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SIMON KUZNETS KHARKIV NATIONAL UNIVERSITY OF ECONOMICS

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METHODOLOGY AND ORGANIZATION OF SCIENTIFIC RESEARCH

Textbook

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M54

Рецензенти: віце-президент із міжнародних відносин, професор кафедри маркетингу Університету прикладних наук Верхньої Австрії (Австрія), д-р філософії *А. Цехетнер;* завідувач кафедри економіки повітряного транспорту Національного авіаційного університету (Київ), д-р екон. наук, професор *О. В. Ареф'єва;* завідувач кафедри економічної кібернетики Харківського національного економічного університету імені Семена Кузнеця, д-р екон. наук, професор *Л. С. Гур'янова.*

Рекомендовано до видання рішенням ученої ради Харківського національного економічного університету імені Семена Кузнеця.

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All aspects of conducting scientific research are considered: both in terms of content (methods, models, research technologies), and the issue of research organization at a university, company, and directly at the workplace. Along with traditional topics related to the methodological foundations of scientific research, forms of organization of the research process, methods of empirical and theoretical research, and technologies for preparing publications and defending theses, special attention is paid to modern information and communication technologies used in the process of research using Internet resources.

For post-graduate students (Ph.D. degree holders) of Simon Kuznets Kharkiv National University of Economics.

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INTRODUCTION

- In the conditions of constant renewal of science, new directions, approaches, and technologies are formed. The rapid increase in the role of science in the modern world requires the researcher to have a significant level of theoretical knowledge and practical skills in conducting scientific research and their effective organization. The search for adequate scientific results becomes possible only thanks to the use of large amounts of accumulated knowledge that can be used in the process of conducting and implementing scientific research. For a scientist, the ability to organize scientific research activities and effectively use already known scientific developments, as well as a perfect mastery of the methodology of scientific research, become important.
- The educational discipline "Methodology and organization of scientific research" (MOND) is a basic educational discipline and is studied in accordance with the curriculum for the training of specialists of the third (educational -scientific) degree. The discipline involves the use of various forms of education, the main of which are lectures and practical classes in the form of seminars, workshops, presentations, independent processing of theoretical material and the implementation and defense of an individual research project (INDZ) . (The structure of the INDZ and a detailed description of its individual sections are given in Appendix 1 of the study guide).

the purpose study of the material presented in this study guide is formation and development of the ability to apply methodological principles and methods of scientific activity in a qualified manner.

To achieve the goal, the following ***tasks*** are solved in the process of processing the material of the manual :

- to form a coherent theoretical understanding of the general methodology of scientific creativity in graduate students;
- familiarize with the requirements for scientific research, the basics of their planning and organization;
- equip graduate students with a toolkit of scientific methods that can be usefully applied in the process of researching complex systems, economic, pedagogical, informational, etc.;
- familiarize with the requirements for the registration of various research works;
- to form the skills of effective work with sources of information in graduate students;
- to give post-graduate students a set of knowledge and skills that will help them in the future to carry out research and creative activities in the process of fulfilling their professional duties.

- ***Object*** of the academic discipline is methodology as a teaching about the organization and conduct of scientific research.
- ***subject*** the methods of scientific research, as well as the theoretical and methodological foundations of the organization of scientific and research activities are presented in the academic discipline .

As a result of studying the academic discipline, a graduate student should know:

- modern trends, directions and regularities of the development of domestic science in the conditions of globalization and internationalization;
- methodology of scientific knowledge;
- achievements of world and Ukrainian science in the relevant area;
- (to realize and accept) the social responsibility of science and education;
- principles of organization of scientific activity and scientific research;
- algorithms for setting the topic, problem and goal of scientific research;
- principles of system thinking in scientific creativity;
- basics of empirical research methodology;
- basics of the methodology of research of complex systems;
- methods of theoretical research;
- methods of mathematical modeling;
- characteristics of project forms of scientific research;
- dissertation work technology;
- principles of organization of scientific work;
- the technology of presentation, protection and implementation of the results of scientific research;

As a result of studying the academic discipline, a graduate student should be able to :

- effectively organize research activities;
- formulate the topic, problem and purpose of scientific research;
- distinguish the object and subject of research;
- to develop a plan for carrying out scientific research works;
- perform analysis of complex systems;
- conduct scientific research using empirical methods;
- process empirical data and build mathematical models based on them;
- formulate hypotheses, develop classifications, obtain and justify scientific results using theoretical research methods;
- effectively use existing information resources from various sources, analyze and process information;
- perform design, presentation, protection and implementation of the results of research work.
- analyze, evaluate and compare various theoretical concepts in the field of research and draw conclusions;
- conduct independent scientific research, characterized by academic integrity, based on modern theories and methods of analysis;
- generate own new scientific ideas, communicate their knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge;
- choose and effectively use modern research methodology;
- plan and forecast your further professional development.

As a result of studying an academic discipline, a graduate student should *have the skills* (autonomy and responsibility):

- critical analysis, assessment and comparison of various scientific theories and ideas;
- analytical and experimental scientific activity;
- planning and forecasting of research results;
- oratory and public speaking at international scientific forums, conferences and seminars;
- scientific writing and scientific communication;
- planning, coordination and implementation of scientific research processes;
- systematic understanding of the field of study and demonstrate the quality and effectiveness of selected scientific methods;
- participation in scientific activities, fundamental scientific domestic and international projects;
- leadership management and leadership of the scientific team;
- responsible and creative attitude to scientific and scientific-pedagogical activities;
- conducting information search and experience in transmitting scientific information using modern information and innovative technologies;
- protection of intellectual property rights to scientific discoveries and developments.

Learning outcomes and competencies that form the academic discipline:

Study results	Competencies
choose and effectively use modern research methodology;	Demonstrate a systematic understanding of the field of study, mastery in terms of skills and research methods used in this field
analyze, evaluate and compare various theoretical concepts in the field of research and draw conclusions;	
critically analyze, evaluate and compare different scientific theories and ideas;	
systematic understanding of the field of study and demonstrate the quality and effectiveness of the chosen scientific methods	
organize, plan and implement the process of scientific research;	Plan, develop, implement and adjust the complex process of scientific research;
analyze and process information from various sources;	
conduct independent scientific research, characterized by academic integrity, based on modern theories and methods;	
generate their own new scientific ideas,	
Formulate the problem, research topic, object, subject and tasks of the research	
conducting a patent search and experience in the transfer of scientific information using modern information and innovative technologies;	
apply for grants and use project management methods when managing scientific research;	

Learning outcomes and competencies that form the academic discipline (continuation):

Study results	Competencies
have the skills to participate in scientific events, fundamental scientific national and international projects;	To contribute, with their own original research, to the expansion of the boundaries of the scientific field, which may merit publication at the national or international level
justify the topicality of the topic, scientific novelty and practical significance of the obtained results	
apply the modeling method in scientific research	
apply empirical and theoretical research methods	
apply the methodology of research of complex systems	
conduct a professional and comprehensive analysis of problems in the relevant area;	Critically analyze, evaluate, and synthesize new and complex ideas
carry out an examination of scientific projects and research;	
to have the techniques and methods of the system approach and system analysis	
use multi-paradigm and interdisciplinary methodological approaches in scientific research	

Learning outcomes and competencies that form the academic discipline (end):

Study results	Competencies
to communicate their knowledge and ideas to the scientific community, expanding the boundaries of scientific knowledge;	Communicate their knowledge and achievements to colleagues, the scientific community and the general public
apply the skills of oratory and public speaking at international scientific forums, conferences and seminars	
Defend scientific results in the form of a discussion as a form of scientific communication	
Publish research results in articles, monographs, theses	
use the mechanism of implementation of scientific developments in practical activity;	Contribute to the development of a knowledge-based society
plan and forecast your further professional development	
Use and form norms of interaction in the scientific community and scientific ethics of the research scientist;	
To develop one's own creative potential and techniques for activating scientific creativity	

Chapter 1. Methodological foundations of scientific research

The idea that science can and should develop according to fixed and universal rules is both unrealistic and harmful. It is unrealistic because it comes from a simplified understanding of human abilities and the circumstances that accompany or cause their development. And it is harmful because ... it makes our science less flexible ...

All methodological prescriptions have their limits, and the only "rule" that remains is the rule that "everything is allowed."

Feyerabend P. Selected works on the methodology of science. — 1986. — P. 450-451
.

Science and scientific research

System elements of the topic

1. 1. The origins of the scientific method thinking

1.2. Different approaches to studying the methodology of science

1.3. What does the term “science” mean? Classification of sciences

1.4. Basic elements of science: fact, hypothesis, concept

1.5. Scientific theory

1.6. Stages of formation of science

1.7. Cycles of science development

1.8. Paradigms of science

1.9. Types of concepts. Operations with concepts

Control questions. Practical component

1.1. The origins of the scientific way of thinking (1)

- Science is a form of spiritual activity of people, which is aimed at obtaining knowledge about the world (nature, society, thinking), discovering objective laws and predicting trends in the development of the surrounding world.
- Science is the process of creative activity to obtain new knowledge, and the result of this activity in the form of a complete system of knowledge formulated on the basis of certain principles.
- The main task of science is to identify the objective laws of reality, and its main goal is true knowledge.
- The criteria of scientificity are: objectivity, systematicity, practical targeting, orientation to predictions, evidentiality, reasonableness and reliability of the results.

The origins of the scientific way of thinking (2)

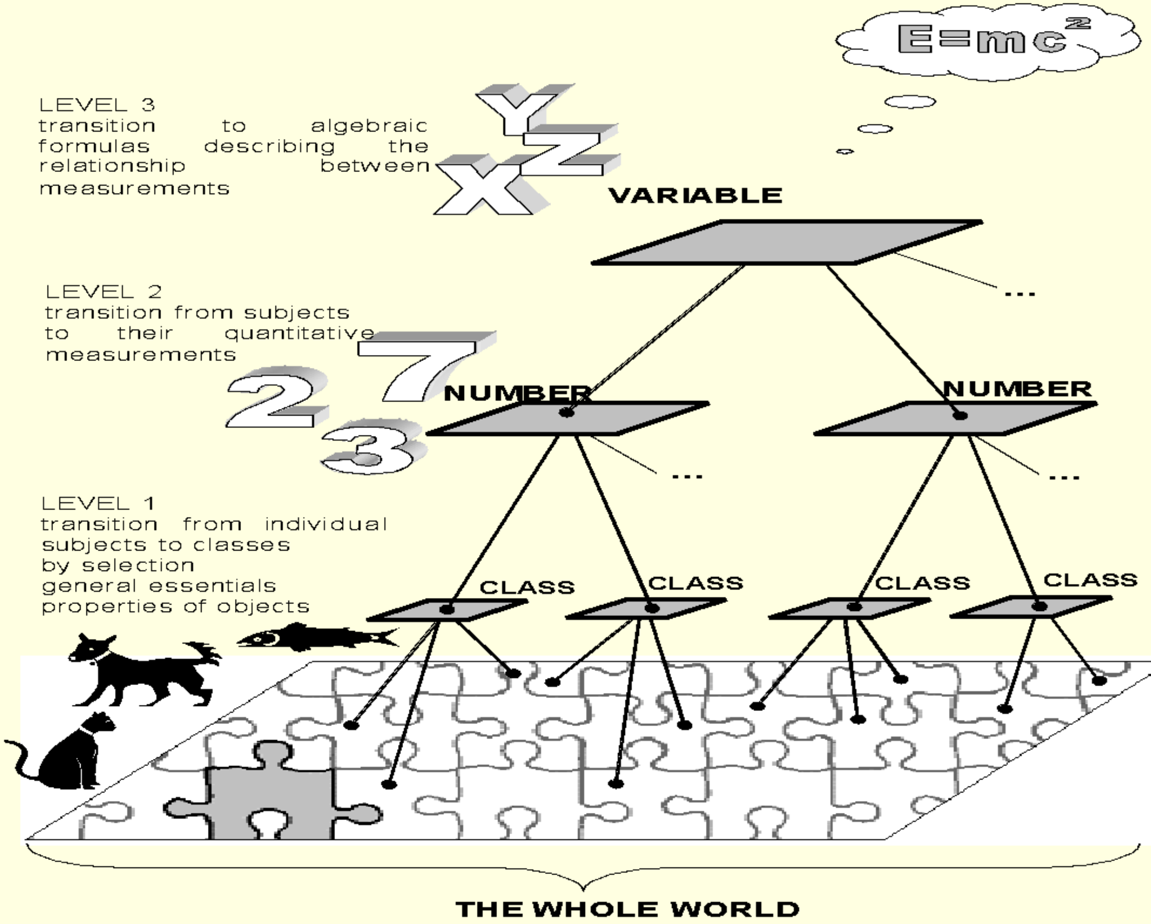
20th century
Einstein, Bohr

17th century
Galileo, Kepler
Algebra

Pythagoras
Class
classes

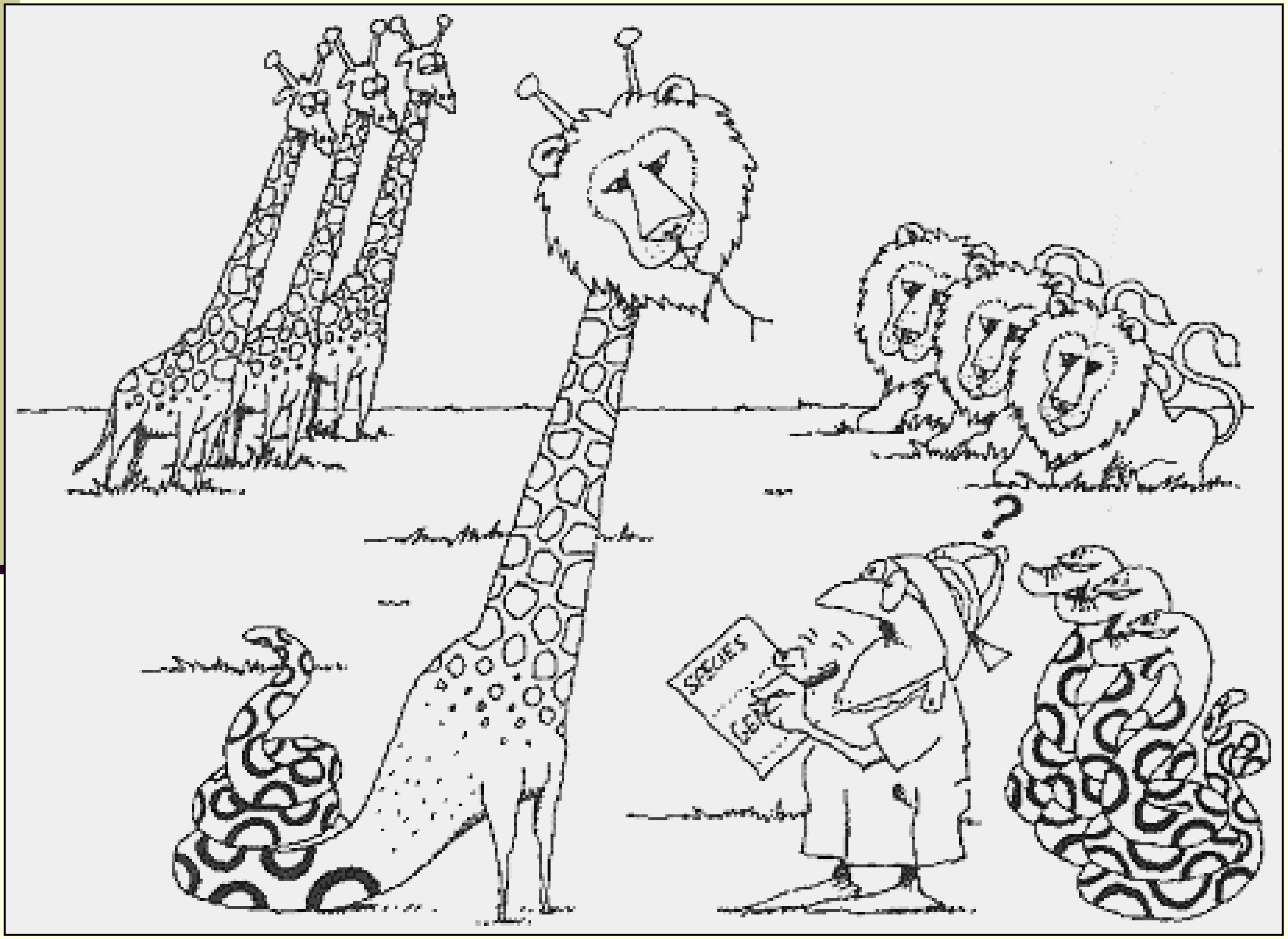
Aristotle
Classes
objects

The first explorers of the world
Borders
But the names

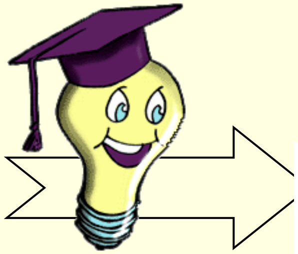


The origins of the scientific method of thinking (3)

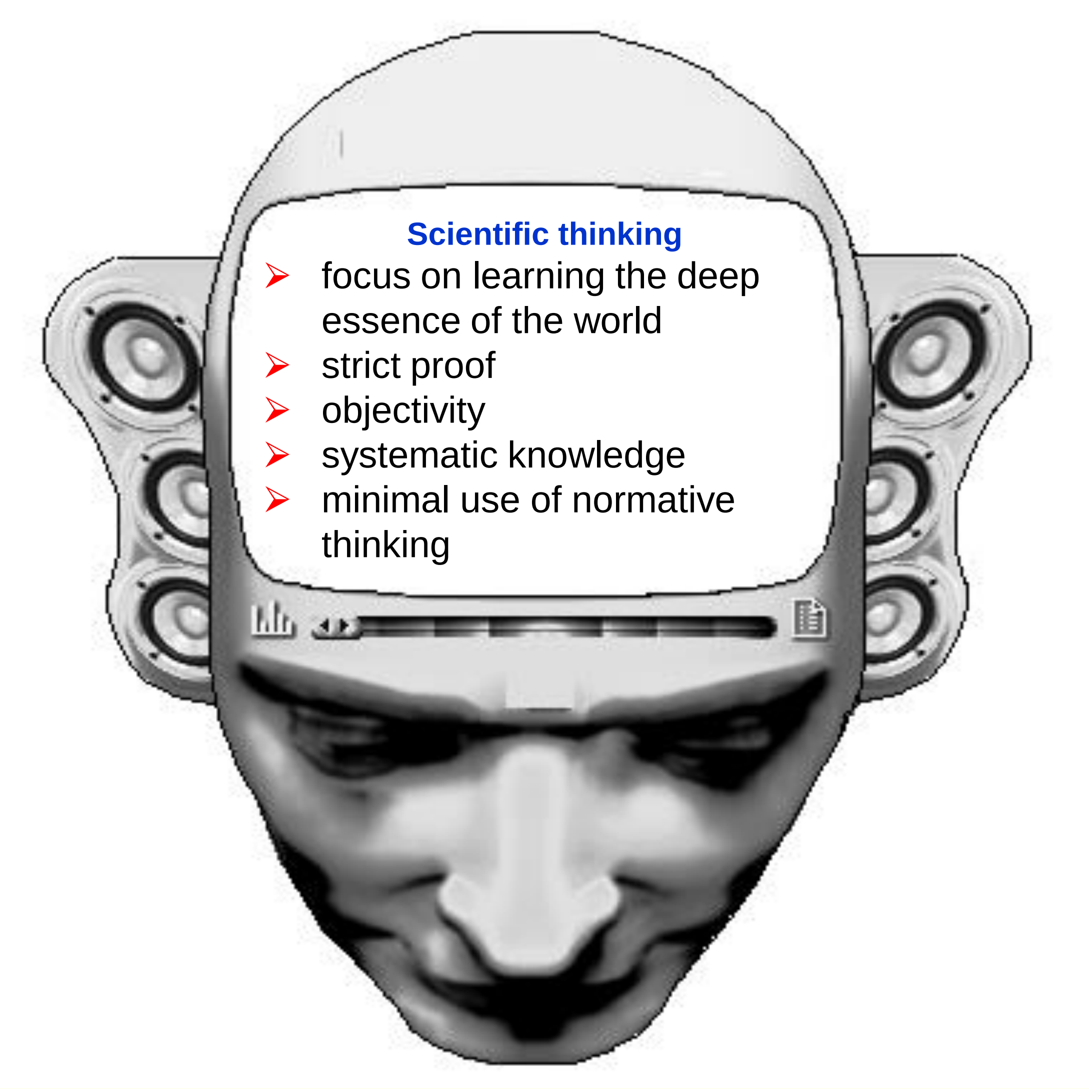
"These animals are similar to each other, and the others are not at all similar to them, so let's call this group "Lions" and the other group "Giraffes".



