,8	71,4	78,3	-	-	-
Ternopil	37,8	23,1	15,9	55,6	71,4	80,8	6,6	5,5	3,3
Kharkiv	42,8	26,1	21,6	57,2	73,9	78,4	-	-	-
Khmelnytska	41	23,5	17,6	58,8	76,3	82,2	0,2	0,2	0,2
Cherkasy	48,8	26,9	20,7	51,1	72,9	79,1	0,2	0,2	0,2
Chernivtsy	55,4	25,3	14,6	44,6	74,7	85,4	-	-	-
Total: in the forest-steppe	47,2	27,6	19,9	52,1	71,8	79,7	0,7	0,6	0,4
In Ukraine	49,5	28,2	20,1	50,0	71,4	79,6	0,5	0,4	0,3

The zone is characterized by high plowing. Riela occupies 80.8% of agricultural land. In Cherkassy region, the level of cultivation reaches 90%.

High level of cultivation of land led to the development of significant erosion processes. An important direction in reducing the intensity of erosion processes, further degradation of soil cover is the continuation of work on the removal of unproductive, erosionally hazardous land. The reduction of arable land in cultivation and its transfer to natural forage lands and forging correspond to the basic principles of rational land use, protection and reproduction of soil fertility.

During the period of the land reform, as part of the agrarian transformation in the village, privatization of land was transferred to the ownership of non-state agricultural enterprises, a monetary valuation and placement of agricultural land were made, peasants' certificates for the right to a land parcel (share) were issued to the peasants. This created the conditions for the reform of collective agricultural enterprises into economic structures of a market type based on private ownership of land.

In the course of the land reform, there were 4937 former agricultural enterprises reformed, and 7285 new agro-formations of the market type were created on their basis. In total, 8466 thousand hectares of agricultural land are unpacked, of which 1162 hectares are of the same formation.

Changes in the socio-political structure of Ukraine and the transformation of its economy led to changes in the structure of the land fund by ownership. Areas of privately owned agricultural land, in terms of areas, range from 68 to 76% of the total land area, arable land - from 78 to 85%. The largest privately owned arable land is in the Chernivtsi region.

In the forest-steppe zone there are two largest cities in Ukraine - Kyiv (about 2.6 million people) and Kharkiv (about 1.5 million people), the population in each of the 16 cities, the study area reaches, more than 50 thousand people. In these cities the industrial and scientific-technical potential of the national importance is concentrated: the machine-building complex, the electrotechnical industry, instrument-making, electronics and other branches, which determine the scientific and technological progress in the national economy.

In the zone of Forest-steppe, a powerful agro-industrial complex was formed, which includes: agriculture; an industry that processes agricultural raw materials and produces the necessary machinery, equipment, and other means of production for this purpose; specialized transport; harvesting and sale of crop and livestock products.

The natural and economic conditions of the Ukrainian forest-steppe are favorable for the efficient production of many kinds of plant products: grains, sugar beets, potatoes, vegetables, fruits, etc. Fertile land in the zone, moderately warm climate, developed industry for processing agricultural products, convenient economic and geographical location led to the development of agricultural production.

Many years of business management and analysis of statistical data indicate that the most important branches of forest-steppe crop production are the production of grain and sugar beet, which are considered strategic for Ukraine.

In recent times, cereals become the dominant species in the structure of crop production. Each subject of management, by establishing certain proportions in the size of the industry, proceeds from its profitability. At the present stage, under the grain crops (wheat, barley, corn for grain) in the forest-steppe zone occupied 6833.1 thousand hectares, which makes up almost 58%. The largest area under grain crops is occupied in the Poltava, Kharkiv, Vinnytsia and Kyiv oblasts, and the least in Chernivtsi. Thus, wheat occupies 419.8 thousand hectares in the Kharkiv region, 327.0 thousand hectares in Poltava region, and -318.8 thousand hectares in Vinnitsa.

Significantly, the share of the forest-steppe zone in beet growing, which amounted to more than 70% of the collected area and gross national income of Ukraine. This was facilitated by the soil conditions of the region for the cultivation of sugar beet.

At the moment, the state of beet production in the agricultural enterprises of the zone is negative. In most farms, as a result of the economic crisis, this sector has been destroyed, which also affected the results of the industrial activity of rural commodity producers. First of all, it concerns agrarian enterprises of Vinnytsia, Poltava and Kharkiv regions.

Among fodder crops, large areas are allocated to corn for grain (1051.9 thousand hectares). The largest areas are occupied by this crop in Poltava (269.3 thousand hectares), Kiev (117.4 thousand hectares) and Cherkasy (167.6 thousand hectares).

Features of the natural and productive characteristics of the agricultural enterprises of the steppe of Ukraine.

The steppe zone occupies the southern and southeastern parts of Ukraine and contains 46.5% of the country's agricultural land. Under the conditions of the thermal regime, humidifying the territory and the soil, the zone is divided into the northern and southern sub-zones. The natural boundary between them is the line of transition of chernozems common in the south.

Among the most diverse natural resources, climatic resources occupy a significant place. From the way they are used, the results of human economic activity depend to a large extent. As research shows, high yields can only be obtained through the use of crops at the appropriate agrotechnical level, taking into account weather and climate characteristics.

Northern Steppes. The subzone includes Dnipropetrovsk, Luhansk, Donetsk regions, southern and south-eastern regions of the Kirovograd, Poltava and Kharkiv regions, northern regions of Mykolaiv, Kherson and Zaporizzhya regions, northern and central parts of the Odessa region. The continental climate. The average monthly rainfall is 425 ... 450 mm. They are distributed unevenly, idle periods often last for 25-30 days. High temperatures and low relative humidity often cause drought, especially in the second half of the summer. Strong winds cause soil deflation. The relief is predominantly equal, it is disturbed along the foothills of the Donetsk ridge and the spurs of the Middle Russian, Priazovsky and Volyn-Podilsky hills.

The southern steppe covers the southern and southwestern regions of the Odessa region, the southern regions of the Mykolaiv and Zaporizhzhia regions, the central and southern regions of the Kherson region and the Autonomous Republic of Crimea. This subzone is characterized by high air temperatures in the summer months, low relative humidity, frequent dryland, soil and air droughts. The average annual rainfall is 300 ... 450 mm, of which in the warm period of the year - 200 ... 250 mm, often in the form of storms, which are accompanied by a hail, storm or storm, which cause significant damage to agriculture. Almost annually there are impotent periods of different duration, including once every two years for more than 40 days. The largest amount of dry-day days - an average of 15 to 24 times per year - is observed in the Black Sea-Pryazov steppe. The southern steppe is mostly flat or shallow plain, separated by river valleys, ravines and gullies.