According to the Bible, one of Adam's first tasks was to give names to animals and plants. For this he had to work hard. First, it was necessary to identify similarities and differences between objects of nature, and then to group everything similar and learn to distinguish it from everything dissimilar. In these actions of Adam, we see the manifestation of the 1st level of abstraction: by diverting from the individual properties of animals and plants, Adam moved to the classes of natural objects .
(Kherluf's comic Bidstrap)



Scientific thinking



Scientific thinking

- focus on learning the deep essence of the world
- strict proof
- objectivity
- systematic knowledge
- minimal use of normative thinking

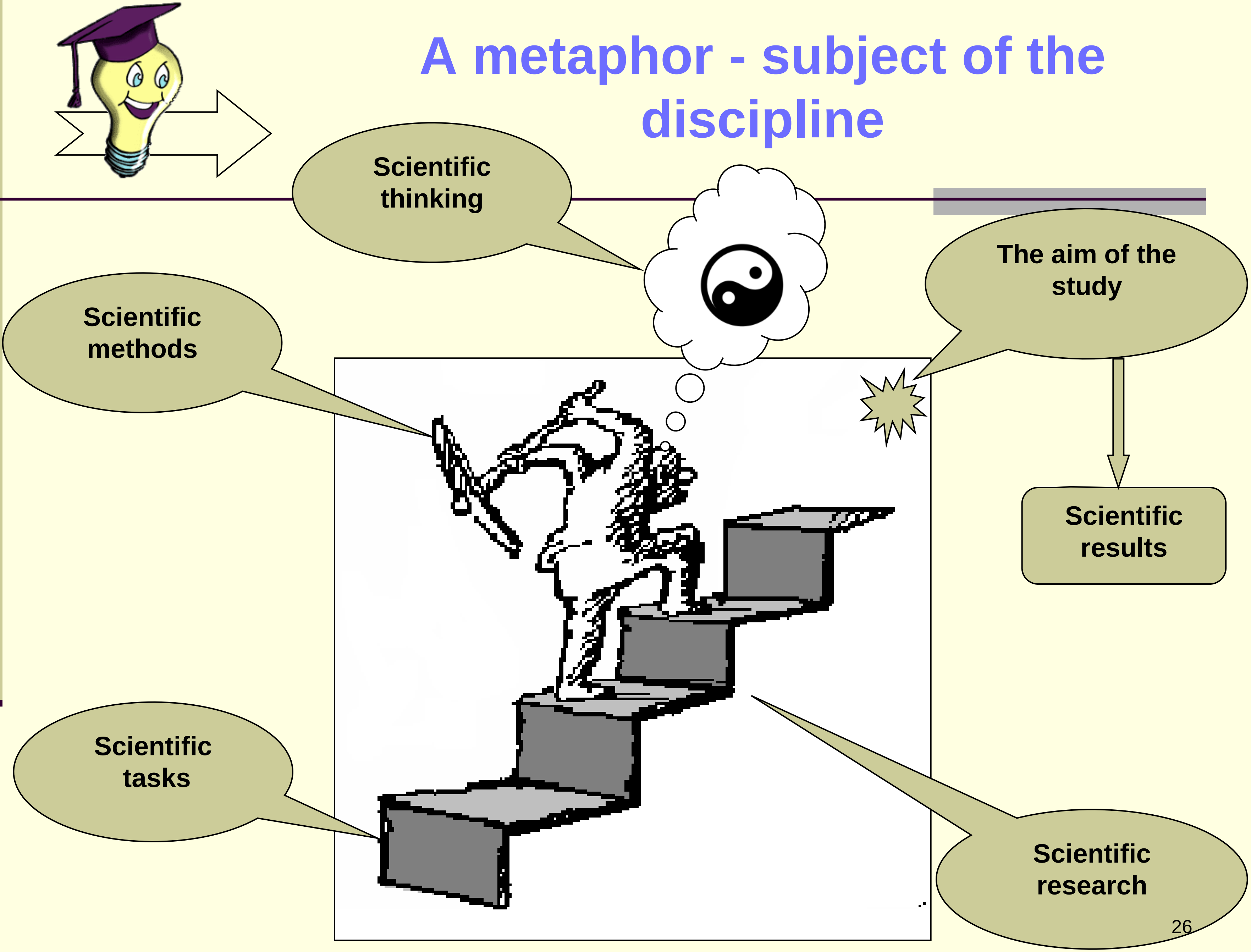
1.2. Different approaches to studying the methodology of science

- Active - a metaphorical approach
- A "product" approach
- A competency approach
- A technological approach
- A systematic approach

Research activities

- ***Activity*** is a form of human activity aimed at the world around him.
- ***Any activity*** consists of three components:
  - goal,
  - process,
  - result.
- ***Scientific activity*** is a purposeful, motivated transformation of information about the world surrounding a person, focused on knowledge (and/or change) of this world.

A metaphor - subject of the discipline

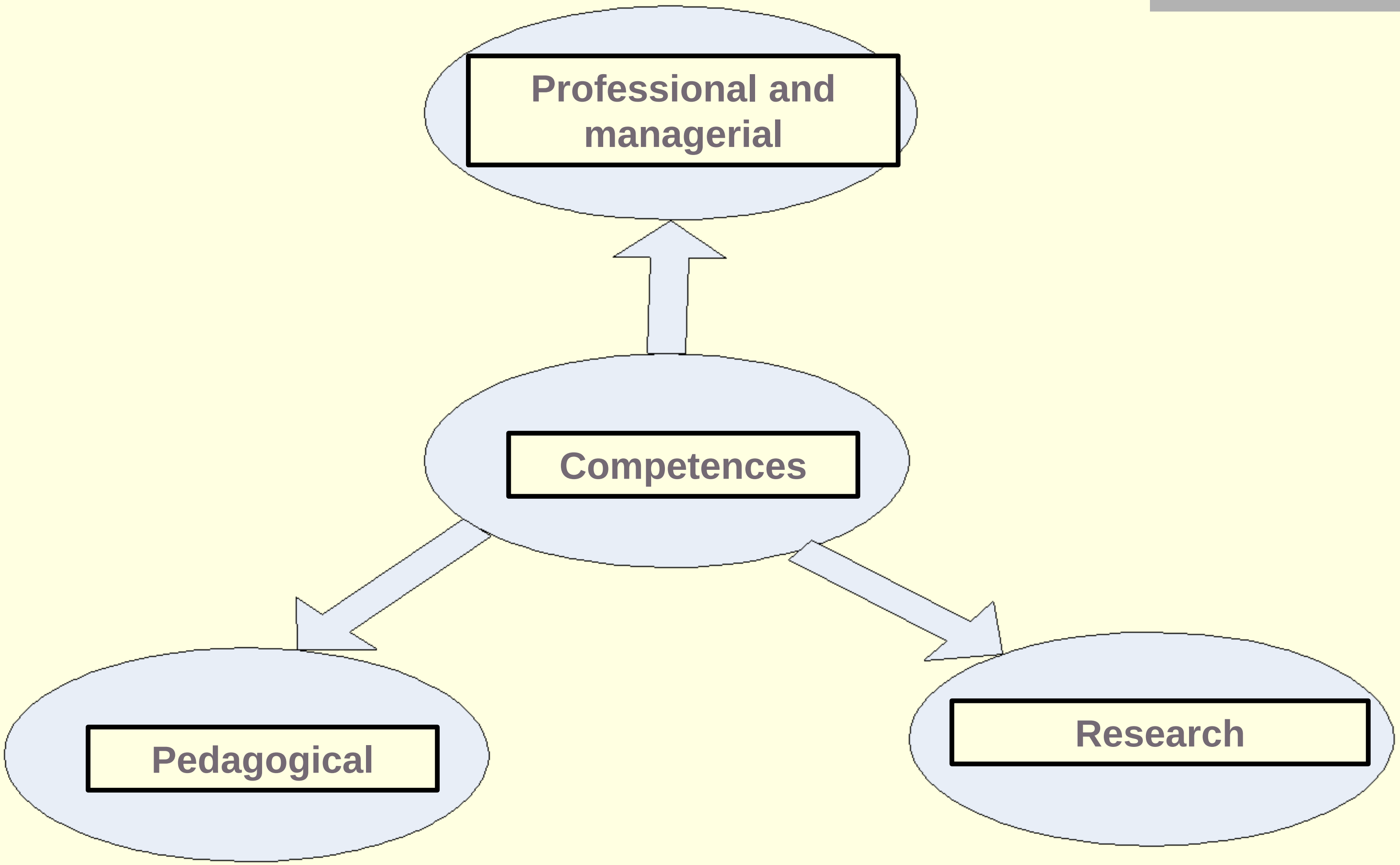


"Products" that a scientist receives as a result of his activities (scientific results):

- Hypotheses - Concept - Deadlines - Axioms - Principles - Concepts - Laws - Regularities - Theories - Models	- Conceptual approaches - Research methods - Methods of transformation of the surrounding world - Methods - Methodical approaches - Scientific conclusions

- A competence approach

The structure of the system of competences of a scientist-pedagogue



The structure of a competence

First short conclusion. What does a scientist do?

Verbs define the essence of the relevant competence

- **Identification of** the object, phenomenon (by drawing boundaries) and **formation** of the concept
- **Naming** the concept
- **Definition** properties of the object (phenomenon)
- **Classification** of similar objects (phenomena)
- **Building** a model of an object (phenomenon)
- **Development of** proposals (methods): how to use the process or object (phenomenon)?
- **Development of** proposals (methods): how to change (improve) a process or an object?

Where is research competence used?

- Research activity of a University teacher
- Activities on teaching scientific activity at university
- Implementation of research as part of the of university activity
- Forming and maintenance of contracts for

implementation of scientific research for a company,

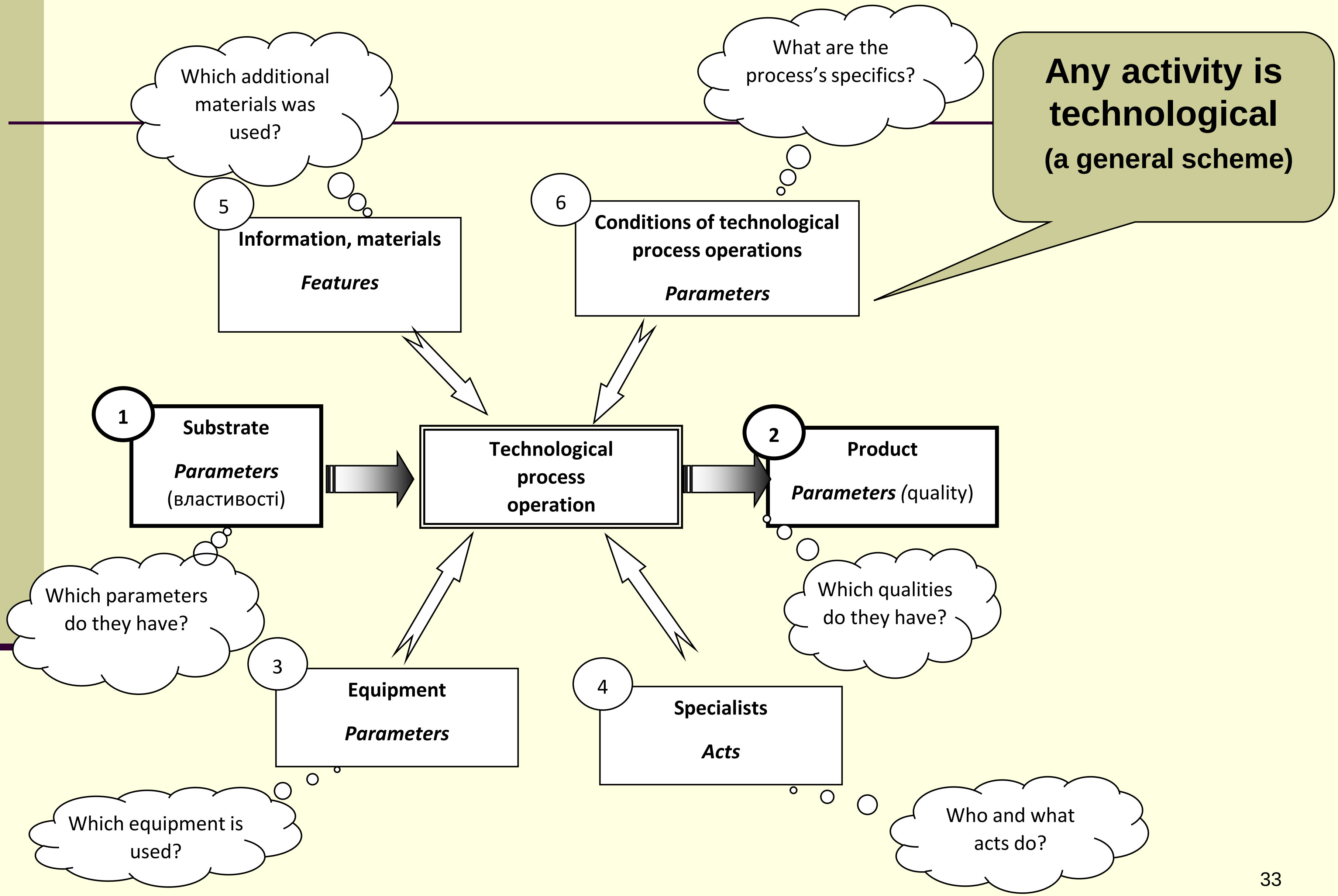
Research activities in the composition of scientific divisions in the field.

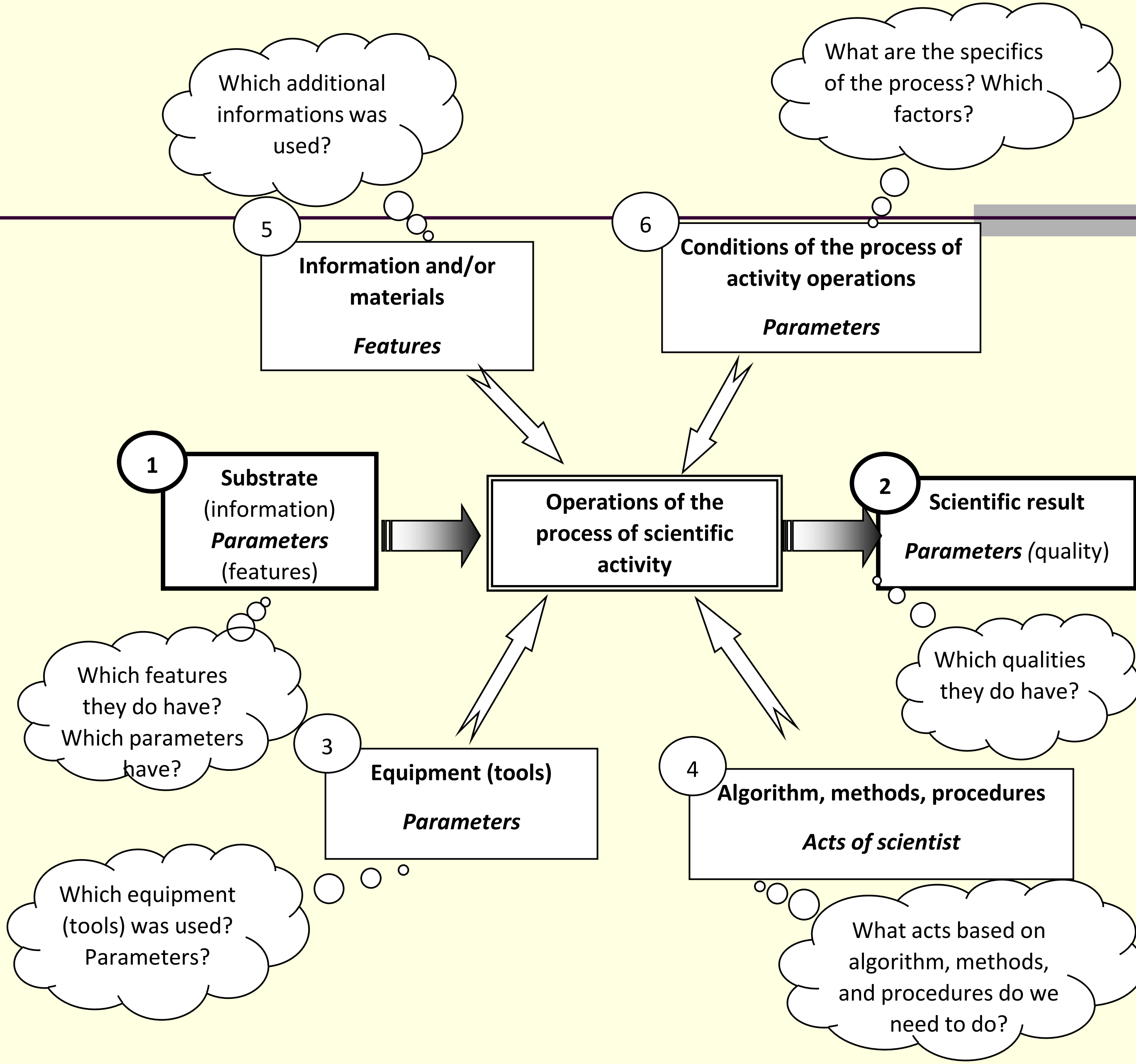
- Analysis of development processes in the industry, decision-making on transformation at the enterprise or organization

What is the content of research competences?

- **Analyticai** competences
- Competences in **information search and processing**
- Competences in **identifying, formulating and solving scientific problems and tasks**
- Competences in **the use of methods and technologies** of scientific research
- Competences in **the presentation and defense of scientific results**
- Competences in **the use of scientific results** for the development of an enterprise or other economic object

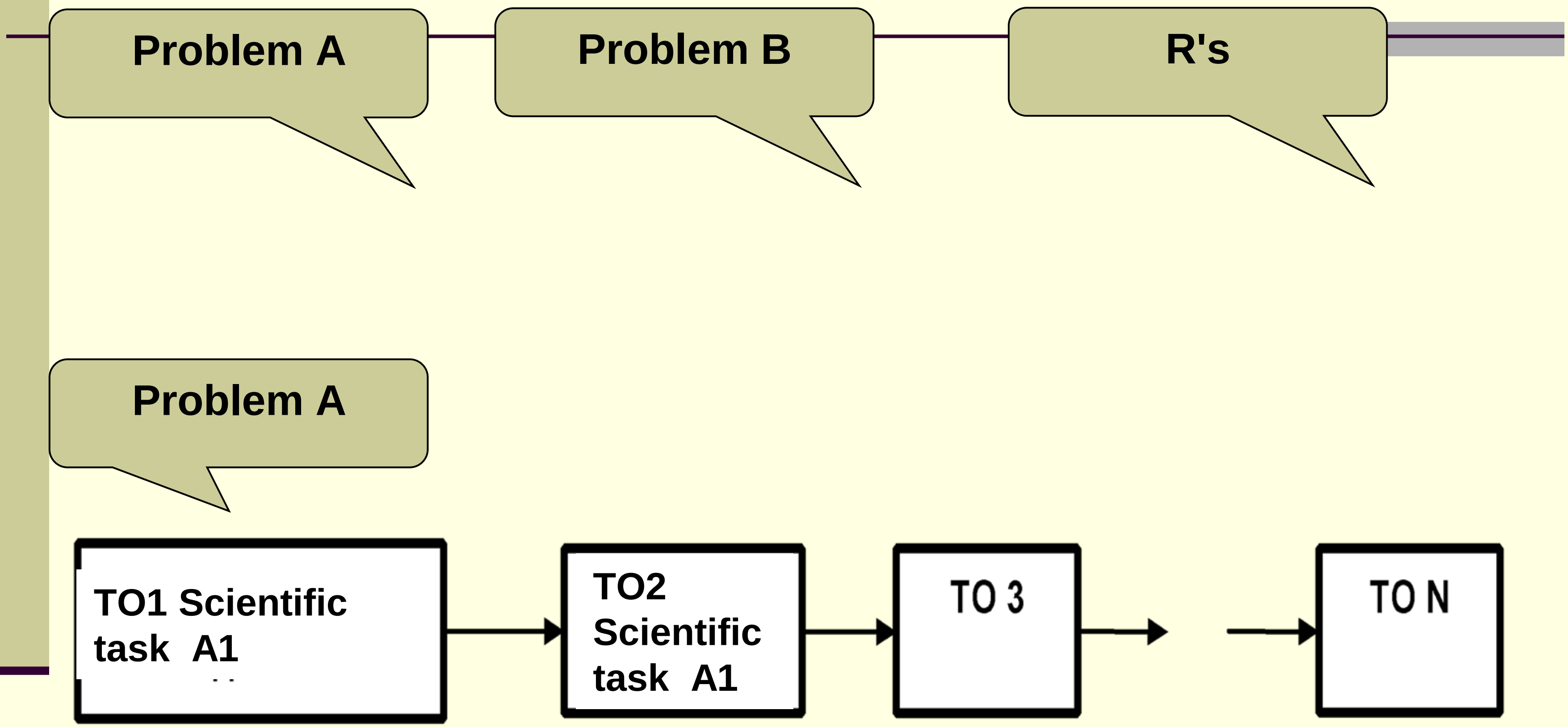
A technological approach





Which additional informations was used?
What are the specifics of the process? Which factors?
5
Information and/or materials
Features
6
Conditions of the process of activity operations
Parameters
1
Substrate (information)
Parameters (features)
Operations of the process of scientific activity
2
Scientific result
Parameters (quality)
Which features they do have? Which parameters have?
Which qualities they do have?
3
Equipment (tools)
Parameters
4
Algorithm, methods, procedures
Acts of scientist
Which equipment (tools) was used? Parameters?
What acts based on algorithm, methods, and procedures do we need to do?