For most of the territory, Steppe is characterized by dust storms. Especially often they are repeated in the Kherson, Mykolaiv and Zaporizhzhya regions, in the central regions of Crimea and eastern regions of the Luhansk region.

The average annual air temperature in the zone of the Steppe fluctuates from 7.9 to 10.9 ° C of heat. In January, the coldest month of the year, the average air temperatures are in the range from 5.3-6.7° C of frost in the north-east of the Steppe to 0.4-4.1° C of frost in the southwest and in the steppe part of the Crimea. The absolute minimum temperature of air changes accordingly from minus 42° C to minus

20 °C. The lowest air temperature occurs when these continental arctic air flows into these latitudes. Such low air temperatures occur once every 50-60 years. The average monthly air temperature is approaching January.

Winter is characterized by intense thaws with an increase in air temperature to 10-20° C of heat. After thaw, there is a cooling down, which often leads to the formation of ice crust. Starting from March, the temperature of each next month increases by 6-8 °C.

The summer period is characterized by high temperatures without significant changes in the territory of the zone. In July, the warmest month of the year, the average air temperature is 21-22 °C. Record values of absolute maximum air temperatures reach 39-41 °C.

An important characteristic of the thermal regime of the steppe of Ukraine in relation to the cultivation of various crops is the duration of the warm period of the year in general and the period of vegetation in particular.

The vegetative period of most crops is limited to transitions in the spring and autumn of the average daily temperature of air through plus 5 °C.

The period of vegetation of heat-loving crops is limited to the transitions of the average daily temperature of air through plus 10 °C (as a rule, at this time there are no frosts), and the period of the most active vegetation - transitions of temperature through plus 15 °C.

In the second half of the XX century. the beginning, the end and the duration of the warm and cold periods of the year in the Steppe zone changed to 5 days. In this regard, the length of the growing season in various parts of the zone increases from north-east to south-west from 210 to 250 days. Summer ends in mid-September, and in the south - at the end of September - in early October, its duration was 120-140 days.

For the duration of the growing season of crops not only in the zone of the Steppe, region, district, but also in different fields of one farm significantly affected by frostbite (lowering the temperature to 0 °

and lower in the warm season). The first autumn frosts in the north-east of the Steppe are possible in late August, and in the south - in mid-September. Their average date falls on October. The end of spring frosts is observed on average in April, and in some years - even in the first decade of May. The number of frosty days is 165-200.

On the soil surface, spring frosts end later, and autumn is observed 10-25 days earlier than in the air.

In spite of the warming of the climate, in the last years of May, as a rule, frostbite occurs with a drop in temperature to minus 4-5 in the air and to minus 6-8°C on the surface of the soil. They occur at a higher background than air temperatures, which increases their negative impact on agricultural production. In 2009, for the first time in the Steppe zone, an abnormal phenomenon of death of winter wheat from May frosts was observed. Such anomalies, scientists explain the violations of the zonal transfer of air masses and intensive bays of cold from the Arctic latitudes in the spring, which have become more frequent in recent times. According to scientists-climatologists of the Ukrainian Research Hydrometeorological Institute, this pattern may persist in the future.

The area of the Steppe is about 249.4 thousand km^2, which has 17.4 million hectares of agricultural land, or 41.5% of all lands in Ukraine.

Agricultural lands make up 76.6% of the total land area, or 45.9% of the agricultural land in Ukraine.

The area of arable land is 15603,7 thousand hectares, or 48% of its total indicator for Ukraine.

In the area of agricultural land of the steppe zone, 2.4% falls on perennial plantations and 15.8% - on natural forage lands. The lands under forest and protective afforestation occupy 7.4%. the area of all land in the steppe zone.

The largest agricultural area is concentrated in Dnipropetrovsk (2512.3 thousand hectares) and Odesa (2594.5 thousand hectares), while the smallest is in Kherson (1968.5 thousand hectares) and Luhansk (1918.9 thousand hectares) areas (Table 3.6).

Accordingly, the area of arable land is also distributed. The zone is characterized by the highest plowing. Ryle occupies 81.4% of the area of agricultural land.

The highest in the Steppe zone is the level of agricultural land cultivation in the Kherson and Mykolaiv regions, respectively, 90.2 and 84.4%, while the lowest is in the Luhansk region and the Crimea - 70.0% and 69.0% respectively.

High plowing of the earth's Steppe does not contribute to the intensive management of agricultural production. After all, the use of degraded and poorly-grounded soils in the arable land leads to direct damage. Highly intensive use of arable land, a high level of cultivation of land and the use of eroded lands under crops, especially under cultivated crops, lead to the development of erosion processes and periodic dust storms in the steppe zone of the country, which cause great damage to the national economy.

In the fight against wind erosion, work is devoted to the creation of a system of forest protection strips. Under their influence on adjacent fields, wind, temperature, water regimes, wind erosion, more evenly distributed snow, etc., are changed. Protected forest strips reliably protect the fields from dry weather.

Changes in the socio-political structure of Ukraine and the transformation of its economy have led to land reform in our country. In the course of its implementation, the structure of the land fund was changed according to the forms of ownership. Data on the distribution of land by all land owners and land users by ownership by region are given in Table 3.6.

44.3% of land is in state ownership, of which 21.7% belongs to agricultural land, 55.1% and 71.3% of private ownership respectively. The distribution of land by ownership forms varies considerably in the context of administrative areas. Most of the state-owned land is concentrated in the Crimea and Kherson regions (respectively 55.8% and 50.0%), and privately in the Zaporizhzhya, Kirovohrad Mykolaiv regions (63.4, 58.4%, 57.1%). In the economy of the steppe, the agrarian sector is of great importance. Almost every agricultural enterprise develops crop production in one way or another, but a significant part of agricultural enterprises has reduced the production of livestock products because of its loss-making nature. The main branches of agriculture in the steppe in plant growing are the production of grain, sunflower and vegetables, and in livestock - meat and dairy cattle breeding. The production of plant products in the areas of the Steppe zone has the distribution presented in Table 4.7.

Table 4.7

Structure of land in the steppe zone, ths.ha

Regions	Total area	Agricultural lands	Of these:				Forests and forest covered areas	Other land
			arable land	perennial plantations	natural forage lands	long-fallow land		
Crimea	2694,5	1828,2	1261,7	100,0	452,9	13,6	334,0	532,3
Dnipropetrovsk	3192,3	2512,3	2122,3	55,6	334,4	-	191,4	488,6
Donetsk	2651,7	2047,6	1655,0	59,7	332,9	-	203,2	400,9
Zaporozhye	2718,3	2247,5	1903,5	40,0	303,2	0,8	115,9	354,9
Kirovograd	2458,8	2042,0	1766,9	26,9	248,2	-	180,6	236,2
Lugansk	2668,3	1918,9	1343,7	31,3	508,9	35,4	341,3	408,1
Nikolaev	2458,5	2011,6	1699,4	36,4	274,3	1,5	120,2	326,7
Odessa	3331,3	2594,5	2076,5	90,7	407,4	19,9	222,9	513,9
Steppe	25019,8	19171,1	15603,7	467,4	3028,8	71,2	1860,6	3988,1
Ukraine	60354,8	41800,4	32544,1	912,8	7938,7	404,8	10438,9	8115,5

Table 4.8

Distribution of land by ownership,% of total area

Region	State property			Private property			Collective ownership (according to state acts)		
	Total lands	Incl agricultural land	Of them, arable land	Total lands	Incl agricultural land	Of them, arable land	Total lands	Incl agricultural land	Of them, arable land
Crimea	55,8	24,4	23,8	43,9	64,0	76,2	0,4	0,4	-
Dnipro	44,4	29,9	18,7	55,5	70,0	81,3	0,4	-	-
Donetsk	41,2	26,1	20,0	56,6	72,7	79,0	0,1	0,1	1,0
Zaporizhye	36,2	23,8	19,0	63,4	76,0	80,0	2,2	1,2	0,1
Kirovograd	41,3	30,1	21,4	58,4	69,6	78,3	0,4	0,2	0,3
Lugansk	43,2	22,9	19,0	55,1	76,0	80,0	0,3	0,3	1,0
Mykolayv	42,7	30,6	21,5	57,1	69,2	78,4	1,7	1,1	0,1
Odessa	43,4	28,0	20,0	56,4	71,8	79,8	0,2	0,2	0,2
Kherson	50,0	28,3	23,6	49,7	71,3	76,0	0,3	0,4	0,4
Steppe	44,3	21,7	20,6	55,1	71,3	79,0	0,6	0,4	0,3
Ukraine	49,5	28,2	20,1	50,0	71,4	79,6	0,5	0,4	0,3

§ 4.5. The rational technological processes in crop production and their theoretical bases of the development

Theoretical foundations and methods of designing mechanized technological operations are developed in the works of Zavalishin F.S, Kirtbaya Yu.K., Iofinova S.A., Didenko M.K., Sydorchuk OV, Melnik I.I., Pastukhov V.I., Grechkosia V.D. etc. First and foremost, the general principles of constructing technological processes include:

a) the continuity of work or movement of the material being processed;

b) the consistency of operations in time and space;

c) the most complete loading of all parts of the technological process;

d) the least turnover of materials, goods and technical means;

e) the principle of rhythmic operations (for the current process).

At the same time, the production process is constructed in such a way that the object being processed (from one machine unit to another) or machine aggregates itself (in stationary material) move continuously (taking into account not only mechanical but also biological changes of the object being processed) Each kind of continuity has its own specificity and has one or another advantage and disadvantages. For the rational construction of technological processes, the principle of continuity is important because of the desired continuity of the movement of the material, in which it is possible to construct technological processes without intermediate operations of storage, storage and reloading operations. To maintain the continuity of the technological process, it is necessary that the volumes of the already processed material in its various links be the same at any time of the technological process. In the field of agricultural processes, continuity has a pulsating character, in which the material that is processed from one machine aggregate to another moves in certain doses, parts.

Quantitatively, the degree of continuity $Ст_б$ is proportional to the ratio [62]

$$Ст_б = \frac{q}{Q};$$

where q — second throughput of working machines;

Q — load carrying capacity of vehicles.

The degree of continuity $Ст_б$ also, in some cases, can be characterized by the ratio of the number of technological operations n_{tech} to the actual number of production operations $n_{p.o.}$.

Consistency of production operations in time involves the implementation during the technological process of each operation is necessarily at a certain technology time, with the necessary intervals between operations, and consistency in space - the execution of operations on a given field or corner.

The principle of the most complete loading of all parts of the technological process involves such a high-quality dismemberment of the process, which ensures high productivity of the complexes of machines and machine aggregates and high productivity (as a whole throughout the technological line, and on its individual elements, links).

The download here should be attributed to: Duration of operations; bandwidth of cars; power and other operating parameters of machine aggregates.

The smallest turnover of materials, loads and technical means. Technological processes in which the mutually agreed field agricultural assembly, distribution, transport operations, connected with the movement of machines and the processed material are performed - with their cargo turnover. At the same time, a considerable part of both labor costs and mechanical work and technical equipment is attributed to the movement of machine aggregates, processed material, ie - to the circulation of materials, goods and technical equipment. Therefore, one of the important principles of the construction of mobile technological processes is the principle of the least turnover of materials, goods and technical means.

These general principles are generally manifested simultaneously and consistently, but sometimes they have to face certain contradictions. For example, the continuity of material flow can reduce the number of intermediate warehouses and the number of operations, but machine aggregates can not be fully loaded.

Characteristics of technological processes. By the nature of the movement of the treated material and other features of the process can be:

a) monotonous;

b) continuously pulsating;

c) continuous flow;

d) consecutive.

A monotonous process involves:

a) continuous movement of the processed material;

b) the amount of material in individual parts of the process remains constant at any time;

c) the quality of the material being processed remains unchanged throughout the period.

This kind of process is perfect and can be considered for comparative purposes.

Continuously pulsing-production process characterized by the fact that the material is handled within the complex machines, and which, in turn, make a production line (manufacturing operations consistent group), moving continuously. The said movement is carried out - for transfer to vehicles or technological machines that perform the accumulation or concentration of the material being processed. In this technological indicators of machine units are consistent with each other, that discharge from one (for example, with the combine harvester) is a load to another (in vehicles, storage). The material moves continuously, but in separate portions, ripples.

Continuously-streaming process is widely used in harvesting. The technological process is distinguished by the divided groups, which are separated from each other in time. The processed material within this group of operations moves continuously, in separate portions. Between separate groups of the process, the continuity of material movement is violated (intermediate storage is used). Such processes are built without alterations, that is, further operations are not violated by the previous operations.

Sequential process. In this process, one operation is separated from the other in time, the processed material moves intermittently. An example is the production process of cultivating any agricultural crop.

Streaming technology. To create the continuity of the flow, it is necessary to adhere to the principle of equality in the performance indicators of all components of the technological complex of machines, [62] ie

$$\begin{cases} \sum W_\Sigma = n_1 W_{h.1} T_1 = n_2 W_{h.2} T_2 = \cdots = n_m W_{h.m} T_m \\ \qquad\qquad\qquad or \\ \sum \acute{W}_\Sigma = n_1 \acute{W}_{h.1} T_1 = n_2 \acute{W}_{h.2} T_2 = \cdots = n_m \acute{W}_{h.m} T_m \end{cases}$$

where $\sum W_\Sigma$; $\sum \acute{W}_\Sigma$ — total productivity of the links of the flow per day in units of area and in units of mass (the main or additional product);

$W_{h.}$; $\acute{W}_{h.}$ — respectively, per hour;

n — number of machine aggregates or transport units;

T — daily lifetime of the machine, h.;

The indices 1,2, m denote individual components of the flow of the stream (groups of the same names or machines of the same type).