Scientific activity - a technology
(technological process)

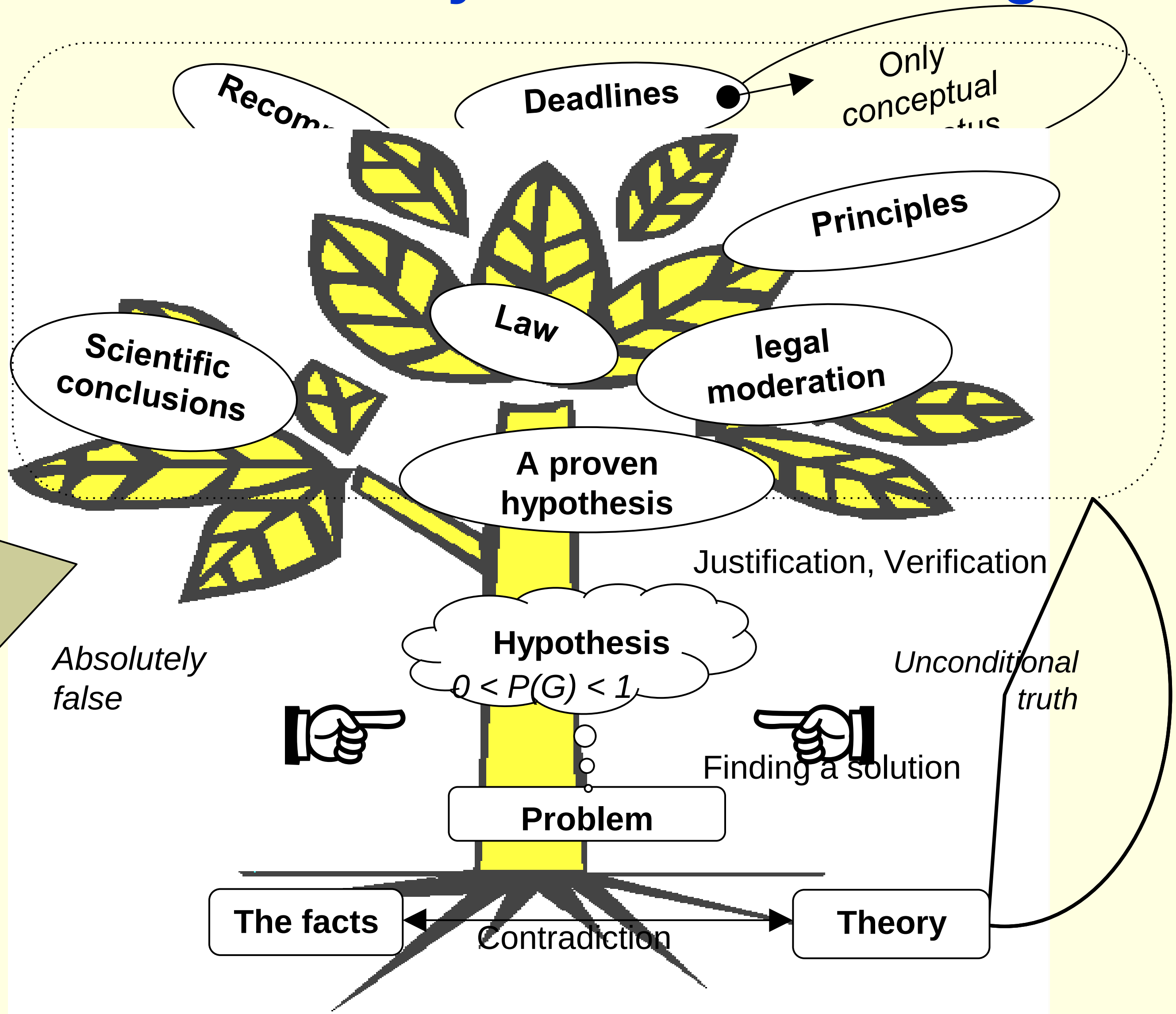


TO – Technological Operation

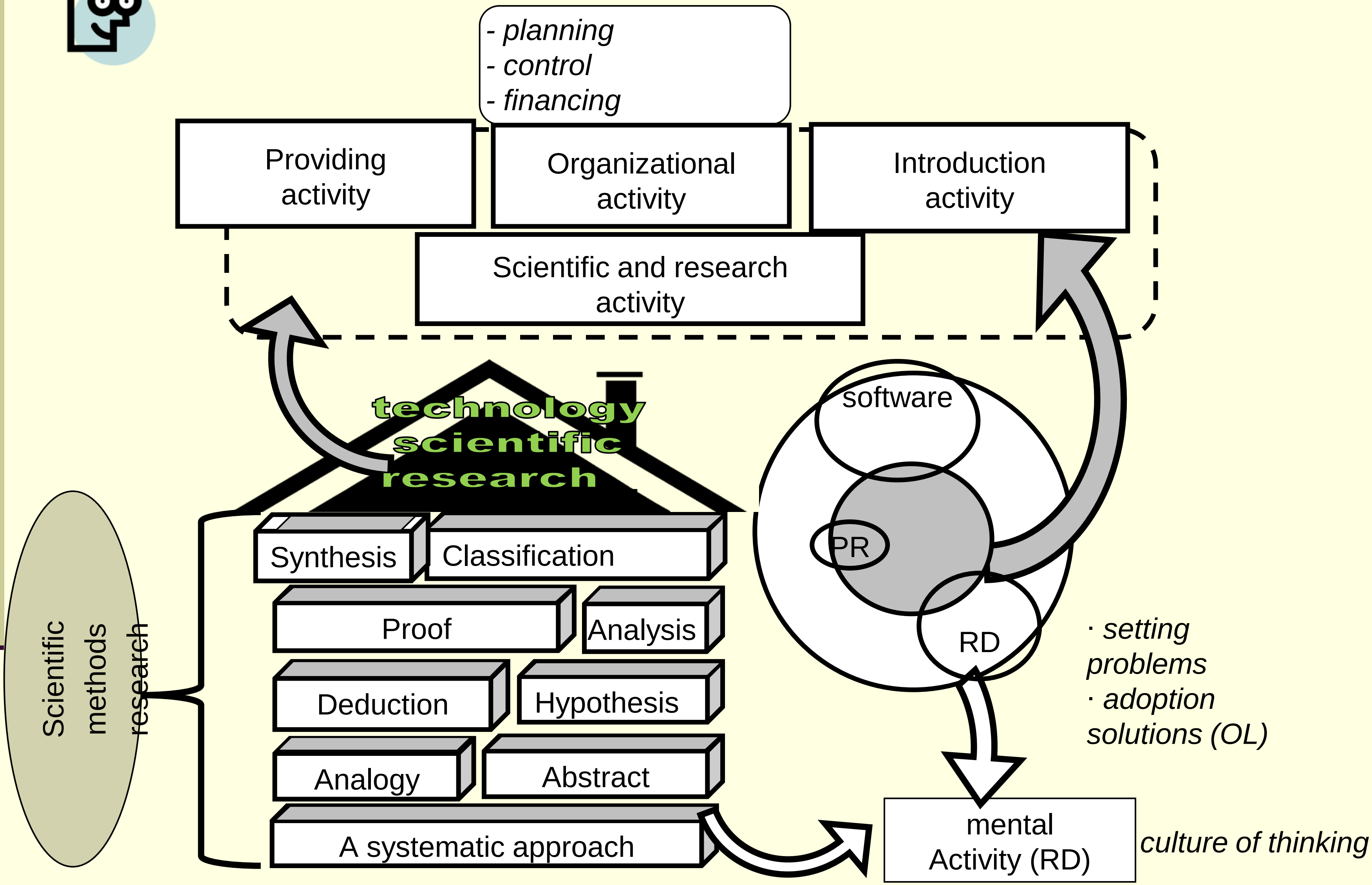
❑ A systematic approach

Science as a system of knowledge

Each element of scientific knowledge comes from the whole, is connected with the whole and exists for the sake of the whole



Why do you need the course "Methodology and Organization of Scientific Research"?



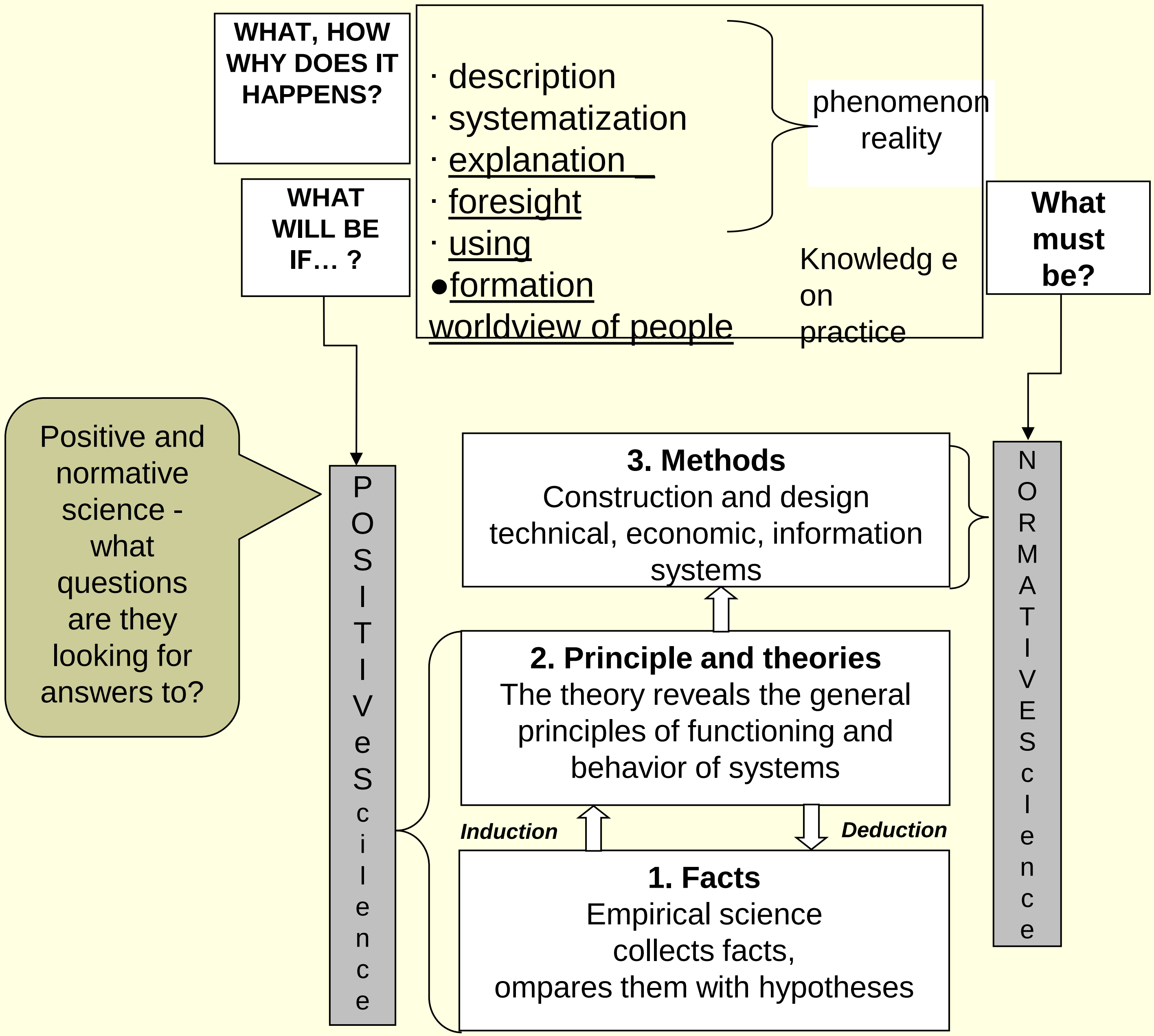
1.3. What does the term “science” mean? Classification of sciences

SCIENCE :

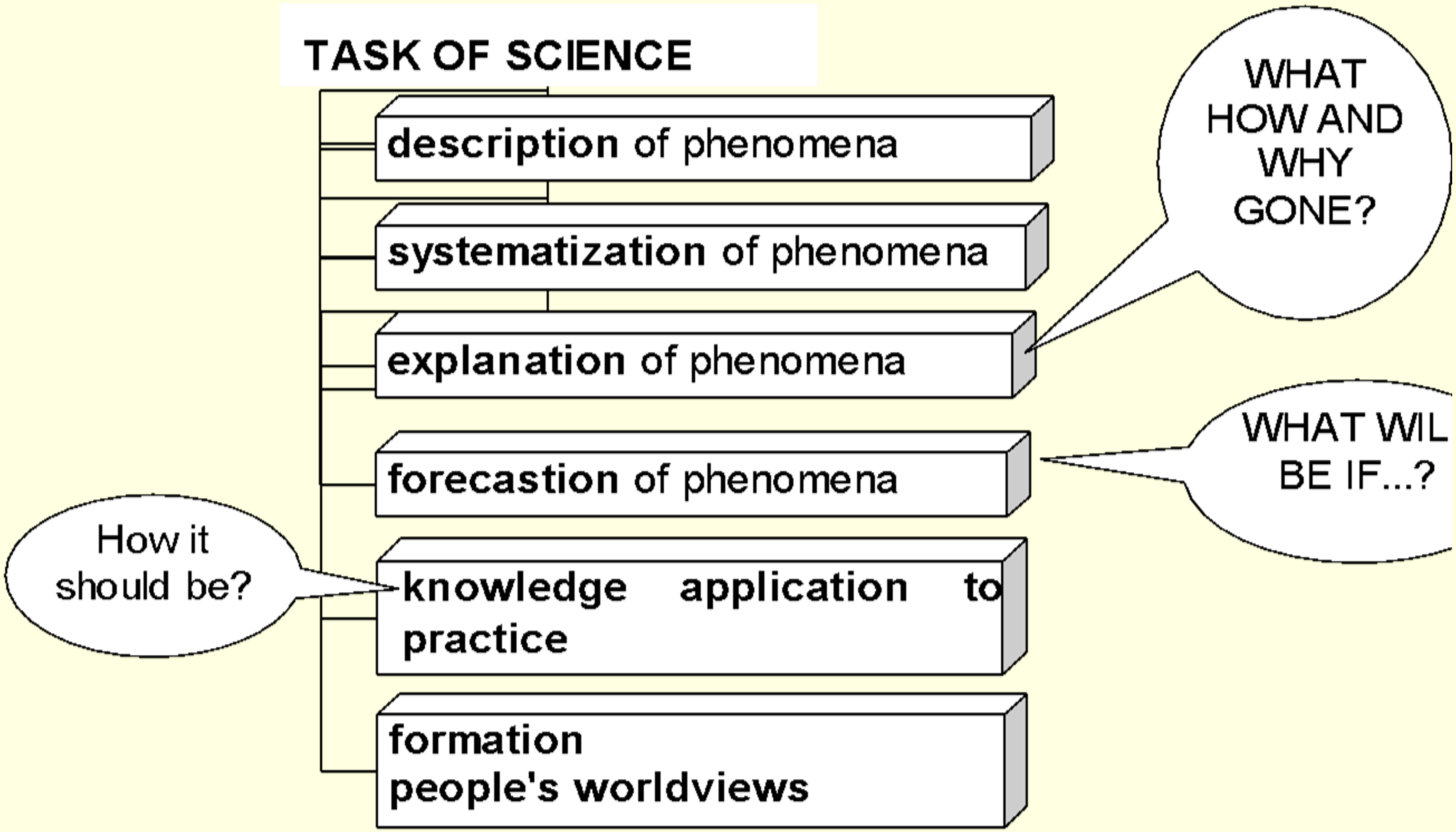
- **a system of knowledge** of objective laws of nature, society and thinking
- **teaching, a subsystem of knowledge**

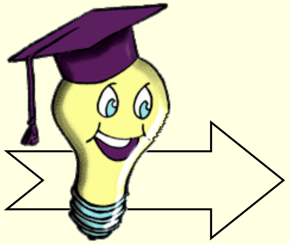
for example Management, Economics

- **the sphere of activity** of people to obtain this knowledge
- **a tool for acquiring knowledge**
- **a social institution**

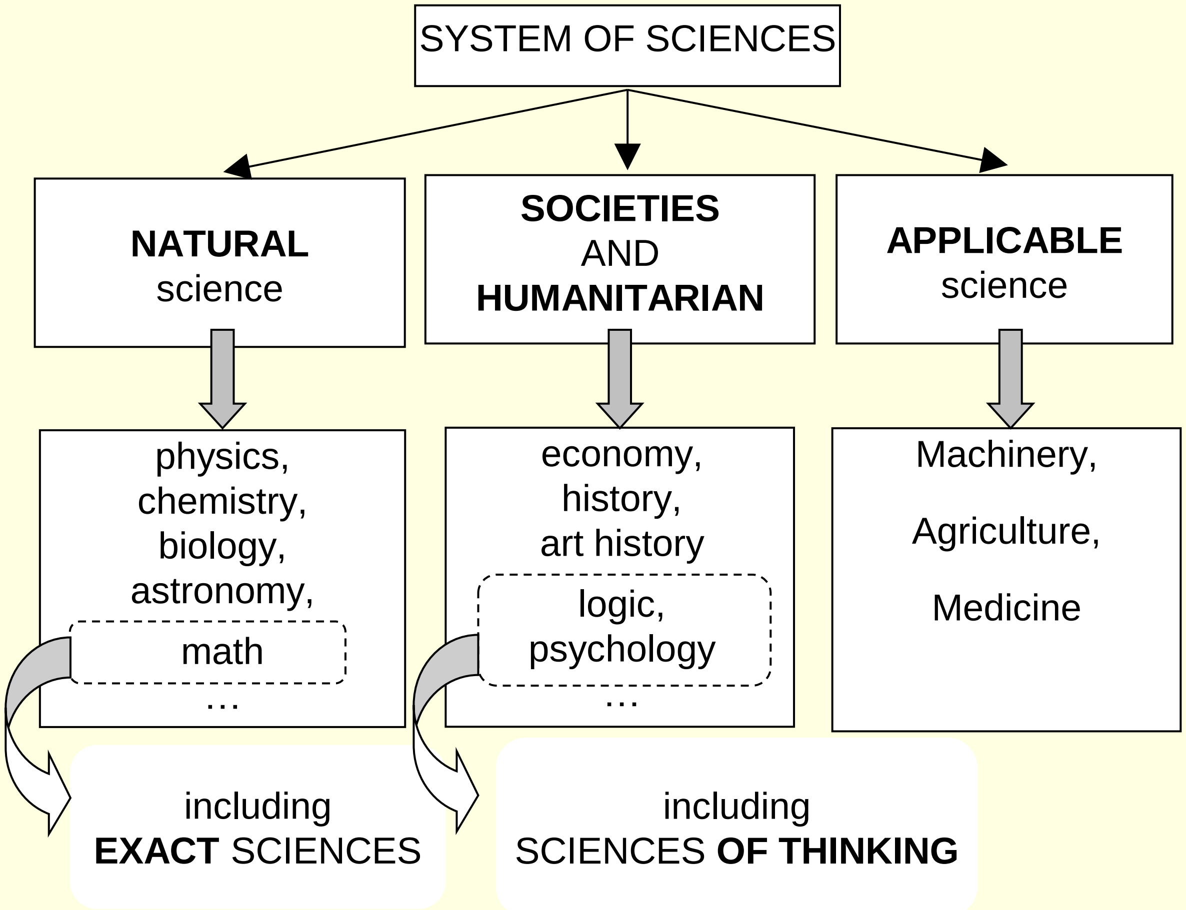

WHAT, HOW WHY DOES IT HAPPENS?
WHAT WILL BE IF… ?
· description
· systematization
· explanation
· foresight
· using
●formation worldview of people
phenomenon reality
Knowledg e on practice
What must be?
Positive and normative science - what questions are they looking for answers to?
POSITIVeScilence
3. Methods
Construction and design technical, economic, information systems
2. Principle and theories
The theory reveals the general principles of functioning and behavior of systems
Induction
Deduction
1. Facts
Empirical science collects facts, ompares them with hypotheses
NORMATIVEScIence

Result


TASK OF SCIENCE
description of phenomena
systematization of phenomena
explanation of phenomena
forecastion of phenomena
knowledge application to practice
formation people's worldviews
WHAT HOW AND WHY GONE?
WHAT WIL BE IF...?
How it should be?



Classification of sciences



What is the classification of sciences for ?

· **for planning and coordination of scientific activity;**

· **formation of the structure of scientific institutions;**

· **establishment of connections between science and practice;**

· **development of educational plans for universities;**

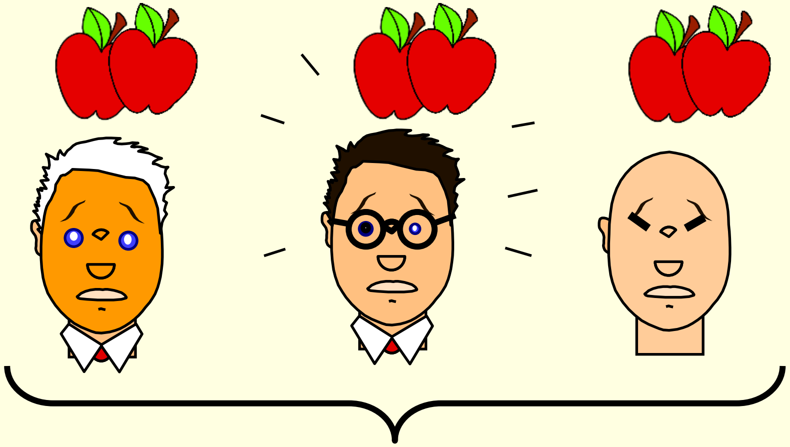
· **determining the content of textbooks;**

· **writing encyclopedic works ;**

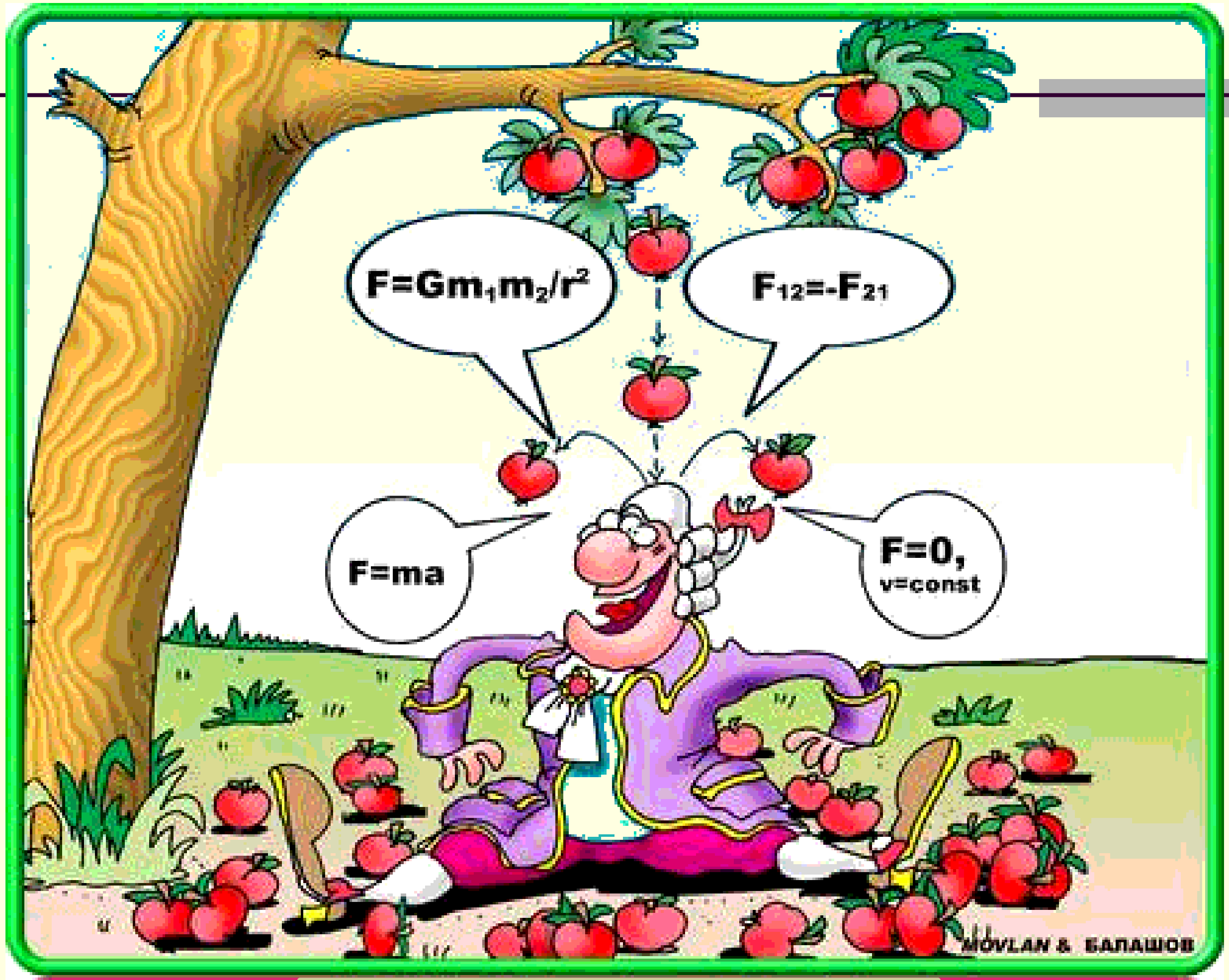
· **organization of libraries.**

1.4. Basic elements of science: FACT, HYPOTHESIS, CONCEPT

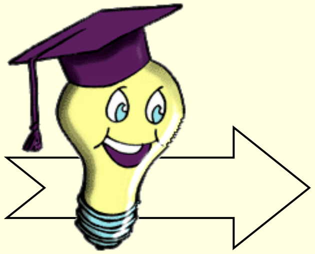
Fact



<u>Facts</u> are empirical (research) data.
<u>Scientific facts</u> are formed on the basis of generalization a certain class of phenomena.