Proceeding from this condition, it is possible to vary the number of machine aggregates or transport units in the line n_i, in some limits -

the daily working time T, and the hourly productivity $W_{h.}$ (By selecting the standard size of machines).

It is known that one and the same mechanized technological operation with quality that satisfies agrotechnical requirements can be performed by a certain number of machine aggregates with a certain number of variants of aggregation of tractors and agricultural machines. The categorically unequivocal condition for successful performance of the machine aggregate is the observance of the latest agrotechnological requirements determined by the system of technological operations, that is, the technology of cultivation. In other words, a machine aggregate can achieve a certain quality of mechanized technological operation and thus maintain the planned technological level of production, or can not and can not categorically be included in the complex of machines. To determine the tact of the production process, consisting of several units, the main (lead) link is selected, whose daily productivity is determined by the required number of other units [62]:

$$n_i = \frac{nW_{h.}T}{W_{h.i}T_i}.$$

To ensure the continuity of the flow, it is required that the performance of the links be the same or multiple. In cases where performance in the previous units is higher than in the following, there is a conditional flow organization of production processes of the technological cycle with the formation of the so-called completion. The difference in productivity of the variable units $W_{h.i} - W_{h.i+1}$ is the hourly output for each subsequent process or operation.

The starting point for all these calculations is the planned agronomic terms of mechanized works, cultivations, yields and the ratio between the main and by-products, the distance of materials transportation, the productivity norms on the main, auxiliary and transport processes of the production complex.

§4.6. Technical and operational indices of machine aggregates for performing mechanized operations in crop production

The mathematical model developed by the Department of Technical Service and Engineering Management of the National University of Life and Environment science of Ukraine enables, firstly, to determine the rational structures of the crop area as the basis for substantiating the rational composition of machine aggregates and machine complexes in the system of crop rotation, and secondly, to carry out a more precise calculation of norms production and fuel consumption at work of machine aggregates in accordance with developed gradation corrections for determination of coefficient of complexity of conditions the use of, and, thirdly, optimize the complex of machines and machine-tractor aggregates when performing a certain technological process, depending on the area of cultivating the crop.

According to our computer program of optimization of machine-tractor units, machine complexes and machine park for the production of plant products, each of the technological operations can simultaneously calculate the rates of use of up to 10 competing aggregates.

Table 4.9-4.15 provides technical and operational indices of competing machine aggregates for performing basic (typical) operations of growing and harvesting agricultural crops in the agro-climatic zones of Ukraine (Step, Forest-steppe and Polissya) for 1000 hectares.

Table 4.9.

Technical and operational indicators of machine units (zone steppe)

Agricultural operations	Machine units		Required quantity	Specific indicators of work (per hectare)			Coefficient of machinery's apply
	Tractors	Agricultural machinery		Labor costs, person · year/ha	Productivity, ha/h	Fuel consumption, kg/ha	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Minimal cultivation	МТЗ-80.1	АГ-2,4-20	4	0,658	1,52	4,31	0,99
	ХТЗ-17022	УДА-3,8-20	3	0,413	2,42	5,85	0,83
	ХТЗ-17022	КШН-5,6	2	0,277	3,61	4,1	0,83
	К-744 Р1	УДА-4,5-20	3	0,343	2,91	8,5	0,69
	Jh.Deere7530	Smar 9/400	3	0,346	2,89	4,18	0,69
	МФ-6499	MIXTER109	3	0,346	2,89	5,05	0,69
	Jh.Deere 8430	MIXTER 113	2	0,229	4,37	4,65	0,69
Plowing reversible	К-744 Р1	ПОН-7-40	2	0,639	1,56	20,29	0,91
	ХТЗ-17022	ПНО-5-40	4	1,312	0,76	18,3	0,94
	ХТЗ-17022	ПО-5	3	0,91	1,1	17,54	0,87
	ARION 640	Діамант 9	3	0,84	1,19	15,52	0,8
	МФ-8480	Diam10 7+1	2	0,463	2,16	14,72	0,66
	AXION 850	Diam.8 6к	2	0,584	1,71	14,33	0,83

Continuation of Table 4.9.

1	2	3	4	5	6	7	8
Sowing soil tillage	ХТЗ-17022	АГ-6	2	0,263	3,8	4,32	0,75
	ХТЗ-17022	ККП-6	2	0,263	3,8	4,39	0,75
	ХТЗ-17022	АП-6	2	0,262	3,81	4,17	0,75
	Jh.Deere 9530	К 800	2	0,191	5,24	6,52	0,55
	Jh.Deere 8430	К 600 PS	2	0,253	3,95	5,5	0,72
	Jh.Deere 8430	Евр_Б-622	2	0,252	3,98	5,19	0,72
Adding herbicides	МТЗ-80,1	Степ 2500	4	0,094	10,6	0,82	0,79
	МТЗ-80,1	ЭКО-2000	4	0,094	10,59	0,84	0,79
	МТЗ-80,1	ОПШ-3524	3	0,074	13,46	0,79	0,83
	МФ-5435	Commander	3	0,072	13,98	0,72	0,79
	Jh.Deere 6830	Campo 32	3	0,07	14,34	0,83	0,77
	ИБИС-2500		2	0,043	23,5	0,59	0,71
	SPRA 7660		2	0,034	29,66	0,67	0,56
	AS 1010		2	0,034	29,63	0,68	0,56

Table 4.10.

Technical and operational indicators of machine units for the sowing and harvesting of sugar beets in the forest-steppe zone

Agricultural operations	Machine units		Required quantity	Specific indicators of work (per hectare)			Coefficient of machinery's apply
	Tractors	Agricultural machines		Labor costs, person· year/ha	Productivity, ha/h	Fuel consumption kg/ha	
Sowing	МТЗ-80.1	УПС-12	5	0,369	2,71	2,76	0,92
	МТЗ-80.1	СТВТ-12/8М	5	0,369	2,71	2,73	0,92
	МТЗ-80.1	СУПН-8А-02	4	0,314	3,19	2,38	0,98
	МТЗ-80.1	Клен-5,6С	5	0,725	2,76	2,29	0,91
	МТЗ-80.1	Клён-5,6С	5	0,725	2,76	2,29	0,91
	МТЗ-80.1	УПС-6-02	6	0,42	2,38	3,03	0,87
	Jh.Deere6830	OPTIMA 18	4	0,538	3,72	2,17	0,84
	МФ-5435	OPTIMA 12	5	0,789	2,53	2,07	0,99
Harvesting	КС-6Б-10		3	0,711	1,41	10,28	0,95
	SF-10-2		2	0,435	2,3	10,68	0,87
	Terra Dos		2	0,462	2,17	13,7	0,92
	М-41		2	0,467	2,14	12,39	0,93

Table 4.11.

Technical and operational indicators of machine units for the planting and harvesting of winter rape in the forest-steppe zone

Agricultural operations	Machine units		Required quantity	Specific indicators of work (per hectare)			Coefficient of machinery's apply
	Tractors	Agricultural machines		Labor costs, person·year/ha	Productivity, ha/h	Fuel consumption kg/ha	
Sowing	К-744 Р1	Солітер 12	2	0,116	8,62	4,96	0,73
	МТЗ-920	Клен-6П	4	0,489	4,09	2,26	0,76
	ХТЗ-17022	МВЗ-4,5	5	0,712	2,81	5,88	0,89
	Jh.Deere 8430	СТА 4000	2	0,132	7,58	3,25	0,82
	Jh.Deere 7830	2N 3010	3	0,175	5,72	3,98	0,73
	Jh.Deere 7530	SPEEDL6000	4	0,258	3,88	4,5	0,81
	Jh.Deere 6830	SPEEDL3000	7	0,515	1,94	5,97	0,92
Straight combine harvester	AGROS-530		7	0,82	1,22	20,9	0,92
	КЗС-9_Сл	ПР-6-01	8	0,991	1,01	22,24	0,97
	ЕНИСЕЙ1200	ПР-5	11	1,376	0,73	20,9	0,98
	Jh.D 9660STS	ПР-6,7-04	5	0,545	1,84	18,18	0,85
	Jh.D 9880STS	ПР-6,7-04	4	0,457	2,19	18,47	0,89
	Dominat130	ПР-4,5-02	10	1,254	0,8	18,19	0,98

Table 4.12.

Technical and operational indicators of machine units for the planting and harvesting of fibre flax in the Polissya area

Agricultural operations	Machine units		Required quantity	Specific indicators of work (per hectare)			Coefficient of machinery's apply
	Tractors	Agricultural machines		Labor costs, person·year/ha	Productivity, ha/h.	Fuel consumption kg/ha	
Sowing	К-744 Р1	Солітер 12	2	0,134	7,48	6,33	0,96
	МТЗ-920	Клен-6П	4	0,549	3,64	2,83	0,98
	ХТЗ-17022	МВЗ-4,5	6	0,808	2,48	7,46	0,96
	Jh.D 8430	СТА 4000	3	0,152	6,57	4,14	0,73
	Jh.D 7830	2N 3010	3	0,199	5,01	5,07	0,95
	Jh.D 7530	SPEEDL6000	5	0,29	3,45	5,7	0,83
	Jh.D 6830	SPEEDL3000	9	0,581	1,72	7,57	0,92
Harvesting	МТЗ-80.1	ЛКВ-4А 2ПТС-4-887	13	1,701	0,59	16,33	0,93

Table 4.13.

Technical and operational indicators of machine units for the planting and harvesting of potatoes in the Polissya area

Agricultural operations	Machine units		Required quantity	Specific indicators of work (per hectare)			Coefficient of machinery's apply
	Tractors	Agricultural machines		Labor costs, person·year/ha	Productivity, ha/h	Fuel consumption kg/ha	
Planting	МТЗ-80.1	КС-4	10	0,728	1,37	6,32	0,91
	ХТЗ-2511	КС-2	18	1,465	0,68	6,58	1,02
	МФ-5435	Marathon	8	0,633	1,58	5,12	0,99
	МФ-5435	GL 32B	16	1,248	0,8	8,53	0,97
Mowing halm	МТЗ-80.1	ДБР-2,8	2	0,712	1,41	6,22	0,89
	МФ-5435	4LKB310	2	0,63	1,59	4,41	0,79
Potatoes harvesting	МТЗ-80.1	ККЗ-2	11	4,402	0,45	21,46	1,00
	ХТЗ-17022	КПК-3	9	8,697	0,57	27,07	0,97
	ARES 616	RDT 1700	10	1,935	0,52	23,13	0,97
	Jh.D 6830	RDT 1700	10	1,937	0,52	24,95	0,97

Table 4.14.

Technical and operational indicators of machine units for the planting and harvesting of winter wheat in the steppe zone

Agricultural operations	Machine units		Required quantity	Specific indicators of work (per hectare)			Coefficient of machinery's apply
	Tractors	Agricultural machines		Labor costs, person· year/ha	Productivity, ha/h	Fuel consumption kg/ha	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Sowing	К-744 Р1	Сіріус-10	1	0,141	7,09	3,64	0,5
	К-744 Р1	Солітер 12	1	0,1	10,01	3,21	0,36
	ХТЗ-17022	СПУ-11-1+ СЗ-3,6А (3 шт.)	1	0,283	7,07	1,8	0,51
	ХТЗ-17022	МВЗ-4,5	2	0,621	3,22	4,08	0,55
	МТЗ-920	Клен-6П	1	0,428	4,68	1,56	0,76
	МТЗ-80.1	СЗ-5,4	1	0,524	3,82	1,78	0,93
	Jh.D 8430	СТА 4000	1	0,113	8,83	2,27	0,4
	Jh.D 7830	2N 3010	1	0,151	6,64	2,56	0,54
	Jh.D 7530	SPEEDL6000	1	0,224	4,47	2,98	0,8
	Jh.D 6830	SPEEDL3000	2	0,447	2,24	4,13	0,8

Continuation of Table 4.14.

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Sowing	К-744 Р1	Солітер 12	2	0,099	10,1	2,72	0,53
	К-744 Р1	Сіріус-10	2	0,14	7,13	3,31	0,75
	ХТЗ-17022	СТС-6	3	0,226	4,43	2,79	0,81
	МТЗ-80.1	СТС-2	8	0,678	1,47	3,53	0,91
	Jh.D 8430	СТА 4000	2	0,112	8,89	2,08	0,6
	Jh.D 7830	2N 3010	2	0,149	6,71	2,21	0,8
	Jh.D 7530	SPEEDL6000	3	0,222	4,51	2,68	0,79
	Jh.D 6830	SPEEDL3000	5	0,443	2,26	3,75	0,95
Straight combine harvester	AGROS-530		5	0,494	2,02	11,45	0,82
	ЕНИСЕЙ1200		7	0,825	1,21	11,35	0,98
	КЗС-9_Сл		5	0,595	1,68	12,17	0,99
	Jh.D 9660STS		3	0,327	3,06	9,95	0,91
	Jh.D 9880STS		3	0,274	3,65	10,19	0,76
	LEXION560		3	0,326	3,07	7,34	0,90
	LEXION580		3	0,289	3,46	7,6	0,80
	MF 9790		3	0,294	3,4	10,02	0,82

Table 4.15.