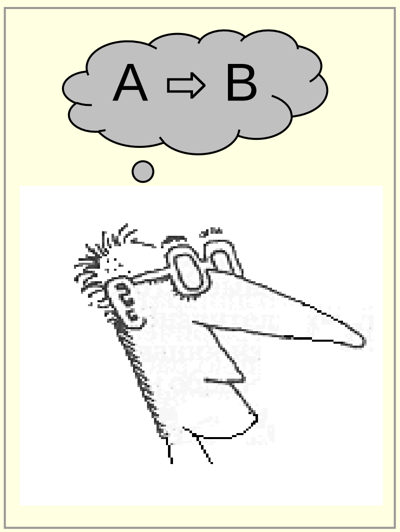


Isaak Newton



Hypothesis

A hypothesis is a preliminary theoretical assumption; the intended solution to the problem.

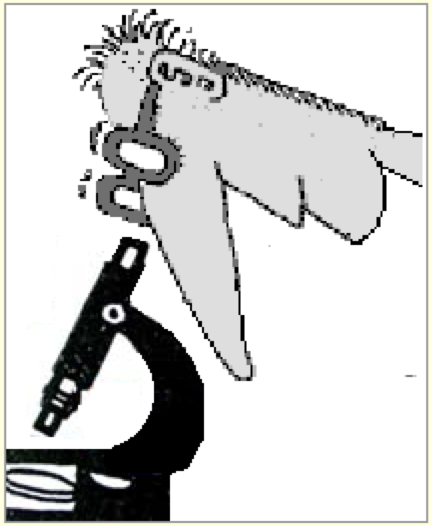


Stages of hypothesis development:

1. Nomination of the main assumptions.

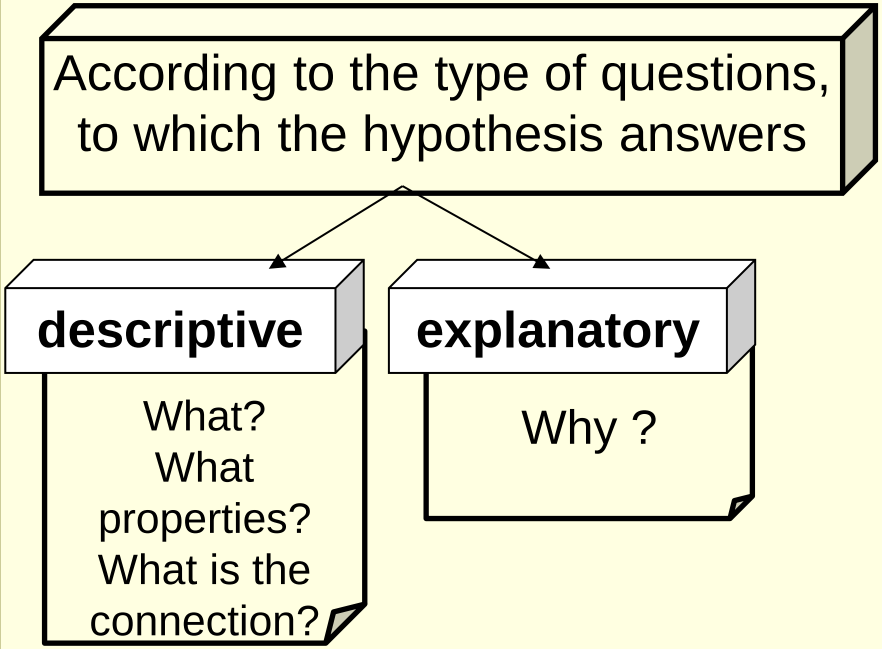
2. Justification of the hypothesis.

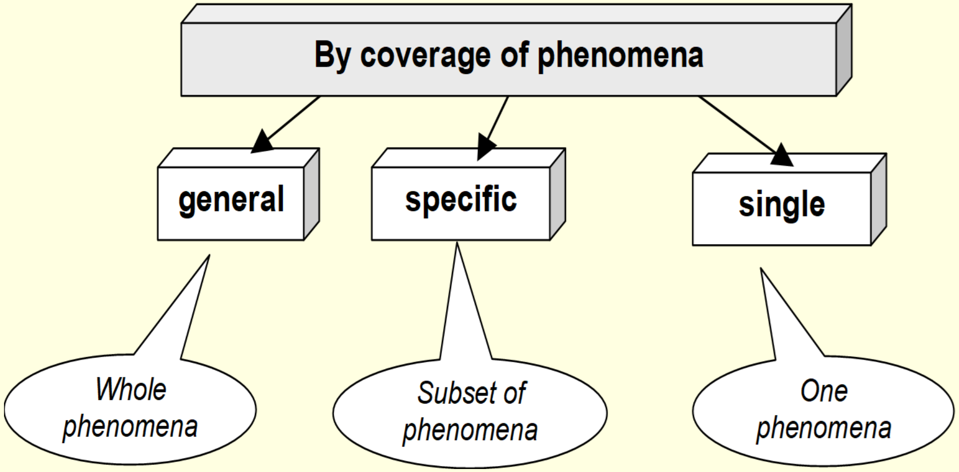
3. Hypothesis testing.

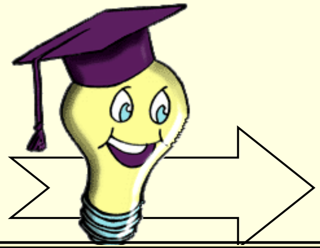


Classification of hypotheses

(more about hypotheses, see Topic 2)

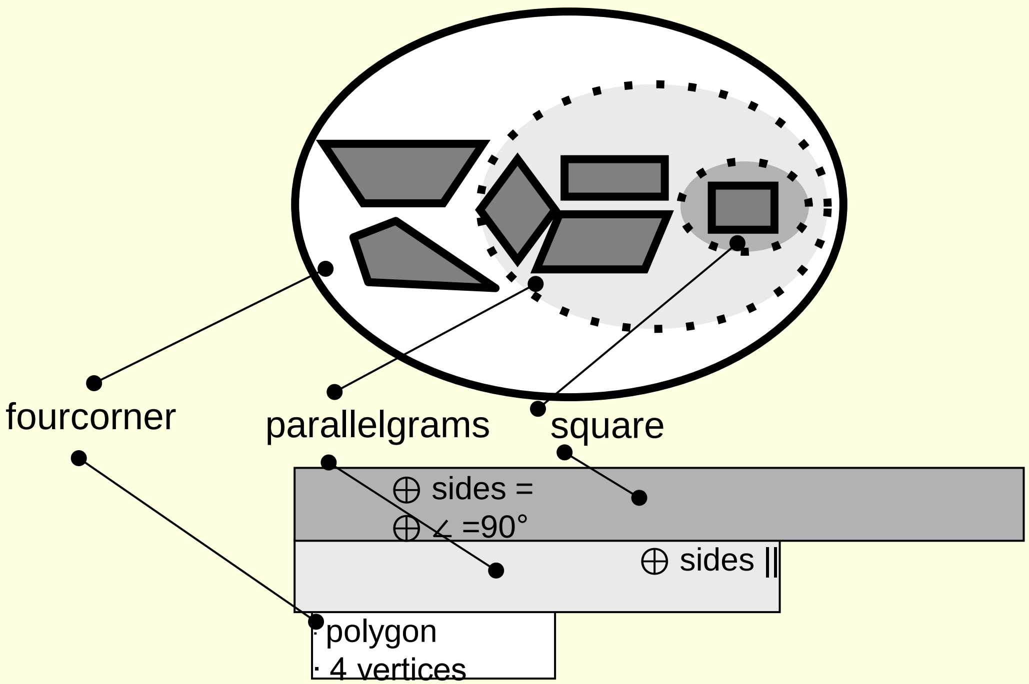






Concept

A concept is an opinion that reflects the general, and moreover essential, properties of objects and phenomena.
The scope of the concept is the set of objects or phenomena to which it applies.
The content of a concept is a set of signs and properties united in it. Disclosure of the content of a concept is called a definition.



The most generalized and fundamental concepts are called **categories**

A concept is a reflection of objects and phenomena from the point of view of their essential properties and relationships (consider the chain of reasoning):

- Any knowledge of nature by a person begins with sensations that connect him with the world of phenomena and give birth to images.
- Phenomena and images are described with the use of language.
- The same words give birth to different images in different people.
- There are words or groups of words that are not directly related, although they appeared thanks to them. This is the concept.
- Concepts generalize collective experience, but they are devoid of details characteristic of specific images, and therefore are suitable for communication between different people.

1.5. Scientific theory

Theory is the highest, the most developed form of organization of scientific knowledge, which gives a holistic view about regularities and essential connections in a certain field of reality.

Theory (Greek theoria - consideration, reflection, teaching) is a system of reliable knowledge about reality that describes, explains, predicts the phenomena of a specific subject area.

The structure of scientific theory

The main elements of the theory:

1) the starting points (fundamental concepts, principles, laws, equations, axioms);

2) an idealized object (an abstract model of the essential properties and relationships of the studied subjects, for example, "ideal gas", "economic man");

3) the logic of the theory (a set of certain rules and methods of proof aimed at explaining the structure and changes of knowledge);

4) philosophical attitudes and value factors;

5) a set of laws and assertions arising as a consequence from the foundations of a specific theory in accordance with its principles.

The structure of holistic scientific theories consists of the following sections:

- structure of the research subject;
- laws of operation of the theory;
- classification of varieties of the subject of research;
- genesis and development of the theory.

Functions of the theory

- *Epistemological (cognitive)*
- *Synthetic systematization*
- *Methodological*
- *Explanatory*
- *Prognostic*
- *Praxeological (practical)*

1.6. Stages of science's formation

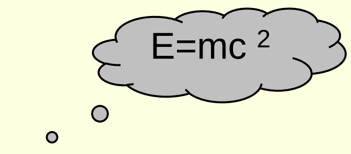
Before science period

Accumulated knowledge is not generated

Empirical level

Empirical knowledge transfer from people to peopl

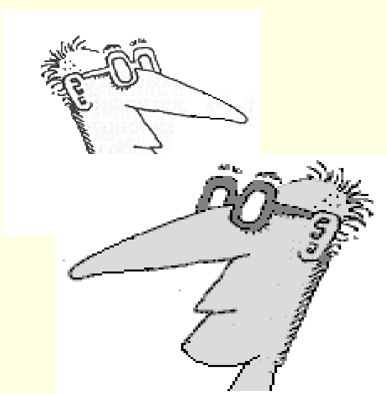
deterioration, extinction,
Induction, deduction, analysis
brightly judged,
brightly ostentatious,
then - statistical data,
empirical formulas



Theoretical level

operation with objects at theoretical level

Proposing hypotheses,
modeling,
idealization,
abstraction
generalization,
imaginary experiment

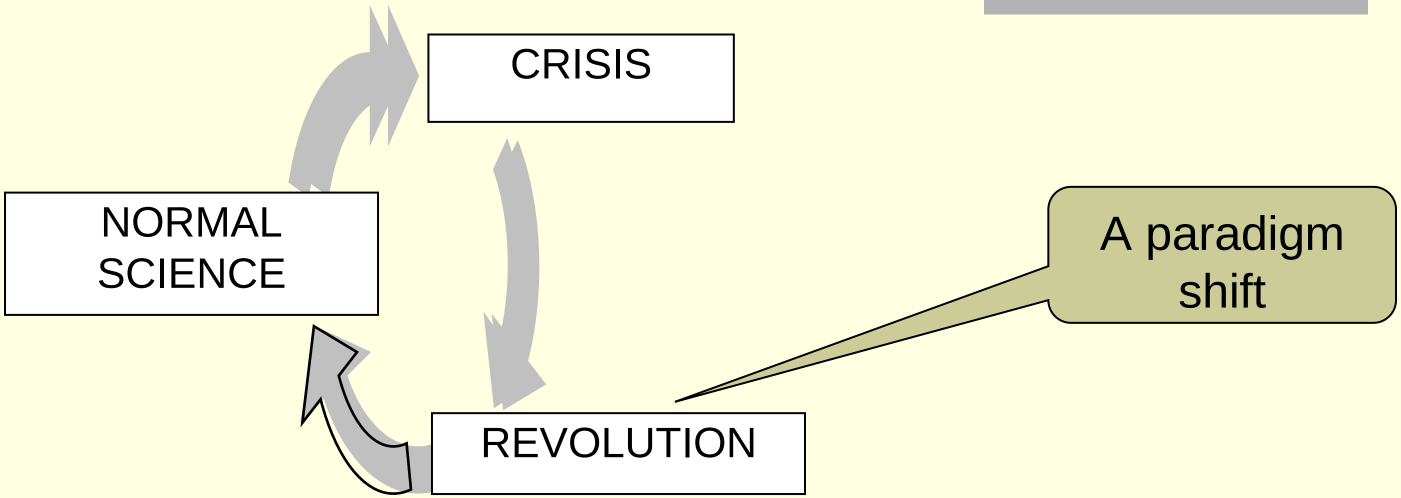


Methodological level

science about science

detection of the object
and subject of research
formulation of the research problem
construction of the research methoc

1.7. Cycles of science development



PARADIGM is **the dominant** model of scientific activity, which consists of a set of:

· theoretical principles,

· methodological standards,

· worldviews,

· value criteria.

Example 1.1.
One cycle of political economy development

- A. Smith's creation of political economy as a scientific system is a real revolution in economic science.
- This revolution marked the beginning of the normal development of science (the last quarter of the 18th century – the first half of the 19th century).
- A. Smith's system is amenable to further improvement, clarification, and deepening.
- (D. Riccardo – analysis of categories from the clear positions of the labor theory of value.
- D. Art. Mill – strengthening the social aspect of the analysis, raising issues of social justice).

Example 1.1. (continuation)

- But the normal state of science gradually accumulated:
  - internal contradictions.
  - the social practice of the 1930s and 1970s makes high demands on political economy.
- Internal contradictions of science – D. Ricardo and his school failed:

1. to explain the transformation of value into the price of production as a result of inter-industry competition.
2. the value of non-reproducible antiques and masterpieces of art,
3. the role of rarity in value formation.
4. In the contrast between labor and capital, D. Ricardo saw the "eternal evil" of the action of the objective laws themselves and considered it an irresistible evil, because the laws of production are not historical, but eternal in nature.

Example 1.1. (continuation)

- Thus, the political economy has entered a new phase – the phase of crisis development.
- Political economy emerges from a crisis state through the revolutionary restructuring of the double revolution.
- The double revolution caused the disintegration of a single "science into two sciences – Marxist and neoclassical.

K. Marx, with the help of F. Engels, in the 1940s and 1970s, created a new economic theory with a neat system of categories.

- The neoclassical revolution took place in several stages.

Example 1.1. (end)

- The neoclassical revolution took place in several stages.
- The first stage (70s of the 19 century) is the subjective orientation of the marginalist revolution (Austrian school – K. Menger, Englishman W. Jevons and Swiss L. Walras).
- The second stage (90s of the 19th century) – neoclassical theory? in the last quarter of the 18th – the first half of the 19th century, developed within the framework of normal science:

"Cambridge" school of A. Marshall, "American" school of J. B. Clark (1847–1938), the "Lausanne" school of V. Pareto (1848 – 1923).

- At these two stages, it was possible to create a theory of microeconomics.
- Macroeconomics became the product of a new cycle of theory development.

1.8. Paradigms of science. Classical paradigm

- *Man asks nature (object) a question, nature answers.* It is assumed that the influence of the means of observation in the experiment can always be made very insignificant.
- ***Classics: Subject*** – ***Means*** – ***(Object).*** Only the object is considered. These are the ideals of classical rationality, the objectivity of scientific knowledge, the inviolability of the open laws of nature, which are fully realized in Newtonian mechanics dealing with macrobodies.

Neoclassical paradigm

- *A person asks nature a question, nature answers, but the answer now depends on the way of asking, on the context of the question* (not only on the means of observation during the experiment, but also on the possibility of conducting joint observations of various quantities). The principle of the relativity of the result to the means of observation arises, the fundamental impossibility of eliminating the influence of observation on the system/

Neoclassical paradigm

- ***Neoclassical: Subject* – *(Means – Object).*** Not only the object is taken into consideration, but also the means. This approach first appears in the theory of relativity, where space-time intervals depend on the observer's frame of reference/
- Living systems and the psyche exhibit similar properties. In human relations, the form of the question and its tone largely determine the answer/

Some specific scientific criteria of classical and neoclassical knowledge

Classic	Neoclassical
Fundamentalism	Fallibilism
Evidence	Non-obviousness
Austerity. Precision Reasonableness Monism Inductance Clarity Knowledge as a given	Probability Subjectivity Alternativeness Hypothetical deductiveness Abstraction Growth and development

Fallibilism (from the Latin Fallibilis – prone to mistakes, fallibility) is the direction of postpositivism, according to which any scientific knowledge is fundamentally not final, but is only an intermediate interpretation of the truth, which implies a subsequent replacement for a better interpretation .

Post-neoclassical paradigm

- *Man asks nature a question, nature answers, but the answer now depends both on the way of asking and on the ability of understanding of the one who is asking.*

- *The subject's cultural level, his psychological, professional and social attitudes, which had not previously been considered by science, must be taken into consideration.*

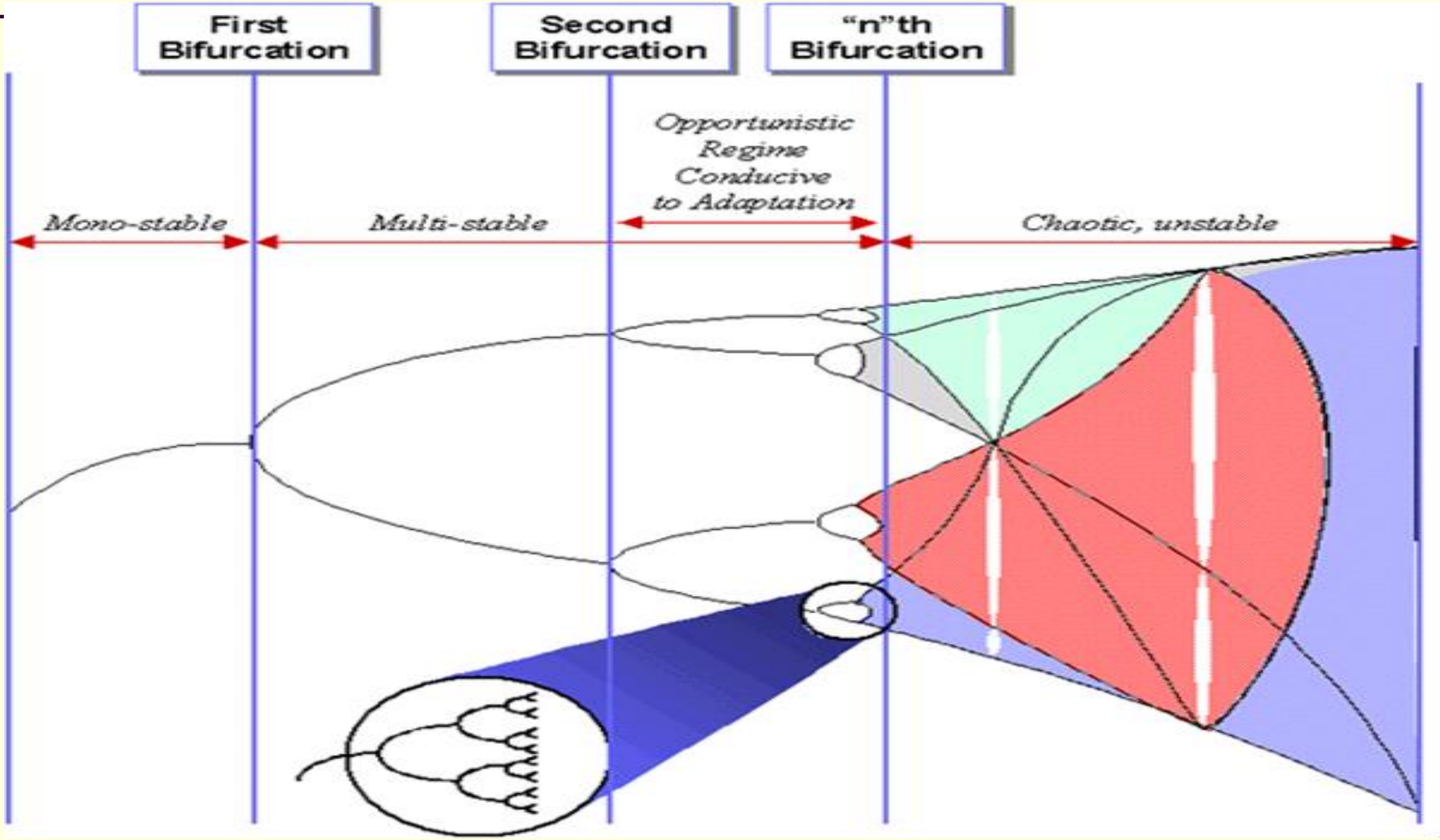
Post-neoclassical

- ***(Subject – Means – Object).*** Now all participants in the process of cognition are under consideration: subject, means, object/
- There is a repeated reading of the text of nature, a change in repeated experiments of ideas about it, the emergence of an evolution of views on nature.
- The field of application of post-neoclassicism is much wider than exact natural science and is designed to synthesize the sciences of inanimate – living – intelligent.