Technical and operational indicators of machine units for the planting and harvesting of sunflower in the steppe zone

Agricultural operations	Machine units		Required quantity	Specific indicators of work (per hectare)			Coefficient of machinery's apply
	Tractors	Agricultural machines		Labor costs, person·year/ ha	Productivity, ha/h	Fuel consumpti on kg/ha	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Sowing	МТЗ-80.1	УПС-12	4	0,32	3,13	2,45	1,00
	МТЗ-80.1	СТВТ-12.8М	4	0,285	3,51	2,34	0,89
	МТЗ-80.1	СУПН-8А-02	4	0,281	3,56	2,19	0,88
	МТЗ-80.1	Клен-5,6КП	4	0,627	3,19	1,95	0,98
	МТЗ-80.1	УПС-6-02	5	0,373	2,68	2,72	0,93
	МТЗ-80.1	УПС-8-02	4	0,28	3,57	2,31	0,88
	МФ-6480	MF 555	3	0,178	5,63	1,7	0,74
	Jh.D 7530	ДжДір 1710	3	0,179	5,6	2,05	0,74
	Jh.D 6920SE	ДжДір 1780	4	0,266	3,76	2,94	0,83
	Jh.D 6920SE	Кінзе 3000	4	0,267	3,75	3,07	0,83

Continuation of Table 4.15.

1	2	3	4	5	6	7	8
Harvesting	ACROS-530	ПС-6	6	0,664	1,51	8,84	0,92
	КЗС-9_Сл	ПЗС-8_	7	0,784	1,27	16,86	0,93
	КЗСР-9_Сл	ПС-6	7	0,755	1,33	10,95	0,9
	ACROS-530	ПЗС-8_	6	0,654	1,53	14,77	0,91
	ЕНИСЕЙ1200	ПЗС-8_	10	1,09	0,92	15,66	0,91
	MF 9790	RD 870 B	4	0,383	2,61	10,54	0,8
	Jh.D 9660STS	RD 870 B	4	0,428	2,33	10,17	0,89
	Jh.D 9880STS	ПС-6,7-05	4	0,369	2,71	7,69	0,77
	LEXION580	RD 870 B	4	0,382	2,61	11,73	0,8
	LEXION560	RD 870 B	4	0,433	2,31	11,31	0,9

accounting

A comprehensive system for recording and summarizing business transactions.

accounting period

The period of time over which accounting transactions are summarized.

account payable

An expense that has been incurred but not yet paid.

account receivable

Income that has been earned but for which no payment has been received.

accrual accounting

An accounting system that recognizes income when it is earned and expenses when they are incurred.

accrued expense

An expense that has been incurred, sometimes accumulating over time, but has not been paid.

adjusted basis

The current tax basis of an asset, equal to the original basis reduced by the amount of depreciation expense claimed and/or increased by the cost of any improvements made.

Agricultural Stabilization and Conservation Service (ASCS)

An agency of the U.S. Department of Agriculture that administers farm production control, price stabilization, and conservation programs.

amortized loan

A loan that isscheduled to be repaid in a series of periodic payments of both interest and principal.

annual percentage rate (APR)

The true annual rate at which interest is charged on a loan.

Annuity

A series of equal periodic payments,

appraisal

The process of estimating the market value of an asset.

Appreciation

An increase in the market value of an asset.

asset

Physical or financial property which has value and is owned by a business or individual.

average

fixed cost (AFC) Total fixed cost divided by total output; average fixed cost per unit of output,

average physical product (APP)

The average amount of physic«! output produced for each unit of input used.

average total cost (ATC)

Total cost divided by total output; average cost per unit of output.

average variable cost (AVC)

Total variable cost divided by total output; average variable cost per unit of output,

balance sheet

A report summarizing the assets, liabilities, and net worth of the business at a point in time.

balloon loan

A loan amortization method in which a large portion of die principal is due with the final payment.

basis (marketing)

The difference between the local cash price and the futures contract price of the same commodity, basis (tax) The value of an asset for tax purposes.

Bonus

A payment made to an employee in addition to the normal salary, based on superior performance or other criteria.

book value

The original cost of an asset minus the total depreciation expense taken to date.

break-even price

The selling price for which total income will just equal total expenses foragiven level of production,

break-even yield

The yield level at which total income will just equal total expenses at a given selling price.

breeding livestock

Livestock owned for the primary purpose of producing offspring, budget An estimate of future income, expenses, or cash flows.

bushel lease

A leasing arrangement in which the rent is paid as a specified number of bushels of grain delivered to the landowner,

capital

A collection of physical and financial assets that have a market value,

capital asset

An asset that is: expected to provide services through more than one production cycle, and can be used to produce other assets or services,

capital budgeting

A process for determining the profitability of a capital investment

capital gain

The amount by whieh the sale value of an asset exceeds its cost or tax basis.

capitalization method

A procedure for estimating the value of an asset by dividing the expected annual net returns by an annual discount rate.

cash accounting

An accounting system that recognizes income when it is actually received as cash and expenses when they are actually paid.

cash expenses

Expenses that require the expenditure of cash, cash flow The flow of funds into and out of a business.

cash flow budget

A projection of the expected cash inflows and cash outflows for a business over a period of time.

cash rent

A rental arrangement in which the operator makes a cash payment to the owner for the use of certain property* pays all production costs, and keeps all the income generated.

coefficient of variation

A measure of the variability of the outcomes of a particular event; equal to the standard deviation divided by the mean, collateral Assets pledged as security for a loan.

Commodity Credit Corporation (CCC)

An entity controlled by the U.S. Department of Agriculture which buys and sells surplus commodities and provides loans for certain government farm programs.

comparable sale

An actual land sale used in an appraisal to help estimate the market value of a similar piece of land.

comparative analysis

The comparison of the performance level of a farm business to the performance level of other similar farms in the same area or to other established standards.

competitive enterprises

Enterprises for which the output level of one can be increased only by decreasing the output level of the other, complementary enterprises Enterprises for which increasing the output level of one also increases the output level of the other.

Compounding

The process of determining the future value of an investment or loan, in which interest is charged on the accumulated interest as well as the original capital.

control

The process of monitoring the progress of a farm business and taking corrective action when desired performance levels are not being met.

corporation

A form of business organization in which the owners have shares in a separate legal entity that itself can own assets and borrow money.