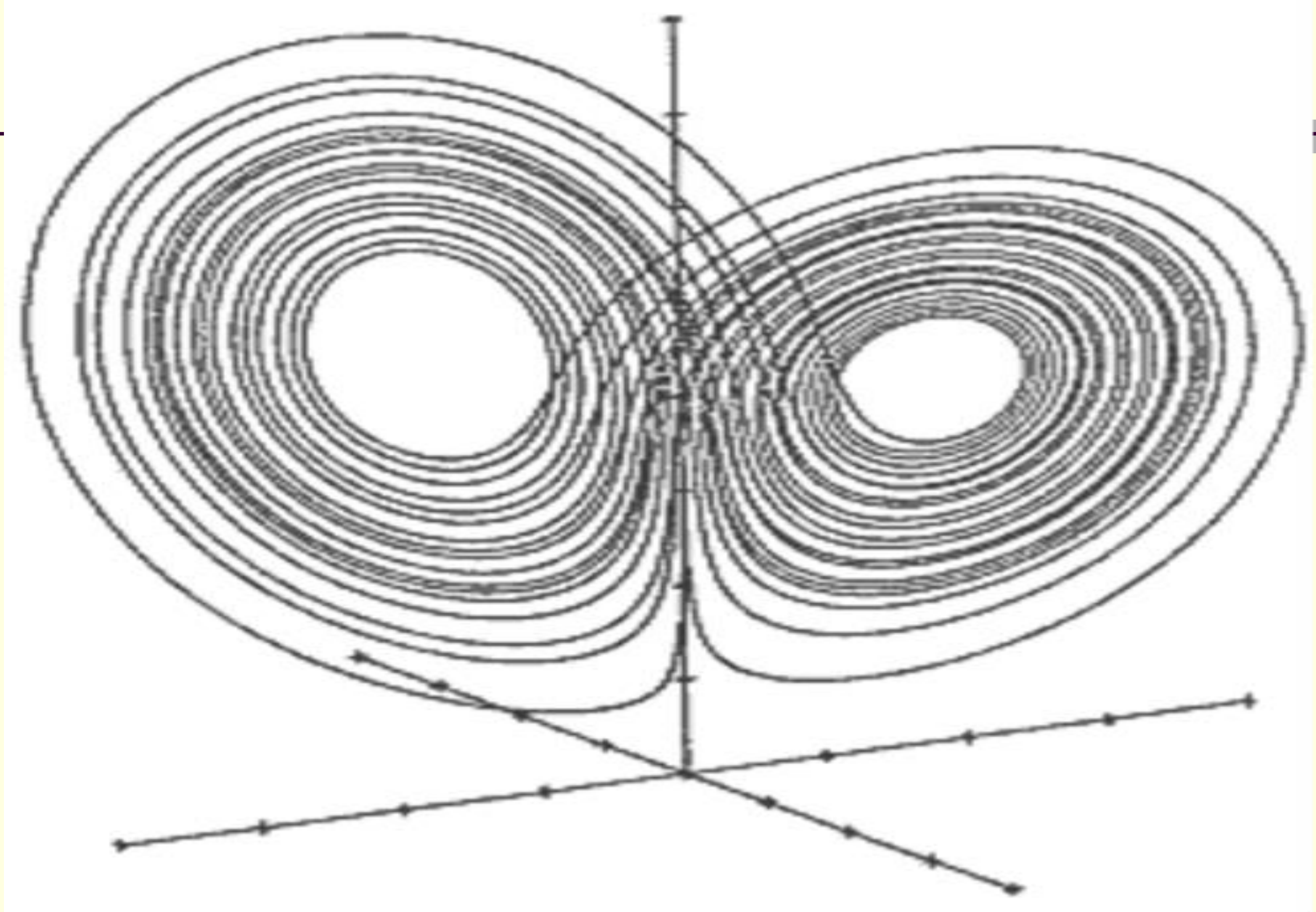
New elements of the language of post-neoclassical science

- Disorder
- Instability
- Variety
- Imbalance, temporality (increased sensitivity to the passage of time)
- Non-linear relationships in which a small signal at the input can cause an arbitrarily large response at the output
- Self-organization,
- Bifurcations, attractors

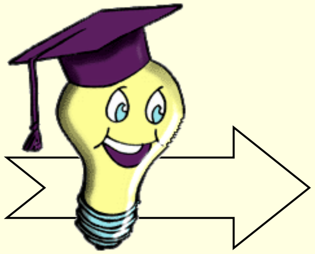
Example 1.2. Bifurcation diagram



Example 1.3. Lorentz attractor

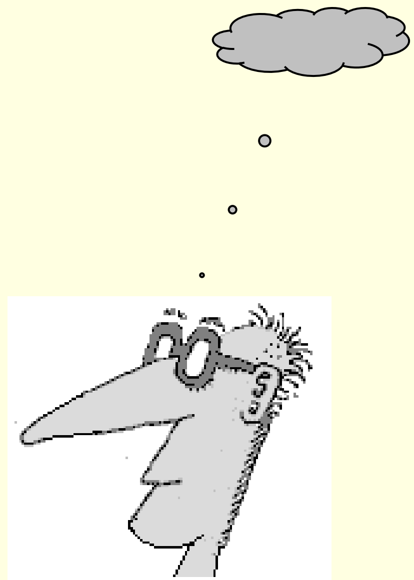


An attractor is a compact subset of points from the phase space of a dynamic system to which the phase trajectories of the dissipative system…



Features of society as the subject of research

- The variability of economic, political, spiritual and ideological systems of society
- Dynamic character development of society
- Self-organization
- Subjective factors
- Conscious, purposeful forces, interests, their contradictions
- An objective system of interaction between people and natural forces
- Appearance of "Black Swans "



Features of the modern science development

- Differentiation of sciences is combined with integration processes, synthesis of scientific knowledge, transfer of research methods from one area to another
- Comprehensive coverage of a scientific problem is possible only on the basis of the integration of the conclusions of individual sciences and the results of research by specialists in various fields of knowledge
- Sciences are becoming more and more precise thanks to the use of mathematical apparatus
- Modern science develops in time and space,
- the gap between the emergence of a scientific idea and its implementation is reduced
- Today, scientific achievements are the result of collective activity, the object of planning and regulation
- The study of objects and phenomena is conducted systematically, comprehensively and forms synthetic thinking.

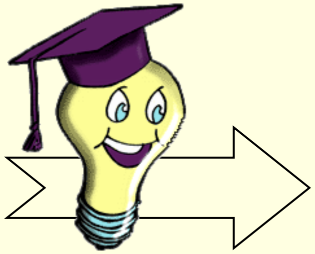
1.9. Types of concepts. Operations with concepts

The content of a concept is a set of signs and properties united in it. Disclosure of the content of a concept is called a definition.

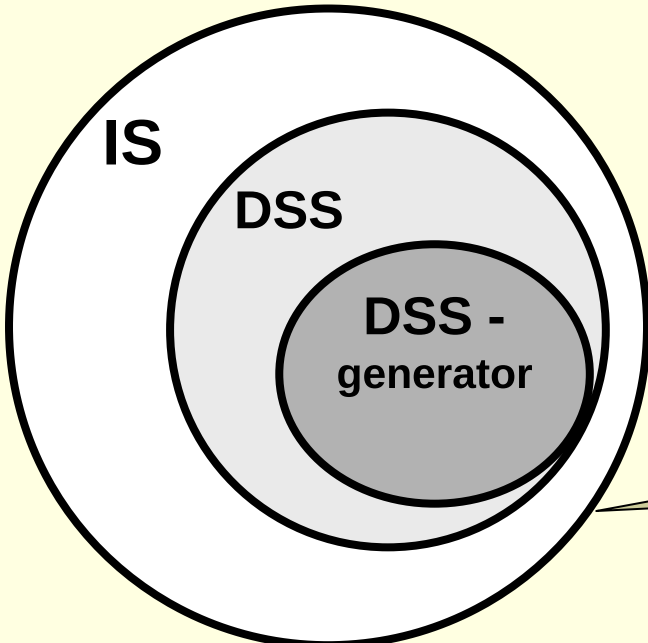
If the content of the concept ↑ , then its volume ↓

(Law or regularity?)

if the scope of the concept is ↑ , then its content ↓



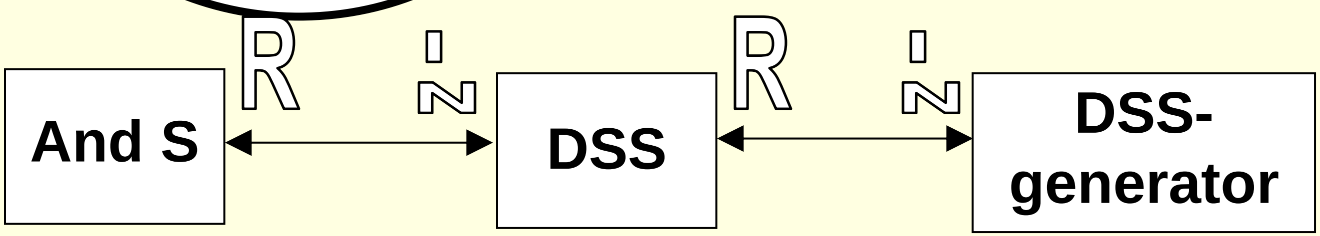
Concepts: generic (P) and species (B)



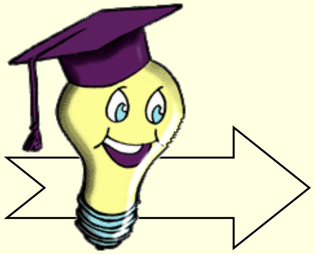
WHERE is it used?

- *for formulation of definition*
- *for classification*

IS is an information system
DSS is a decision support system

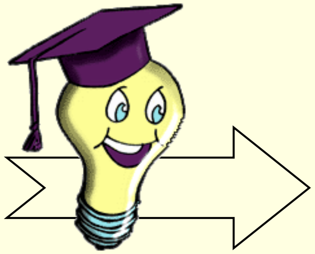


P is a generic concept; B is types of concepts



Types of concepts

Specific *Stone*		**Features of the object**	**Abstract** *Soft*
Single *Author of the economics theory*	V=1	V>1	**General** *Economist*
Highlighted *Star*	Object	Totality of The objects	**Collective** *Constellation*
Positive *Even number*	(+) A sign **inherent** in the object	(—) A sign **absent**	**Negative** *Odd number*
Irrelevant *A men*	**Attributes**	**Relations**	**Relevant** *X father of Y*
Clear *Price of good is 30$*			**Indistinct**



Types of concepts (the end)

- ❑The characteristics of the content and scope act as the basis for the classification of concepts. By volume, the concepts of general, single and empty are distinguished.
- ❑Single concepts are those whose scope extends only to one subject or phenomenon (for example, the concept of world economic system).
- ❑Shared concepts are those whose scope extends to a group or class of objects (for example, the concept of economic system of the country).
- ❑Empty are those whose scope does not cover any subject (for example, the concept of ideal economic system).
- ❑According to the content, concepts are divided into concrete and abstract, unrelated and relative .
- ❑Specific concept that in which some individual object or class of objects (for example, goods) is displayed.
- ❑Abstract concept which reflects individual properties, sides of the relationship *of objects (for example, profitability", "efficiency).*

The law of the inverse relationship between the content and scope of the concept

investor -
the person who invests funds in investment projects

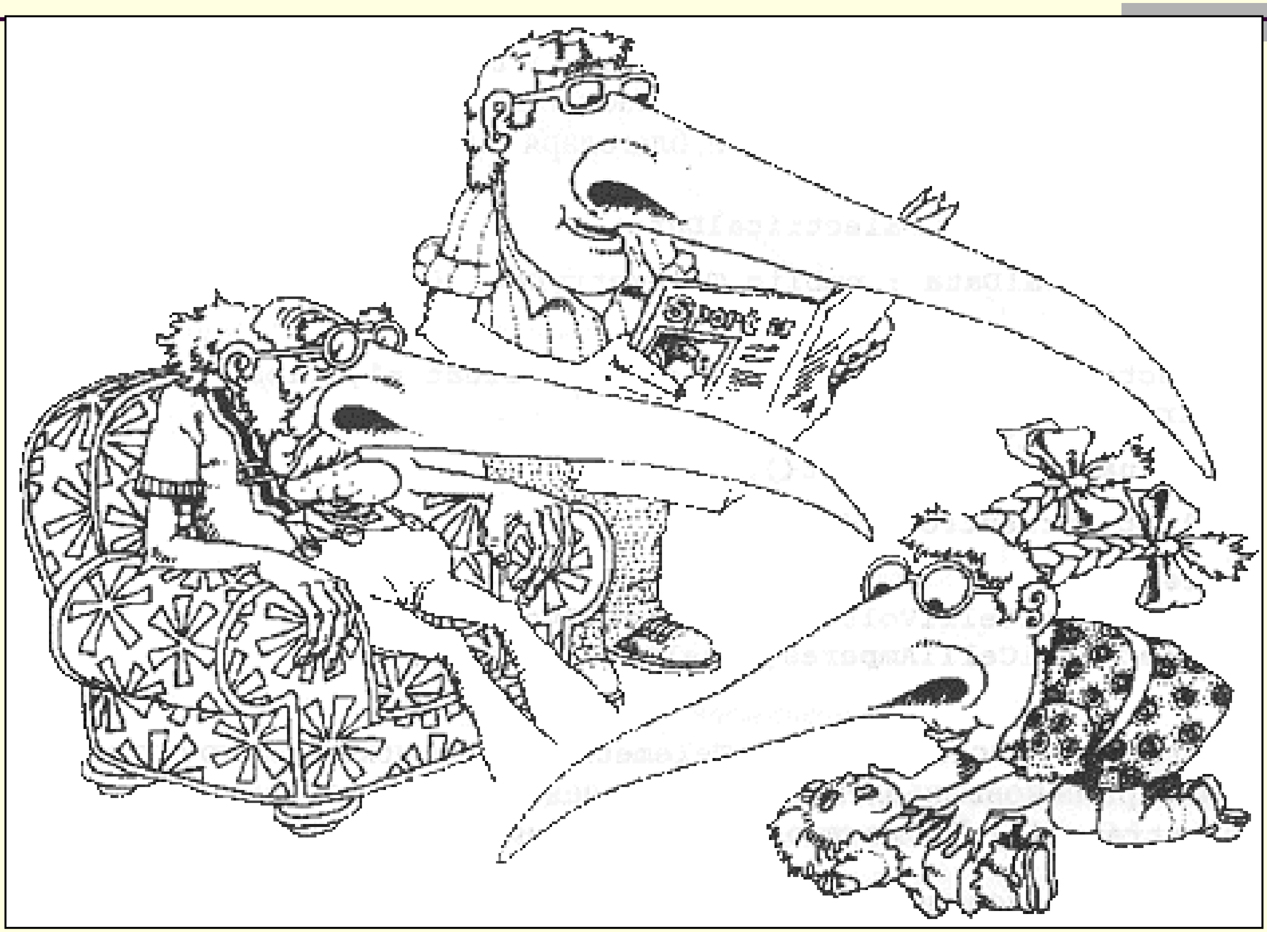
CONTENT of the ↑ CONCEPT

SIZE of the ↓ CONCEPT

Portfolio investor -
a person who invests funds in investment projects and interested in profit maximization directly from securities, rather than in control of the enterprise.

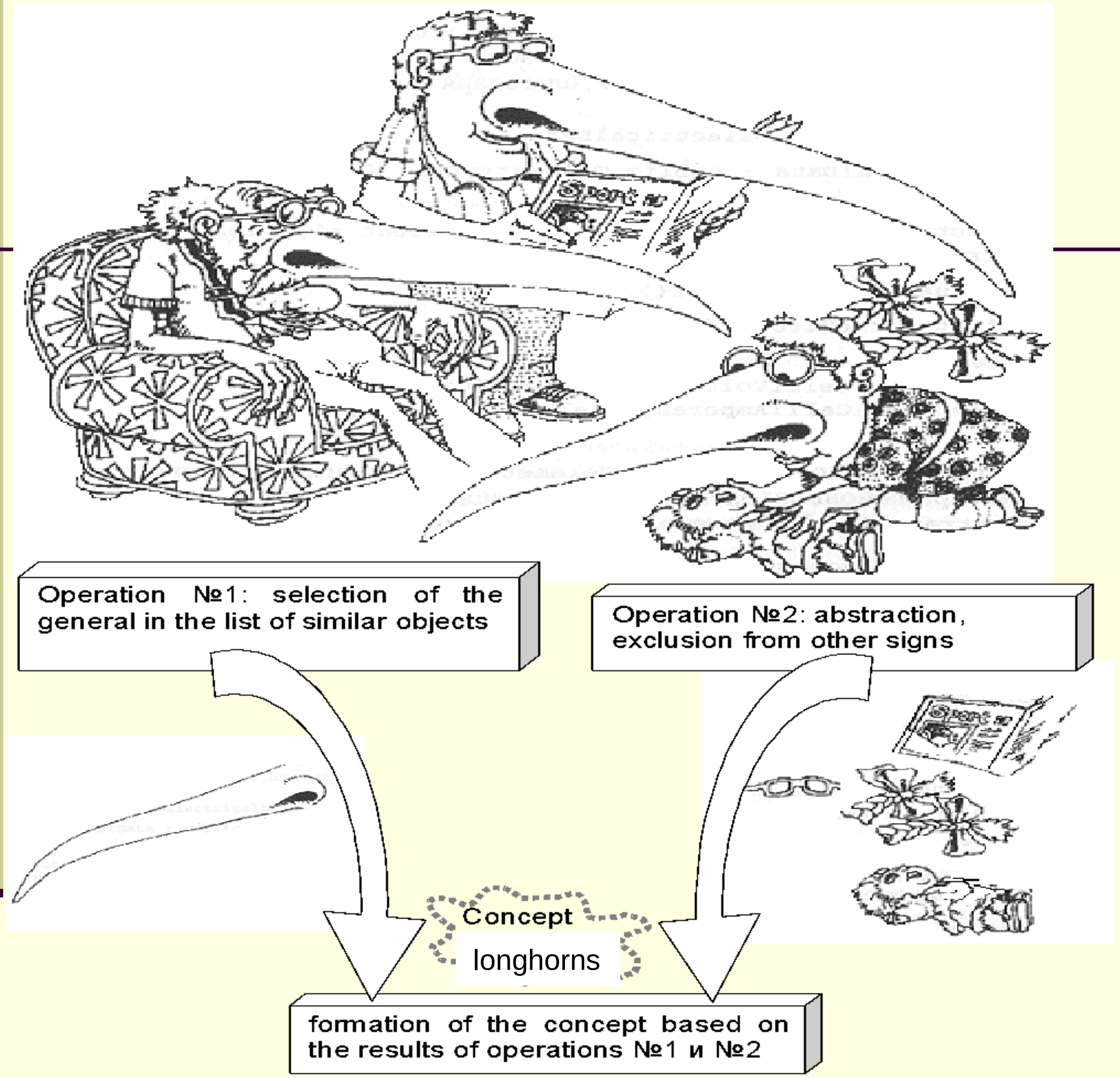
The law of the inverse relationship between the content of the concept and its volume: as the content of the concept increases, its volume decreases, and as the volume of the concept increases, its content decreases.

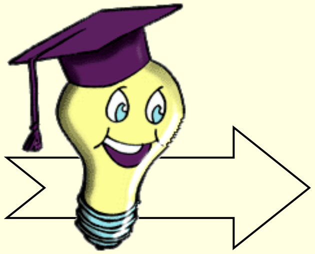
Essential signs



Longhorns are...

Concept as a result of generalization and abstraction operations





Operations with concepts

Generalization is a logical operation, with the help of which, due to the reduction of the content of the concept, its scope is expanded.

parallelogram - *Specific feature* (parties and ||) → quadrangle

Limitation is a logical operation in which, by complicating the content of a concept, its scope is narrowed.

parallelogram + *Specific feature* : (sides =; ∠ =90°) → square

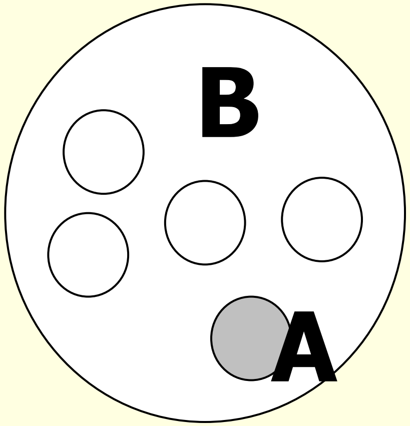
Operations with concepts: definition

Definition is a logical operation that reveals the meaning of a concept

An explicit definition has the form:

A is B, which has C

- A — The concept that is defined
- B — Generic concept
- C — species signs



Definition

- **Real**
- **Nominal**

Types of definitions

- **Definitions that** solve the problem **of describing some objects** are called **real**.

(For example, salary)

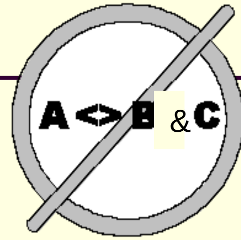
- **Definitions that** express **the requirements that objects should be** are called **nomina .**

(For example, living wage)

Rules for the formation of definitions

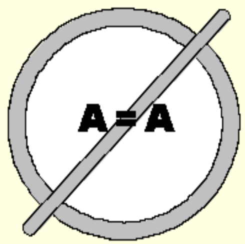
1. **The rule of correspondence of the concept** which is defined and a concept that defines

These concepts should cover the same set of subjects and be interchangeable.



2. **The rule of banning a false circle**

You cannot define a concept through itself.