Credit

The capacity or ability to borrow money.

Crop share lease

A lease agreement in which crop production and certain input costs are divided between die operator and the owner.

Cumulative distribution function A graph of all the possible outcomes fra' a certain event, and the probability that each outcome or one with a lower value will occur.

current assets

Assets that, are normally used up or sold within a year and which can be convened to cash quickly.

current liabilities

Liabilities that are normally paid within a year, current ratio The ratio of current assets to clirtent liabilities; a measure of liquidity.

custom farming

An arrangement in which the landowner pays the operator a fixed amount to perform all the labor and machinery operations needed to produce and harvest a crop.

custom work

An arrangement in which an operator performs one or more machinery operations for someone else for a fixed charge.

Cwt

An abbreviation for hundredweight, equal to 100 pounds. Many livestock products and some crops are priced by this unit.

Debt

An obligation to pay, such as a loan Or account payable, debt/asset ratio The ratio of total liabilities to total assets; a measure Of solvency.

debt/equlty ratio

The ratio of total liabilities to owner's equity; a measure of solvency.

debt service

The payment of debts according to a specified schedule.

decision tree

A diagram that traces out all the possible strategies and outcomes for a particular decision or sequence Of related decisions, deflation A general decrease in the level of all prices.

depreciation

An annual, noncash expense to recognize the amount by which an asset loses value due to use, age, and obsolescence.

depreciation recapture

Taxable income that results from selling a depreciable asset fra more than its adjusted tax basis.

diminishing returns

A decline in the rate at-which total output increases as more and more inputs as used.

discounting

The process of reducing the value of a sum to be paid or received in the future by the amount of interest that would be accumulated on it to that point in time.

discount rate

The interest rate used to find the present value of tin innouni to be paid or received in the future.

diseconomies of size

A production relationship in which the average total cost per unit of output increases as more output is produced or is negatively correlated.

Diversification

The production of two or more commodities for which production levels and/or prices are not closely correlated.

double-entry accounting

An accounting system in which changes in assets and liabilities as well as income and expenses are recorded.

down payment

The portion of the cost of purchasing a capital asset that is financed from owner's equity.

economic efficiency

The ratio of the value of output per physical unit of input or per unit cost of the input.

economies of size

A production relationship in which average total cost per unit of output decreases as output increases.

enterprise

Production of a single crop or type of livestock, such as wheat or dairy

enterprise budget

A projection of all the costs and returns for a single enterprise.

equal marginal principle

The principle which states that a limited resource should be allocated among competing uses in such a way that the marginal value products from the last unit in each use are equal.

equity

The amount by which the value of total assets exceeds total liabilities; the amount of the owner's own capital invested in the business.

equity/asset ratio

The ratio of owner's equity to total assets; a measure of solvency.

expected value

The weighted average outcome from an uncertain event based on its possible outcomes and their respective probabilities.

extension service

An educational service for fanners and others provided jointly by the U,S. Department of Agriculture, state land grant universities, and county governments.

Farmers Home Administration (FmHA)

An agency of the U.S, Department of Agriculture that provides credit to beginning fanners and other operators who are unable to obtain it from conventional sources.

Farm Financial Standards Task Force (FFSTF)

A committee of agricultural financial experts that developed a set of guidelines for uniform financial reporting and analysis of farm businesses.

Farm management

The process of making decisions about the allocation of scarce resources in agricultural production for the purpose of meeting certain management goals.

Feasibility analysis

An analysis of the cash inflows generated by an investment compared to the cash outflows required.

Feeder livestock

Young livestock that are purchased for the purpose of being fed until they reach slaughter weight.

Field efficiency

The actual accomplishment rate for a field implement as a percent of the theoretical accomplishment rate if no time were lost due to overlapping, turning, and adjusting the machine.

Financing The acquisition of funds to meet the cash flow requirements of an investment or production activity.

fiscal year

An annual accounting period that does not correspond to the calendar year

fixed assets

Assets that are expected to have a long or indefinite productive life

fixed costs

Costs that will not change in the short run or wife the level of production and exist even if no production lakes place.

fringe benefits

Compensation provided to employees in addition to cash wages and salary.

future value (FV)

The value that a payment or set of payments will have at some time in the future, when interest is compounded.

gross income

The total income, both cash and noncash, received from an enterprise or business, before any expenses are paid,

gross margin

The difference between gross income and variable costs; also called in- come above variable costs.

Gross revenue

The total of all the revalue received by a business over a period of time; same as gross income.

Hedging

A strategy for reducing the risk of a decline in prices by selling a commodity futures contract in advance of when the actual commodity is sold.

Implementation

The process of carrying out management decisions, improvements Repairs, renovations, or additions to capital assets which improve their productivity and/or extend their useful lives.

income

Economic gain resulting from the production of goods and services, including receipts from the sale of commodities, other cash payments, increases in inventories, and accounts receivable.

income statement

A report that summarizes the income and expenses of a business over a period of time.

Inflation

A general increase in the level of all prices over time, input A resource used in the production of an output

Interest

The cash cost paid to a lender for the use of borrowed money, or the opportunity cost of investing equity capital in an alternative use.

Internal rate of return (IRR)

The discount or interest rale at which the net present value of an investment is just equal to zero.

Internal transaction

A noncash accounting transaction carried out between two enterprises within the same business.

Inventory

A complete listing of die number, type, and value of assets owned at a point in time.

Isoquant

A line on a graph connecting points that represent all the possible combinations of inputs that can produce the same output.

Joint venture

Any of several forms of business operation in which more than one person is involved in ownership and management.

labor share lease

A leasing agreement in which the operator receives a share of the production in exchange for contributing only labor.

land contract

An agreement by which a land buyer makes principal and interest payments to the seller on a regular schedule.

law of diminishing returns

A relationship observed in many physical and biological production processes in which the marginal physical product declines as more and more units of a variable input are used in combination with one or more fixed inputs.

Lease

An agreement that allows a person to use and/or possess someone else's property in exchange for a rental payment.

Lessee

An operator who leases property from the owner; same as tenant, lessor An owner who leases property to a lessee.

Leverage

The practice of using credit to increase the total capital managed beyond the value of the owner’s equity.

liabilities

Financial obligation which must be paid at some future time.

Limited partnership

A form of business in which more than one person has ownership, hut some (the limited partners) do not participate in management and have liability limited to the amount of their investment.

Linear programming

A mathematical technique used to find a set of economic activities that maximizes or minimizes a certain objective, given a set of limited resources and/or other constraints.

Line of credit

An arrangement by which a lender transfers funds to the borrower as they are needed, up to a maximum amount, liquidate To convert (he assets of a business into cash.

Liquidity

The ability of a business to meet its cash financial obligations as they come due.