3. **The rule of clarity of the defining concept**

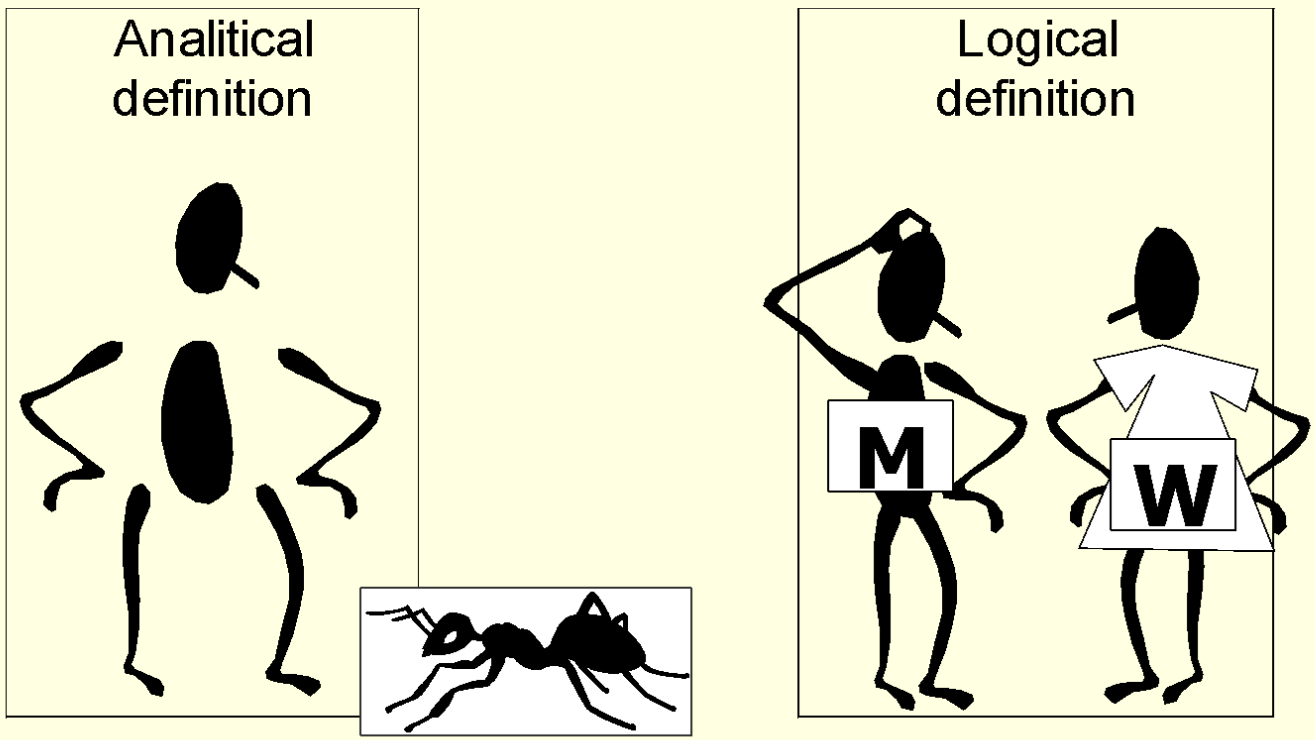
The defining concept must reflect the essential features of the concept being defined, be known to those for whom the definition is intended, and not allow ambiguous interpretation.

Separation of concepts

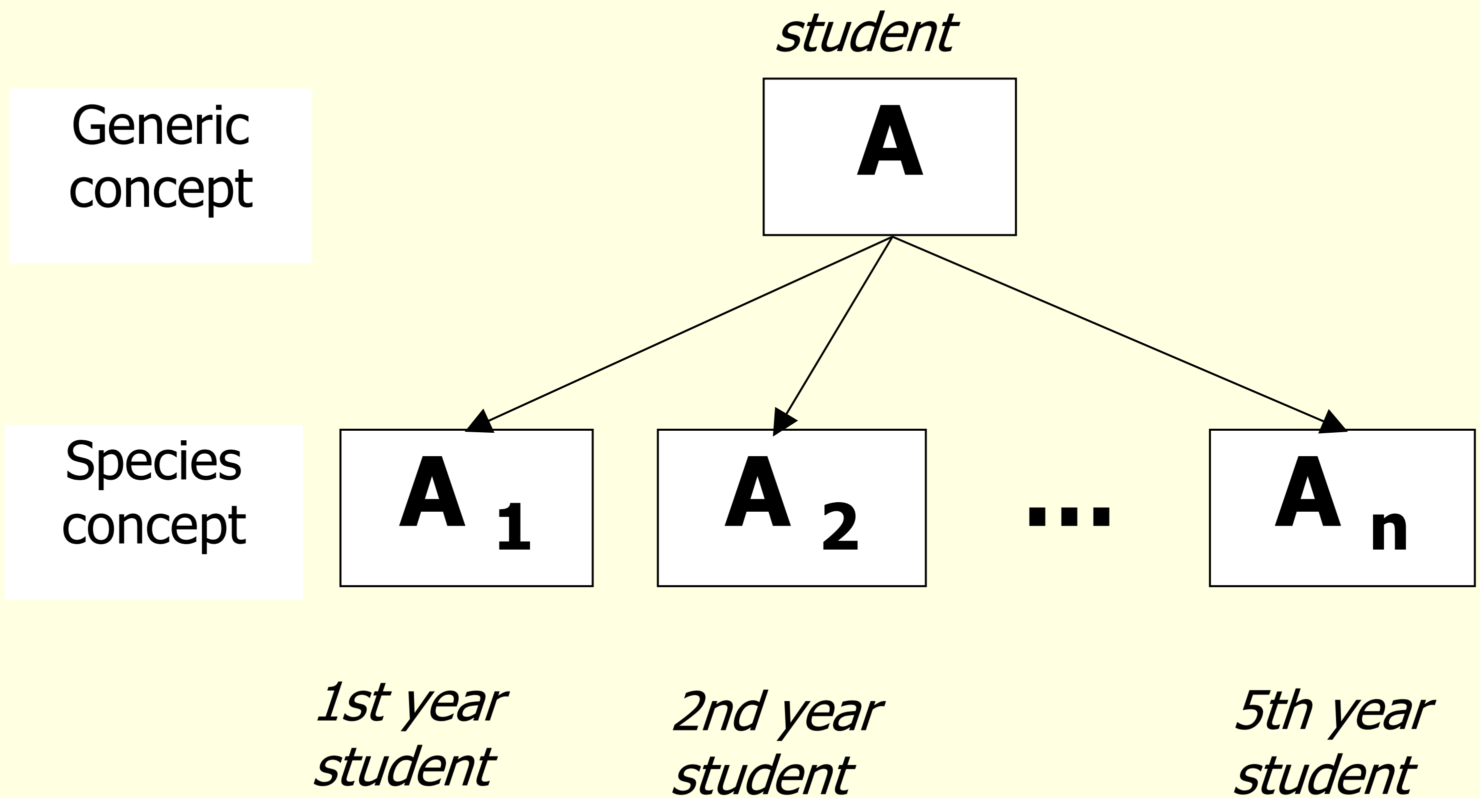
- The content of the concept is established using the definition. The scope of the concept is revealed by division. **To reveal the scope of the concept means to establish what types it is divided into.**
- **Division is the division into types (groups) of subjects** included in the scope of this concept.
- **With the help of division, we determine the species that make up the genus** . For example, by dividing legal facts into "events" and "actions", we reveal the scope of the concept of "legal fact". Speaking about the fact that contracts are "remunerative" and "free", we establish the scope of the concept of "contract".
- In division, **the members of the division and the basis of the division are** distinguished**.**
- A concept whose volume can be divided is called divisible.
- The types of objects into which the genus is divided are called members of the division.
- **The sign by** which **we divide concepts into types** is **called the basis of division.**
- The biggest difficulty and responsibility in the division is the choice of a feature according to which concepts are divided into types. In principle (formally), concepts can be divided into types based on any feature.

Operations with concepts: classification

Classification is



Example 1.4. Classification

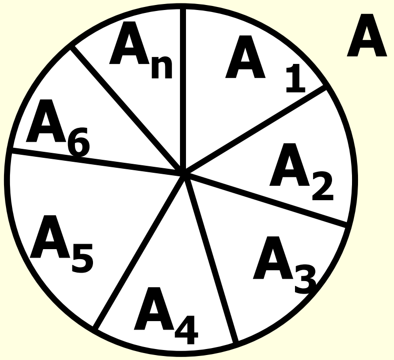


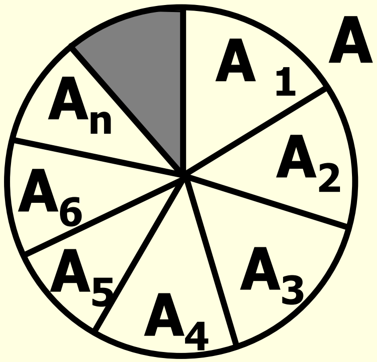
Classification rules

1. **The rule of a single classification feature (basis).**
(The initially selected feature should not be changed during distribution)

2. **Adequacy rule.**
(The distribution must be exhaustive, that is, the classification must cover the entire set of objects without a remainder).

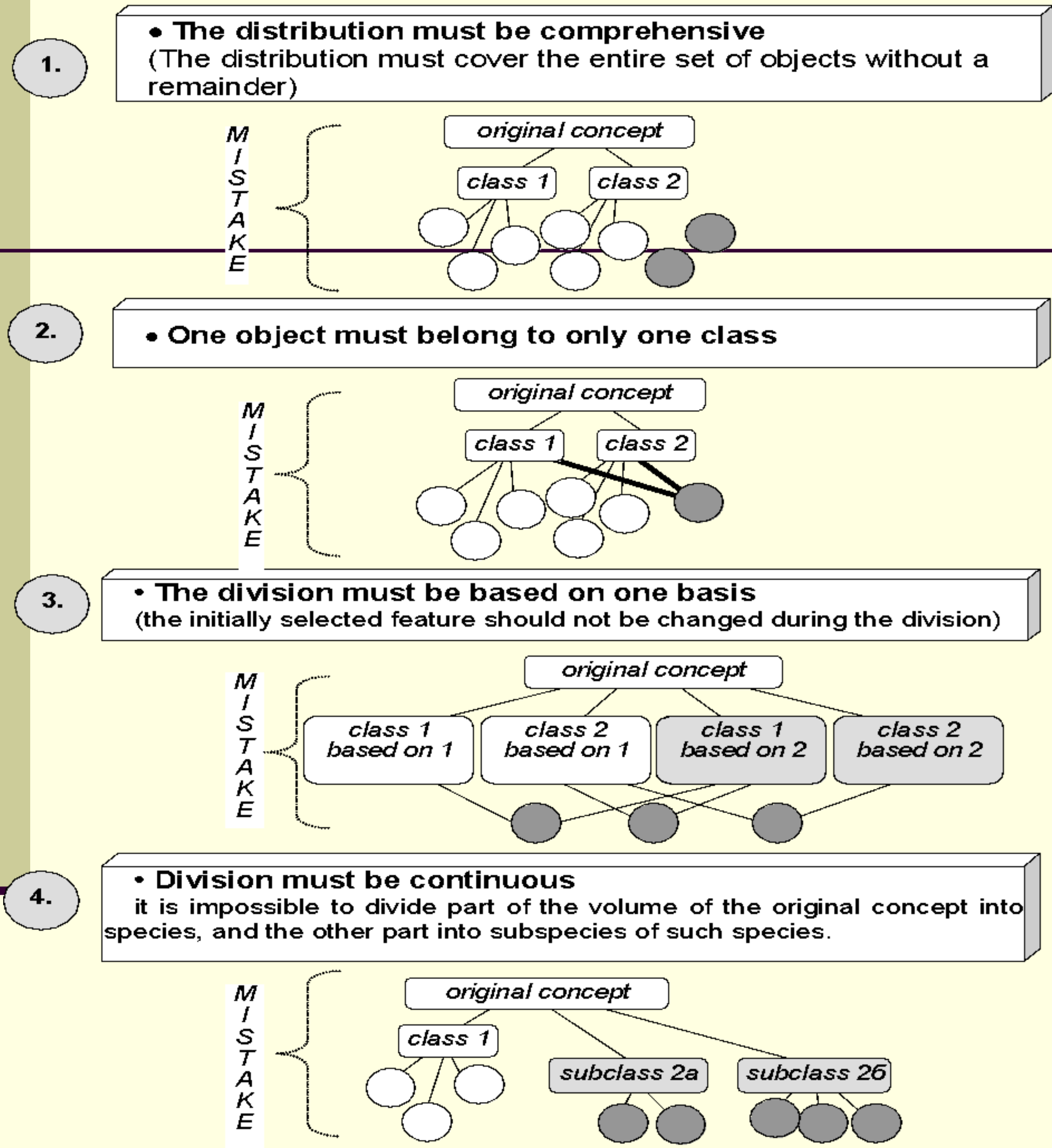
$$V(A_1)+\ldots+V(A_n)=A$$





3 . **One object should belong to only one class**.
4. **The rule of essentiality of a classification feature.**

Classification errors



Example 1.5. Classification errors

People: men, women, children.

People: have primary, secondary, higher education.

Numbers: multiples of two, multiples of 3,

multiples of 5, simple.

Identification and clarification of the content of the key concepts of the studied subject area is based on the analysis of the works of domestic and foreign scientists

The analysis of scientific works should provide answers to the following questions:

- What, according to various researchers, are the essential features of the phenomenon possible in the concept?
- What concepts are considered generic in relation to the analyzed concept?
- According to what signs and into what groups is the considered concept classified in various scientific works?

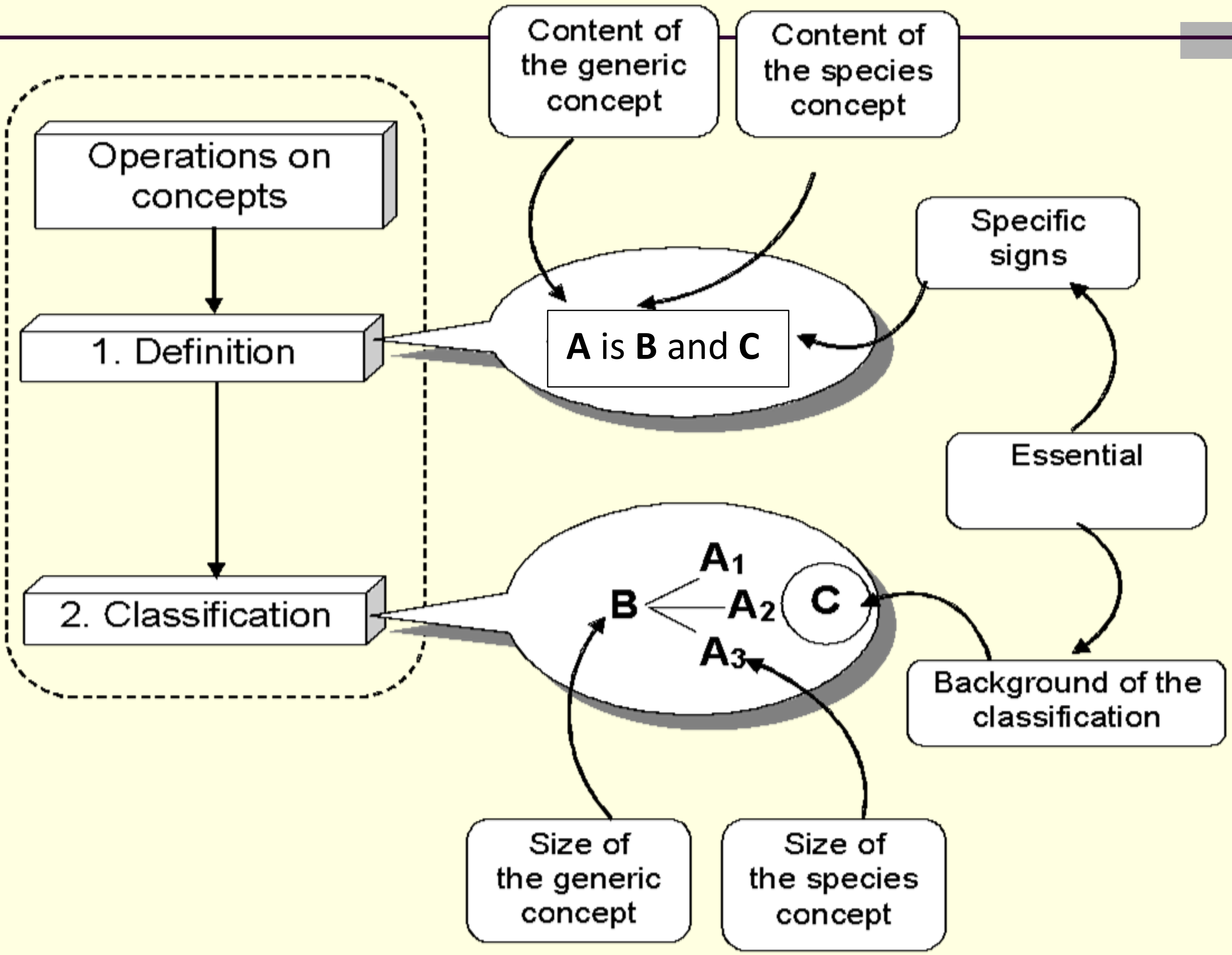
Example 1.6 . Generalization of approaches to defining the term "IT-technology"

Authors	Essence of IT-technology	Key words
Argyres N. S [2]	IT - processes that use a set of means and methods of collecting, processing, accumulating and transmitting data (primary information) to obtain new quality information about the state of the object, process, phenomenon, information product, as well as the dissemination of information and how to implement such processes and methods.	Methods of collecting, processing, accumulating, transmitting data
Feldman M. S. [7]	IT - a broad class of disciplines and fields of activity relating to technologies for creating, preserving, managing and processing data, including the use of computer technology.	Technologies for creating, storing, managing and processing data
Hiltz S. R. [11]	IT is a complex of interrelated scientific, technological, engineering disciplines that study methods of effective organization of labor of people engaged in processing and storage of information, computer technology, methods of interaction with people and production equipment, their practical application, as well as the associated processing of social, economic and cultural problems.	Methods of effective organization of human labor, information processing and storage, computer technology
Kanter R. M. [14]	IT is a system of methods, processes and ways of using computers and communication systems to create, collect, transmit, search, process and distribute information to effectively organize the activities of people.	A system of collection, transmission, retrieval methods,
Kurland N. B. [17]	IT is a set of methods and tools used to collect, store, process and disseminate information	collection, storage, processing and dissemination of information

Example 1.7. Design (concept analysis)

Generic concept	**Definition of the analyzed concept**	**Link to the source**
Style behavior	A special **style of behavior** that is cultivated in the corporation and unites or separates employees in the process of achieving goals	Afanasyev M. V., Shemayeva L. G., Verloka V. S. Basics of management. - Харків: VD "INZHEK", 2003. - 484 p. (p. 437)
Climate		

Interrelationship of definition and classification operations with the main characteristics of concepts



Control questions

1. Define the essence of science as a way of knowing the world. Define the term "science ".
2. Who is the subject of scientific research?
3. Describe the types of hypotheses.
4. The essence of the scientific problem.
5. Define and characterize the types of operations with concepts according to various classification features.
6. Name the components of the standard model of a scientific theory.
7. Describe the main functions of a scientific theory.
8 . Describe the main classifications of sciences. What are they needed for?
9. What are the fundamental differences between natural and social sciences?
10 . Describe the main functions and tasks of science .
11 . What is the essence of methodological and heuristic principles of building theories?
12. Describe the models of explanation and classification of the main paradigms of science.
13. Define the concept of scientific school, normal science, scientific revolution.
14. What opportunities do multiparadigmatic and interdisciplinary methodological approaches in scientific research open up ?
15. What is the specificity of scientific thinking?
16. Give a brief description of the stages of the formation of science.
17. What phases does the development cycle of any mature science include?

Practical component

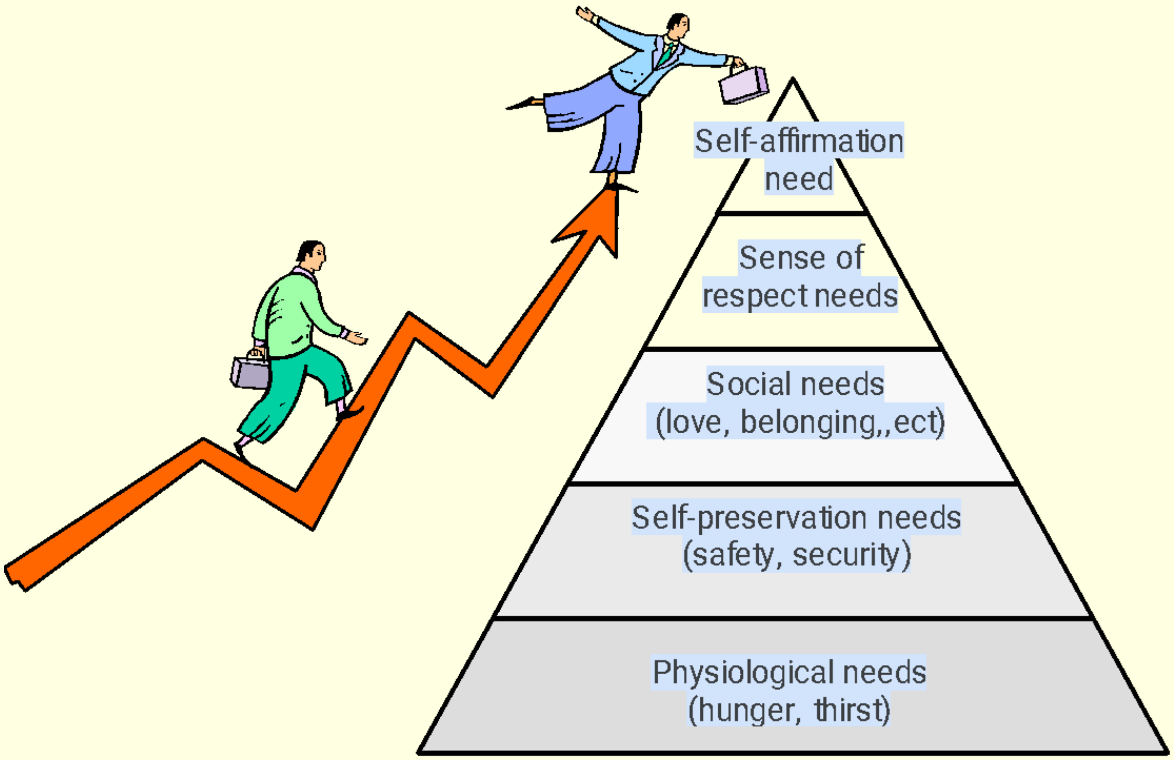
Objectives of the task:

- to consolidate the acquired knowledge about the tasks and functions of science;
- to gain experience in identifying general tasks of scientific research

Example 1.8. Functions and tasks of science

Any scientific research is aimed at solving one or more problems. We remind you that the main tasks of science include:
description of the phenomena of reality;
systematization of reality phenomena;
explanation of the phenomena of reality;
prediction of phenomena is true

- Consider the well-known hierarchy of needs proposed by Abraham Maslow (see the picture).