Livestock share lease

A lease agreement in which both the owner and operator contribute capital and share the production of crops and livestock.

long-term liabilities

Liabilities that are scheduled to be repaid over a period of 10 years or longer.

lumpy input

A resource that can be obtained only in certain indivisible sizes, such as a combine or a full-time employee.

marginal cost (MC)

The additional cost incurred from producing an additional unit of output.

marginal input cost (MIC)

The additional cost incurred by using an additional unit of input.

marginal physical product (MPP)

The additional physical product resulting from die use of an additional unit of input

marginal revenue (MR)

The additional income received from selling one additional unit of output.

marginal tax rate

The additional tax that results from an additional dollar of taxable income.

marginal value product (MVP)

The additional income received from using an additional unit of input.

marketable securities

Stocks, bonds, and other financial instruments that can be bought and sold easily.

market livestock

Animals that are fed for eventual slaughter.

market value

The value for which an asset would be sold in un open transaction.

Modified Accelerated Cost Recovery System (MACRS)

A system for calculating tax depreciation as specified by federal income tax regulations

Mortgage

A legal agreement by which a lender receives the right to acquire a borrower's property to satisfy a debt if the repayment schedule is not met.

net farm income

The difference between total revenue and total expenses, including gain or loss on the sale of all capital assets; also the return to owner equity, unpaid labor, and management.

Net farm income from operations

The difference between total revenue and total expenses, *not* including gain or loss on the sale of certain capital assets.

net operating loss (NOL)

A negative net farm profit for income tax purposes, which can be used to offset past and/or future taxable income.

net present value (NPV)

The present value of the net cash flows that will result from an investment minus the amount of the original investment.

net worth

The difference between the value of the assets owned by a business and the value of its liabilities. Also called equity.

noncash expense

An expense that does not involve the expenditure of cash, such as depreciation.

noncurrent asset

An asset which will normally be owned or used up over a period longer than a year.

noncurrent liability

A liability which wilts normally be paid over a period longer than a year.

non-real estate

All assets other than land and hems attached to land such as buildings and fences.

operating costs

Costs for the purchase of inputs and services that are used up relatively quickly, usually in one production cycle.

operating profit margin ratio

The value represented by net farm income from operations plus interest expense minus opportunity cost of operator labor and management expressed as a percentage of gross revenue.

opportunity cost

The income that could be received by employing a resource in its most profitable alternative use.

option

A marketing transaction in which a buyer pays a seller a premium to acquire the right to sell or buy a futures contract at a specified price.

organizational chart

A diagram that shows the workers involved in a business and the lines of authority and communication among them.

Output

The result or yield from a production process, such as raising crops and livestock.

overhead costs

Costs that are not directly related to the type and quantity of products produced; a type of fixed cost.

owner’s equity

The difference between the total value of the assets of a business and die total value of its liabilities; also called net worth or equity.

ownership costs

Costs that result simply from owning assets, regardless of how much they are used.

partial budget

An estimate of the changes in income and expenses that would result from carrying out a proposed change in the current farm plan.

Partnership

A form of business organization in which more than one operator owns the resources and/or provides management.

payback period

The length of time it takes for the accumulated net returns earned from an investment to equal the original investment

payoff matrix

A contingency table that illustrates the possible outcomes for a particular occurrence and their respective probabilities.

person-yearequivalent

A total of 12 months of labor contributed by one or more persons.

physical efficiency

The ratio of output received per unit of input used all in physical units.

prepaid expense

A payment made for an Input or service prior to the accounting period in which it will be used.

Present value (PV)

The current value of a set of payments to be received or paid out over a period of lime.

Price ratio

The ratio of the price of the input being added to the price of the input being replaced, or the ratio of the price of the output being gained to the {vice of the output being lost.

Principal

The amount borrowed or that part of the original loan which has not yet been repaid.

Probability distribution

A set of possible outcomes to a particular event and the probability of each one occurring.

Production function

A physical or biological relationship showing how much output results from using certain quantities of inputs.

Standard deviation

A measure of the variability of possible outcomes for a particular went, equal to the square root of the variance.

statement of cash flows

A summary of the actual cash inflows and cash outflows experienced by a business during some past time period, subjective probability Probabilities based only on individual judgment and past experiences.

substitution ratio

The ratio of the amount of one input replaced to the amount of another input added, or the amount of one output lost to the amount of another output gained.

sunk cost

A cost that can no longer be reversed, changed, or avoided: a fixed cost

supplementary enterprises

Enterprises for which the level of production of one can be increased without affecting the level of production of the other

sustainable agriculture

Agricultural production practices that maximize the long-run social and economic benefits from the use of land and other agricultural resources

systems analysis

An evaluation of individual enterprises and technologies that takes into account their interactions with other enterprises and technologies

tax-free exchange

A trade of one piece of farm property for another similar piece of property, such that any taxable gain is reduced or eliminated

technical coefficient

The rate at which units of input are transformed into output.

technology

A particular system of inputs and production practices.

Tenant

A farm operator who rents land, buildings, or other assets from their owner; same as lessee.

tenure

The manner by which an operator gains control and use of real estate assets, such as renting or owning them.

tillable acres

Land that is or could be cultivated.

total cost (TC)

The sunt of total fixed cost and total variable cost.

total fixed cost (TFC)

The sum of all fixed costs.

total physical product (TPP)

The quantity of output produced by a given quantity of inputs.

total revenue (TR)

The income received from the total physical product; same as total value product.

total value product (TVP)

Total physical product multiplied by the selling price of the product.

total variable cost (TVC)

The sum of all variable costs.

trend analysis

Comparison of the performance level of a farm business to the past performance of the same business.

unsecured loan

A loan for which the borrower does not give the lender the right to possess certain assets if the repayment terms are not met; there is no collateral

value of farm production

The market value of till crops and livestock and other income generated by a farm business as measured by accrual accounting, after subtracting the value of purchased livestock and feed.

variable cash lease

A leasing arrangement in which a cash payment is made in return for the use of the owner's property, but the amount of the payment depends on the actual production and/or price received by the tenant.

variable costs

Costs that will occur only if production actually takes place, and which lend to vary with the level of production.

variable interest rate

An iniercsl rule that can change during the repayment period of a loan.

variance

A measure of the variability of the possible outcomes of a particular event

whole farm budget

A projection of the total production, income, and expenses of a farm business for a given whole farm plan.

whole farm plan

A summary of the intended kinds and volume of enterprises to be carried out by a farm business.

Workers' Compensation

An insurance plan required by law in most states which protects employees from job-related accidents or illnesses, and sets maximum compensation limits for such occurrences.

working capital

The difference in value between current assets and current liabilities; a measure of liquidity.

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