Example 1.8. (the end)

- It is obvious that this hierarchy solves the task of systematization of human needs: needs are grouped and ranked in terms of their importance.
- At the same time, Maslow's hierarchy is an attempt to explain why people are driven by different interests in different situations. In other words, this scientific result solves the task of explaining the phenomena of reality.
- Moreover, with the help of Maslow's theory , it is possible to predict a person's behavior based on information about which of his needs are satisfied and which are not.
- Thus, the hierarchy of needs proposed by Abraham Maslow solves the task of describing, systematizing, explaining and predicting phenomena
- It is useful to subject the results of all studies to such an analysis. The correct definition of what tasks the conducted scientific research solves allows you to correctly determine the scope of application of its results.

Task 1

- Description of the results of scientific research in literary sources. Determine the solution of which tasks (description, systematization, explanation or prediction of the phenomena of reality) each of the results is aimed at.

Example 1.9. Hypotheses – justification and characteristics

- **An example of a general explanatory hypothesis**
- The research topic, within which the hypothesis is formulated. Organization of accounting in Ukraine.
- **The hypothesis**. The majority of accountants at domestic enterprises are women, due to the fact that women are more patient and meticulous, and are not inclined to change jobs.
- **Justification**. Such qualities of women as patience and pedantry, as well as the lack of inclination to change jobs lead to the fact that, on the one hand, women themselves are satisfied with the painstaking work of an accountant, and on the other hand, this state of affairs suits the management. A man prefers to "grow" all the time, he is more inclined to change jobs, while a woman, having achieved the position of chief accountant, can become a support for the manager for a long time. Constant change of leaders will not benefit any organization.

Example 1.9 (continuation)

- **Characteristics of the hypothesis**. This hypothesis is common and explanatory. It can be used in the process of personnel management of enterprises, in the organization of training of accountants, as well as in the development of an automated workplace of an accountant. Pro-verification of the formulated hypothesis can be carried out with the help of questionnaire methods and mathematical statistics.
- **An example of a partial hypothesis.**
- **The research topic** within which the hypothesis is formulated. Accounting for the interaction of "Alpha", "Beta" and "Gamma" enterprises with consumers of products.
- **The hypothesis**. The volume of product sales at the "Alpha", "Beta" and "Gamma" enterprises will increase if stratification (i.e. grouping) of consumers is carried out according to the stages of making decisions about the purchase .

Example 1.9 (continuation)

- **Justification**. The volume of product sales depends on the effectiveness of methods of stimulating customers to purchase. Since the products of the "Alpha", "Beta" and "Gamma" enterprises are expensive, technically complex and have a production purpose, the decision to purchase is made by the consumer not immediately, but in several stages that have a considerable length of time. At the same time, various methods of stimulation are effective for consumers who are at different stages of decision-making. As a result, the accounting of consumers in terms of decision-making stages will lead to an increase in the effectiveness of stimulation methods, which in turn will lead to an increase in the volume of product sales.
- **Characteristics of the hypothesis**. The considered hypothesis is descriptive , as it answers the question: "In what connection are phenomena A and B?", where A is the volume of sales of the enterprises "Alfa", "Beta" and "Gamma", B is the type of consumer stratification .

Example 1.9 (continuation)

- **According to another classification, this hypothesis is partial** as it concerns the group of enterprises "Alpha", "Beta" and "Gamma". At the same time, this hypothesis can be expanded to a general level, if we note that it is suitable for all enterprises that sell products for industrial and technical purposes (PPTN). The general hypothesis will sound like this: the volume of product sales at enterprises producing PPTN will increase if the stratification of consumers is carried out according to the stages of decision-making about the purchase.
- **An example of a single hypothesis.**
- **The research topic** within which the hypothesis is formulated. Formation of the development strategy of the "Delta" enterprise.
- **The hypothesis**. The successful development of the "Delta" enterprise over the next 10 years will be guaranteed if this enterprise becomes a client of the business incubator.

Example 1.9.

- **Justification**. The company "Delta" belongs to small enterprises, and according to statistics, only 20 % of the total number of newly created small enterprises remain after 2–3 years. At the same time, among enterprises that pass through a business incubator, the proportion is reversed: 80 percent survive and become well-developed firms, and only 20 percent close. Since the personnel of the "Delta" enterprise has a strong intellectual potential, it can be assumed that after exiting the business incubator, this enterprise will successfully develop independently.
- **Characteristics of the hypothesis**. The considered hypothesis is single and descriptive-predictive, as it establishes a connection between the participation of the "Delta" enterprise in the business incubator and the results of the development of this business entity.

Task 2

1. For your topic of scientific research, formulate 2-3 working hypotheses about the properties, relationships and causes of phenomena related to the relevant subject area.

2. Propose a justification of the formulated hypotheses.

3. Define the type of each hypothesis.

4. Describe the purpose of hypotheses (in which areas of science and practice information about the expected regularities) can be used.

5. Describe how the reliability of each formulated hypothesis can be tested.

Task 3 (definition)

Determine whether the following definitions are correct. If not, what requirements do they violate?

- Polyvaccine is a medical drug.
- Information system - SPPR or other information system;
- A weed is an uncultivated plant.
- Quotation marks - a pair of punctuation marks used to highlight direct speech.
- scotland is a country where stingy husbands wear their wives' skirts.
- Algebra is a branch of mathematics.

Task 4 (essential signs)

Find out which of the listed signs form the content of the corresponding concepts, and which ones do not and why:

1) geometry is:

1.1) a section of mathematics;

1.2) a section of mathematics that studies spatial relations, shapes, geometric bodies and their generalizations;

1.3) a section of mathematics taught at school;

2) microeconomic studies are:

2.1) research of economic activity of private entrepreneurs;

2.2) study of the economy at the level of separate economic units;

3) an island is a piece of land that:

3.1) is inhabited by people;

3.2) has some area;

3.3) is surrounded on all sides by the waters of oceans, seas, lakes or rivers;

4) a square is a quadrilateral that has:

4.1) equal mutually perpendicular diagonals;

4.2) a certain area;

4.3) equal sides and right angles;

Task 5 (limitations)

: Can the transition from the concepts named on the left to the concepts named on the right in the following pairs be considered a restriction (justify each statement). If not, give the correct variant of the restriction.

1) state – parliament;

2) crime – criminal;

3) riminal – corrupt;

4) clause member – appendix;

5) person – temperament;

6) lawyer – investigator;

7) school – first grade;

8) mountain - top of the mountain;

9) atom – electron;

10) substance particle – molecule;

11) year – month.

-

Task 6 (limitations)

Limit the following concepts:

- Song
- Economist
- Student
- Parallelogram

Task 7 (summary)

- Are the concepts in the following examples correctly generalized (justify each statement). If not, give the correct version of the generalization:

1) people's deputy – Verkhovna Rada;

2) Kharkiv region – Ukraine;

3) criminal – robber;

4) tree – forest;

5) letter – word;

6) proton – elementary particle;

7) Atom – molecule;

8) numeral – part of speech;

9) battalion – regimen.

- 2: Summarize the concepts: capital city, simple sentence, choleric temperament, rye, Korobchyne village, car, textbook.

Task 8 (classification)

Determine whether the following classifications are correct If not, which requirement do they violate?

- CORNERS ARE SHARP AND OBTUSE.
- Wars are liberating, unjust, conquering, just, long.
- People = adults, boys, girls.
- Kings = hereditary, elected, clubs, diamonds, spades, reds
- Years are divided into days and months.
- Substances = liquid, solid, gaseous, metals.
- People = those who go to the cinema; who go to the theater; who do not go to the cinema or the theater.
- Shoes = men's, women's and rubber.
- People = men, women, children.
- The enterprise can be in the following states: crisis, pre-crisis.
- Concepts are divided into general, individual, abstract, concrete.

There is no tailwind for a ship that does not know where to sail.

Proverb

2. Scientific method. The subject of the methodology of science.
Research technology work

System elements of the topic

2.1. Scientific research. Scientific method

2.2. Stages of scientific research

2.3. Formulation topics, problems, Research goals

2.4. Collection and data processing

2.5. Development of a hypothesis

2.6. Development of methodology and work plan

2.7. Results of scientific research

2.8. Errors in scientific research

2.1. Scientific research. Scientific method

- **Scientific method** is a set of basic methods of obtaining new knowledge and **methods** of solving tasks within any science. **The method** includes methods of researching phenomena, systematization, and correction of new and previously acquired knowledge.
- Features of the scientific method, for any science:
  - the requirement of objectivity, which excludes subjective interpretation of the results;
  - no statements should be taken on faith;
  - observations are documented to ensure independent verification;
  - availability for other scientists of all raw data, methods and research results is ensured.

The structure of the method contains three independent components:

- the **conceptual component** – an idea of one of the possible forms of the researched object;
- the **operational component** – prescriptions, norms, rules, principles regulating the subject's cognitive activity;
- the **logical component** – the rules for fixing the results of the interaction of the object and the means of cognition.

Main groups of methods of scientific knowledge

- Philosophical.
- General scientific.
- General.
- Special (methods of physics, chemistry, etc.).
- Disciplinary - methods of the branch of a certain science and methods that arose at the junction of sciences.

Scientific research is divided into:

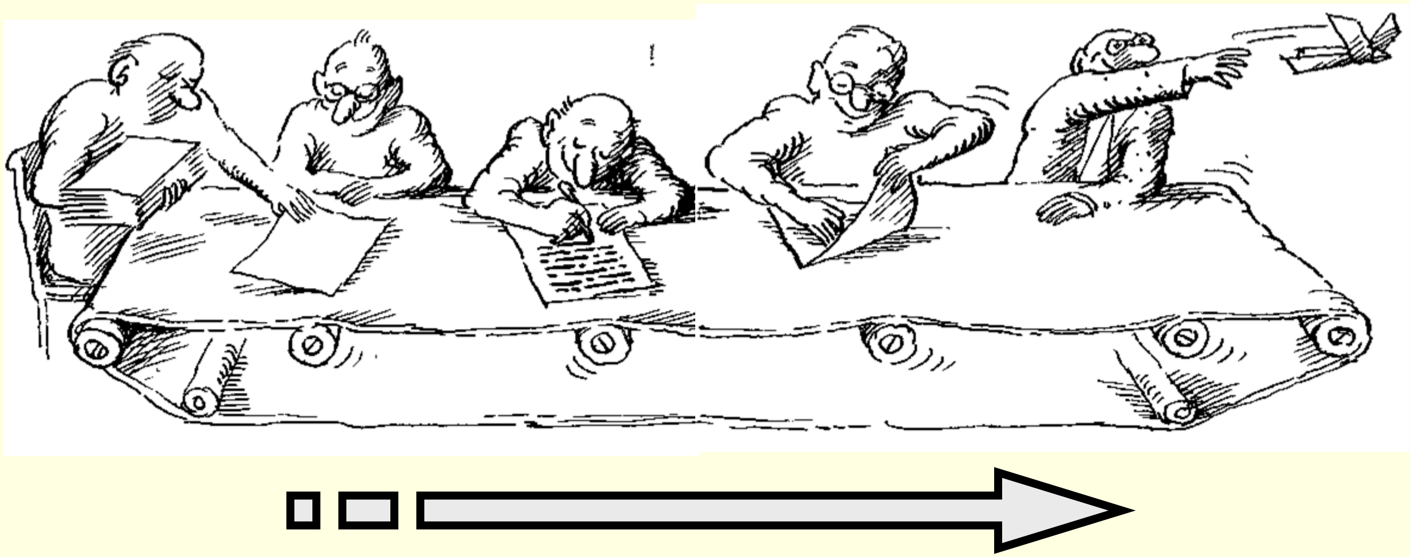
- ★ ***Fundamental research*** *is a theoretical and experimental activity aimed at obtaining knowledge about the laws of the development of nature, society and man (for example, the study of human behavior in decision-making situations).*

- ★ ***Applied research*** *is an activity aimed at obtaining and using knowledge to solve applied problems that arise in the field of practical human activity (for example, work on the creation of tax accounting methods in Ukraine).*

- ★ ***Empirical research*** *is a factual study that aims to identify relationships in the object under study and is based on data from observations and experiments.*

- ★ ***Theoretical research*** *is research aimed at explaining the essence of connections in the studied objects, at dissection of the internal mechanism of phenomena. The purpose of theoretical research is to develop concepts and theories.*

2.2. Stages of scientific research (SR) (The activity process is divided into stages)



- Specification of the TOPIC, justification of relevance.
- Definition of GOALS, TASKS, OBJECT, SUBJECTS.
- Studying the history and current state of the PROBLEM.
- Development of a HYPOTHESIS.
- Definition of METHODS.
- Drawing up a WORK PLAN.

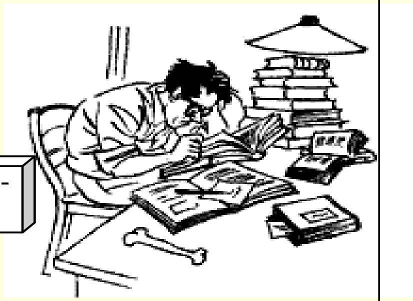
Stages of scientific research (continuation)

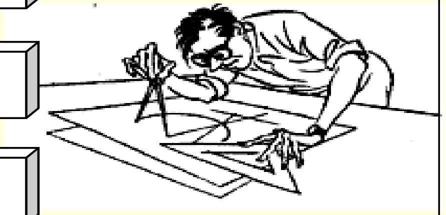
- Creation and processing of NEW INFORMATION (Observations, experiments, analysis).
- Construction of CONCLUSIONS and PROPOSALS.
- Literary exposition of the materials of the ND .
- Discussion of the RESULTS of ND .
- Issuance of the RESULTS of ND .
- Implementation of RESULTS of ND .

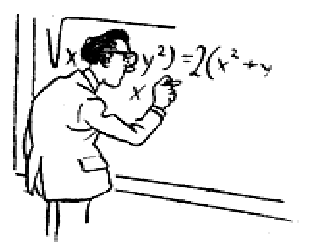
2.2. Stages of scientific research

(the end)

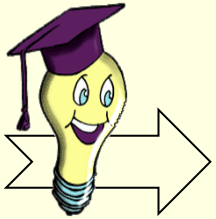
- **Formulation** of the scientific research **topic**
- **Formulation of a scientific problem**, study of its history and current state
- The **goal, tasks, object, subject** of scientific research determination
- **Hypothesis** development
- **Methods** of the research evaluation
- **Working plan** completion
- Creation and processing of **new information** (conducting observations, experiments and their analysis)
- **Conclusions and proposition** development
- **Literary presentation** of the research materials
- Collective **discussion, consultation and review** of the work
- Result of the research **implementation**

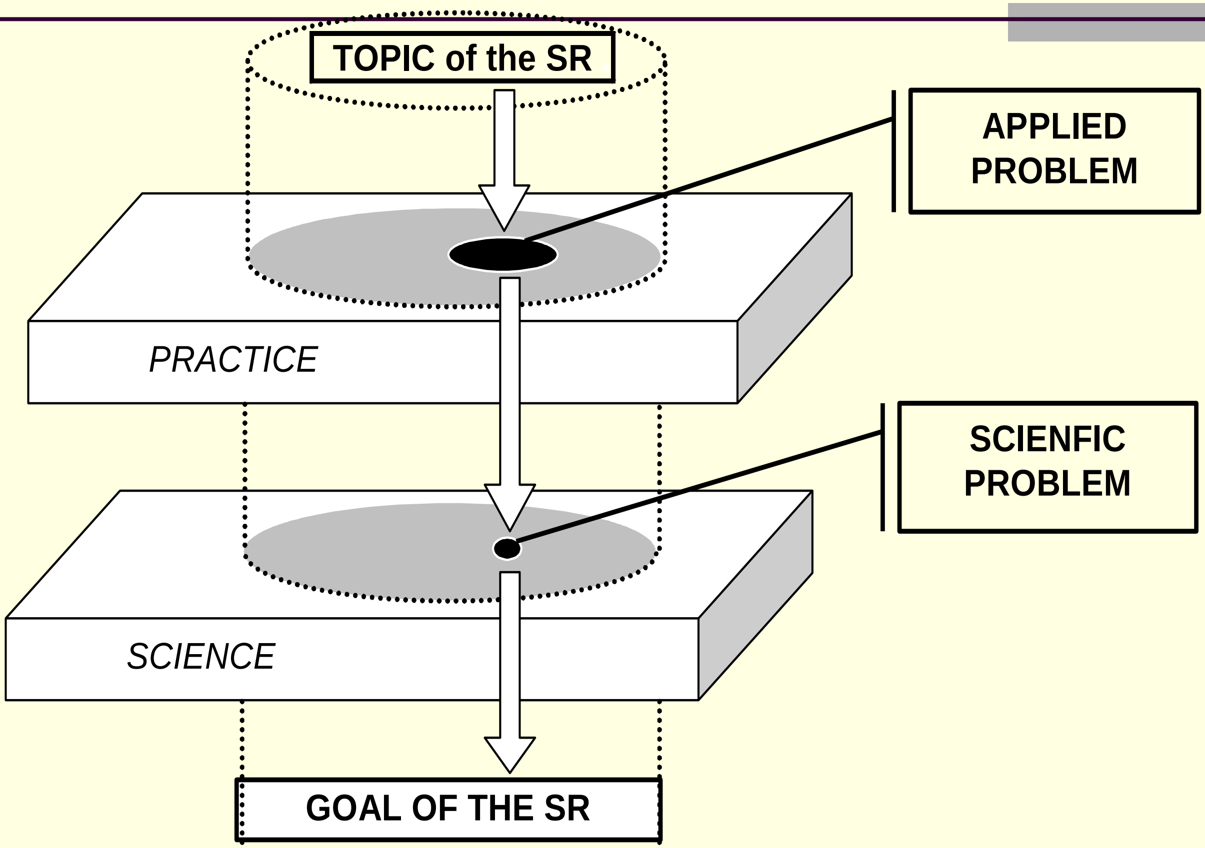






2.3. Formulation of the topic, problem, and goal of the research

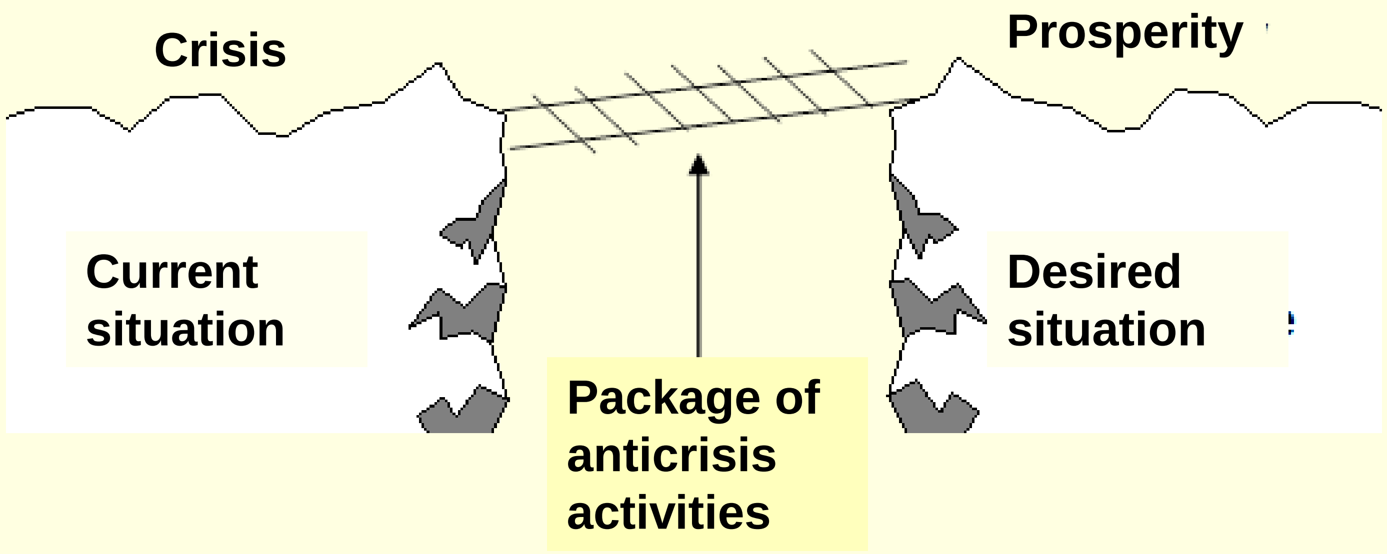




Logical interrelationship of the topic, problem and goal of scientific research

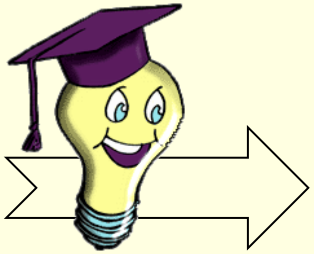
Applied problem research

The origins of scientific research

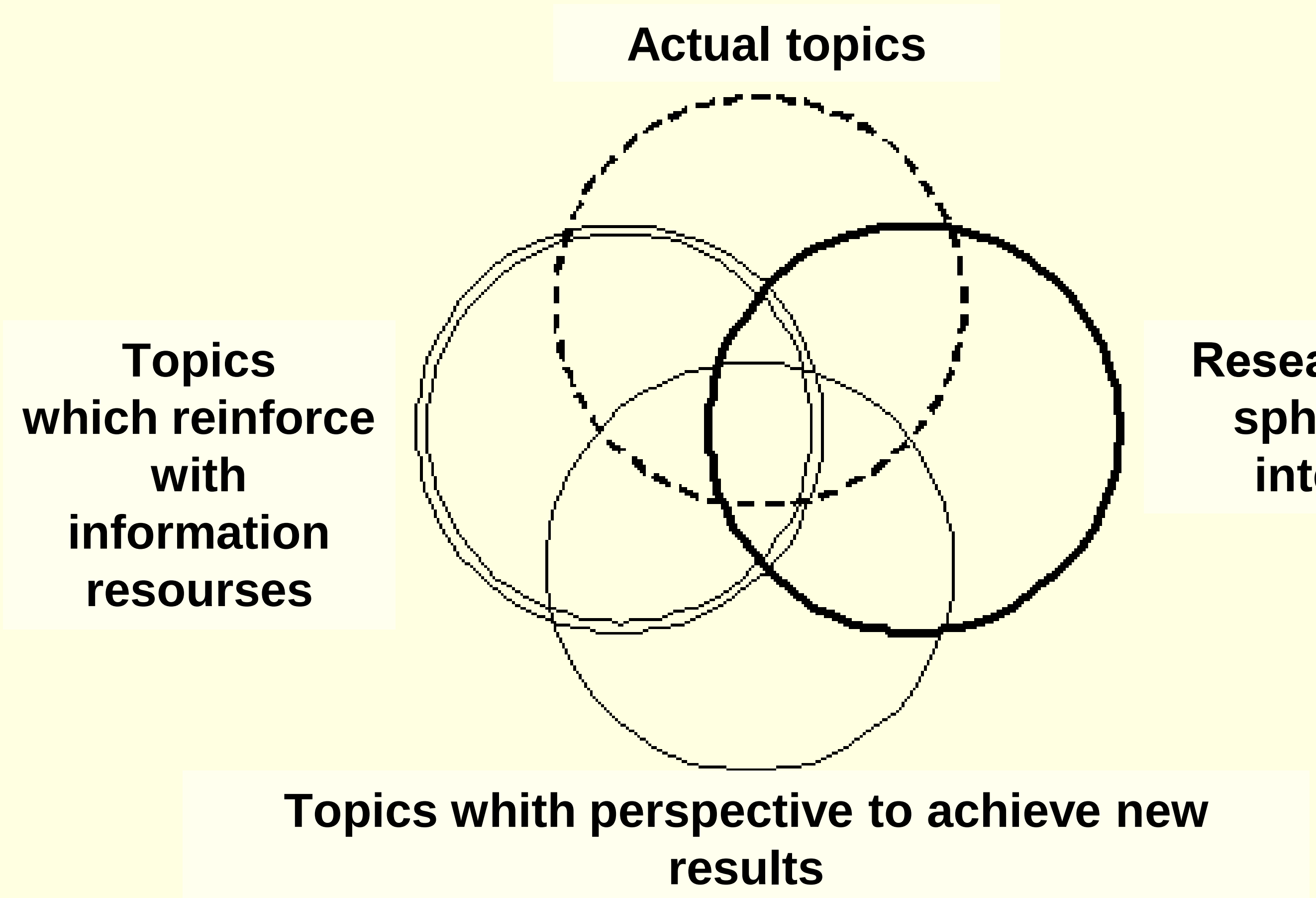


If the posed applied problem is characterized by the sufficiency of scientific knowledge for solution, there exists **a scientific problem**.

If there are not enough means to solve it, it creates **a scientific problem.**



Choosing a research topic



Identification of a scientific problem

★ **A scientific problem is** a contradiction characterized by the sufficiency of scientific knowledge for solution of the problem.

★ **A scientific problem is** a contradiction, for the solution of which it is necessary to go beyond the old, already achieved knowledge.

As a result of formulating the topic and problem, the object and subject of research are determined

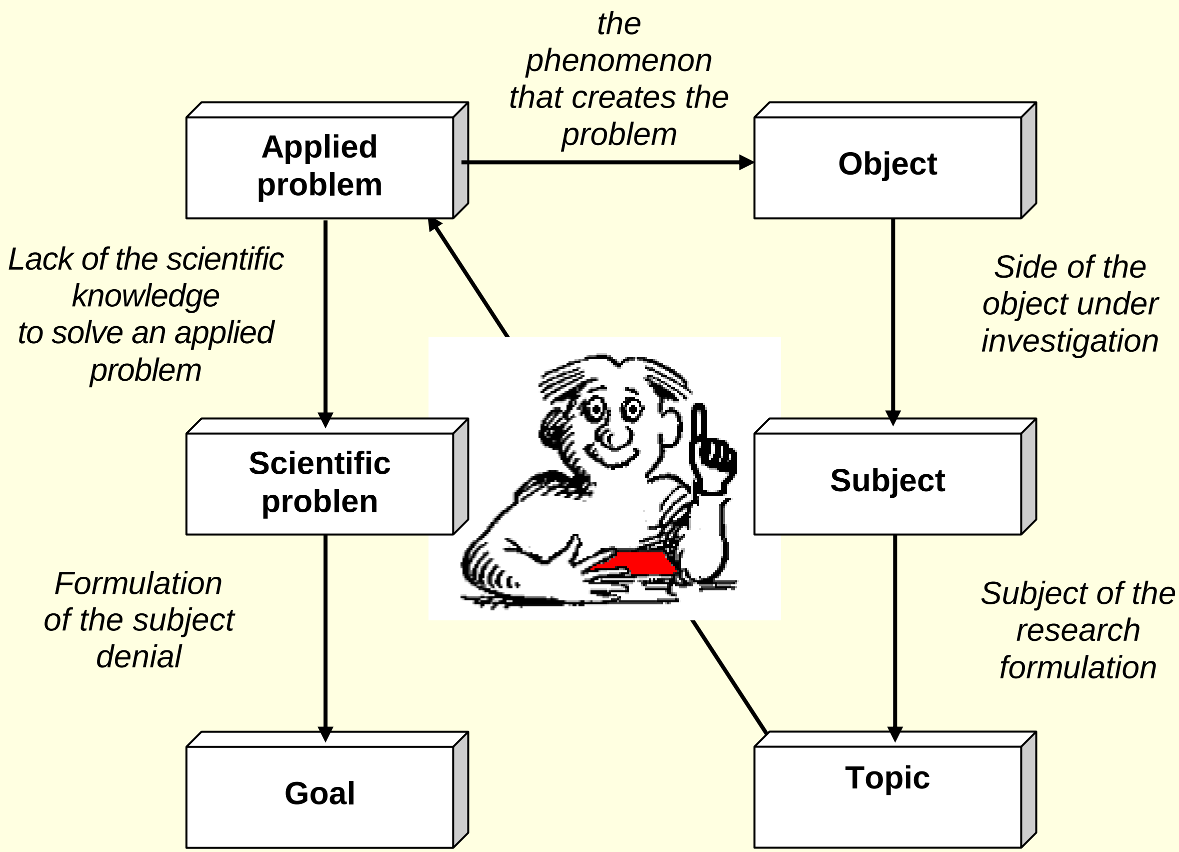
★ **The object of research** is a phenomenon (subject or process) that gives rise to a problematic situation and, as a result, is chosen for study.

★ **The subject of research is** that side of the object of research that is considered in this research work.

The object and the subject of the research are related to each other as general and partial (for example, the object is the enterprise, the subject is the accounting of the results of the investment activity of the enterprise).

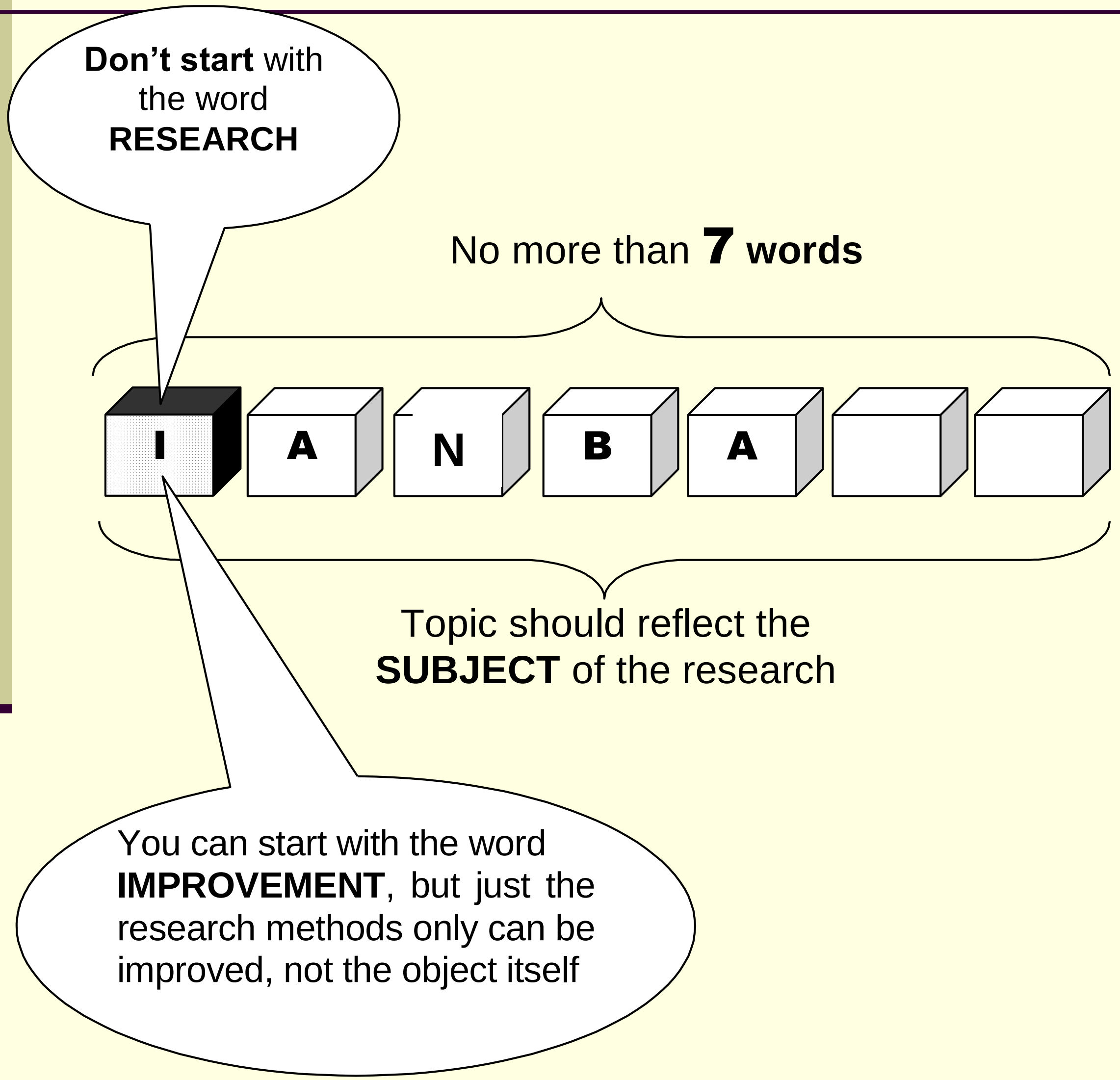
★ **The purpose of the research** is the subject of the researcher's aspiration and is described in the form of a list of necessary scientific results.

The formulation of the goal can be obtained as a negation of the formulation of the problem



Interrelationship of formulations of the problem, goal, object, subject and name of the topic of scientific research

Requirements for formulating the name of the research topic

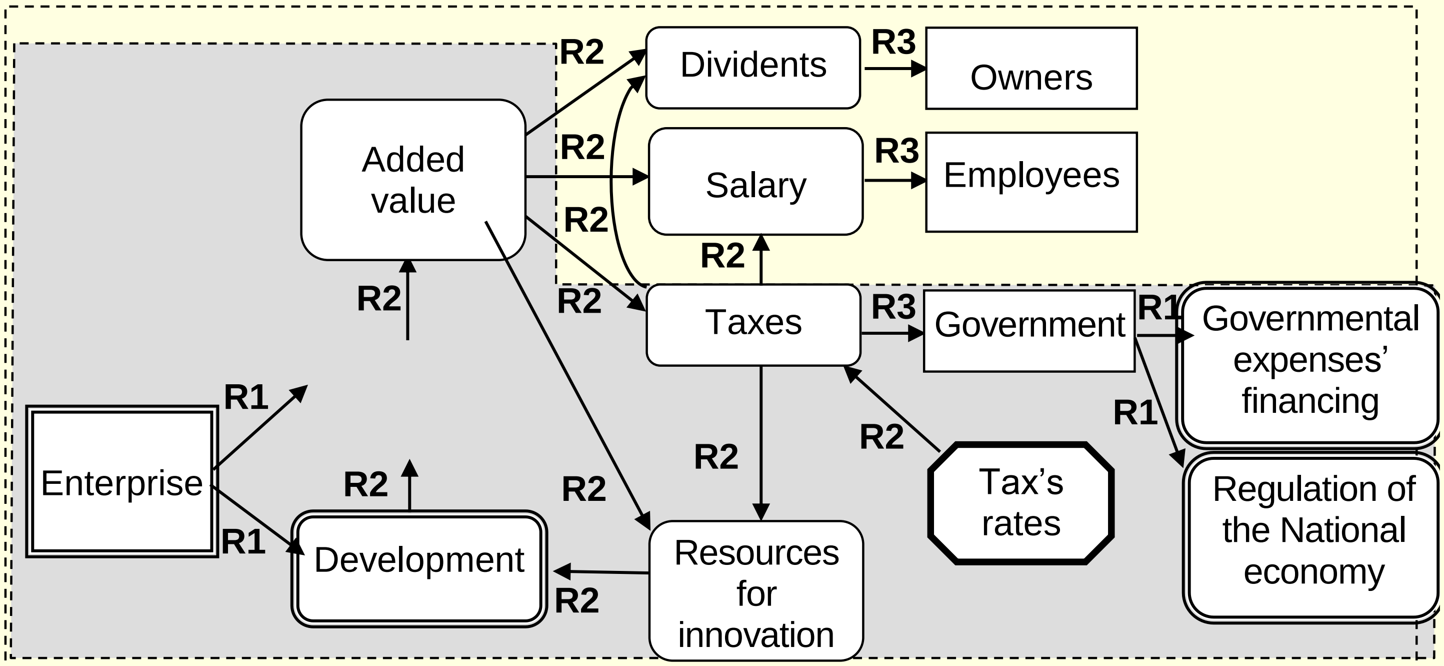


Formulation of research tasks

The purpose of the research is further clarified and decomposed, resulting in a list of individual research tasks

- For a correct understanding of the essence of the problem to be solved and a clear formulation of the list of tasks, it is necessary to accurately outline the subject area of research and identify its structure.
- ★ **The subject area of research** is a set of all subjects and phenomena that must be taken into account in the process of scientific research for a correct understanding of the problem and achievement of the set goal.
- ★ **To carry out the structuring of the subject area** – means to identify the boundaries and elements of the subject area and the connections between the elements. The main form of structuring is the construction of a structural model of the subject area.
- ★ **The structural model of the subject area** is a symbolic model depicted in the form of a graph, the vertices of which are the objects and phenomena of the subject area, and the edges are the relationships between them.

The structural model of the subject area (Example 2.1)



Continuation of Example 2.1 (the end)

Structural model of the subject area
research on the topic "Modeling the management of enterprise development"

Marking

production and economic systems;

process and;

economic entities

resources and subjects of interest etc. subjects;

R1 – the relationship "system **–** process"
R2 – the relationship of the dependence "factor **–** response“;
R3 – the relationship "resource **–** subject of consumption“;
R4 – the relationship "whole **–** part".

Example 2.2.

The Purpose, the Task, the Object and the Subject of research

- **Topic:** Modeling the development of electronic business

- **The purpose of the research is** to develop a set of economic and mathematical models for managing the development of electronic business.

- **The objectives of the study:**
  - conducting an analysis of existing approaches to modeling the development of ES;
  - implementation of the structuring of the e-business development process and the formalization of its main components;
  - development of the concept of EB development modeling;
  - development of a structural model of EB development;
  - development of innovative implementation methods
  - company strategies based on the introduction of new information technologies;

Example 2.2. (the end)

- **The research task (continued)**
  - construction of models of formation of added value in EB;
  - creation of a system of economic and mathematical models to ensure the company's competitiveness in the European Union;
  - development of the method of managing the interaction of companies within the framework of technological chains.

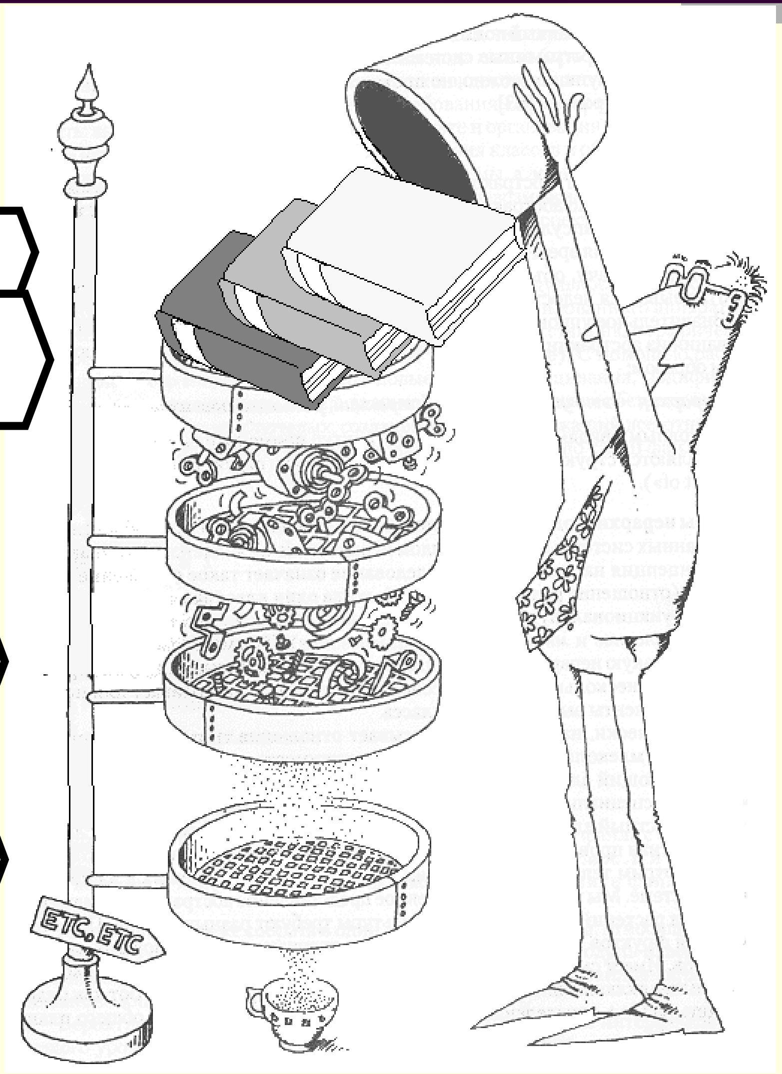
- **The object of the research:** the company's e-business development processes.

- **The subject of the research is** a set of economic and mathematical methods and models that support decision-making in the electronic business development management system.

2.4. Collection and processing of information

Basic stages of processing the information collection

- **Systematization**
- **Elimination excesses**
- **Rating suitability**
- **Analysis content and credibility**
- **Elimination contradiction and generalization**



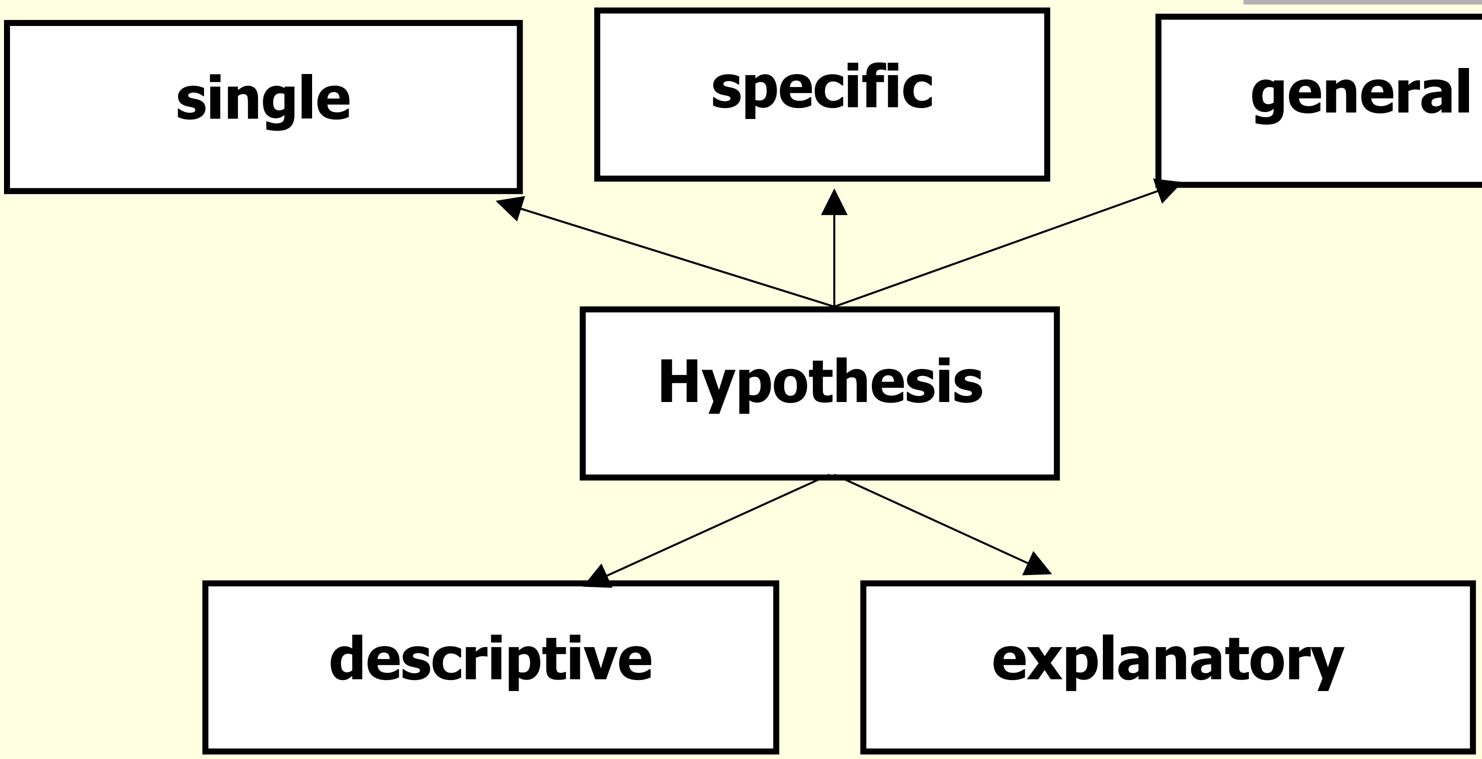
2.5. Development of a hypothesis

For the experimenter ... it is much better to work with bad hypotheses than with no hypotheses at all, when it is not known what to test

Basic definitions

- **A single hypothesis** (“ad hoc”) is an assumption about the characteristics of a single phenomenon.
- **A partial hypothesis is** an assumption about **regularities** that apply only to some elements from the many phenomena of the subject area.
- **A general hypothesis is** an assumption about **regularities** that apply to the entire set of phenomena in the subject area.
- **A descriptive hypothesis is** an assumption about **the properties** or relationships of the studied phenomena.
  - "What is this subject?"
  - "What properties does this object have?"
  - "In what connection are these phenomena?"
- **An explanatory hypothesis is** an assumption about **the causes** of the studied phenomena: "What are the causes of the occurrence of these phenomena?"

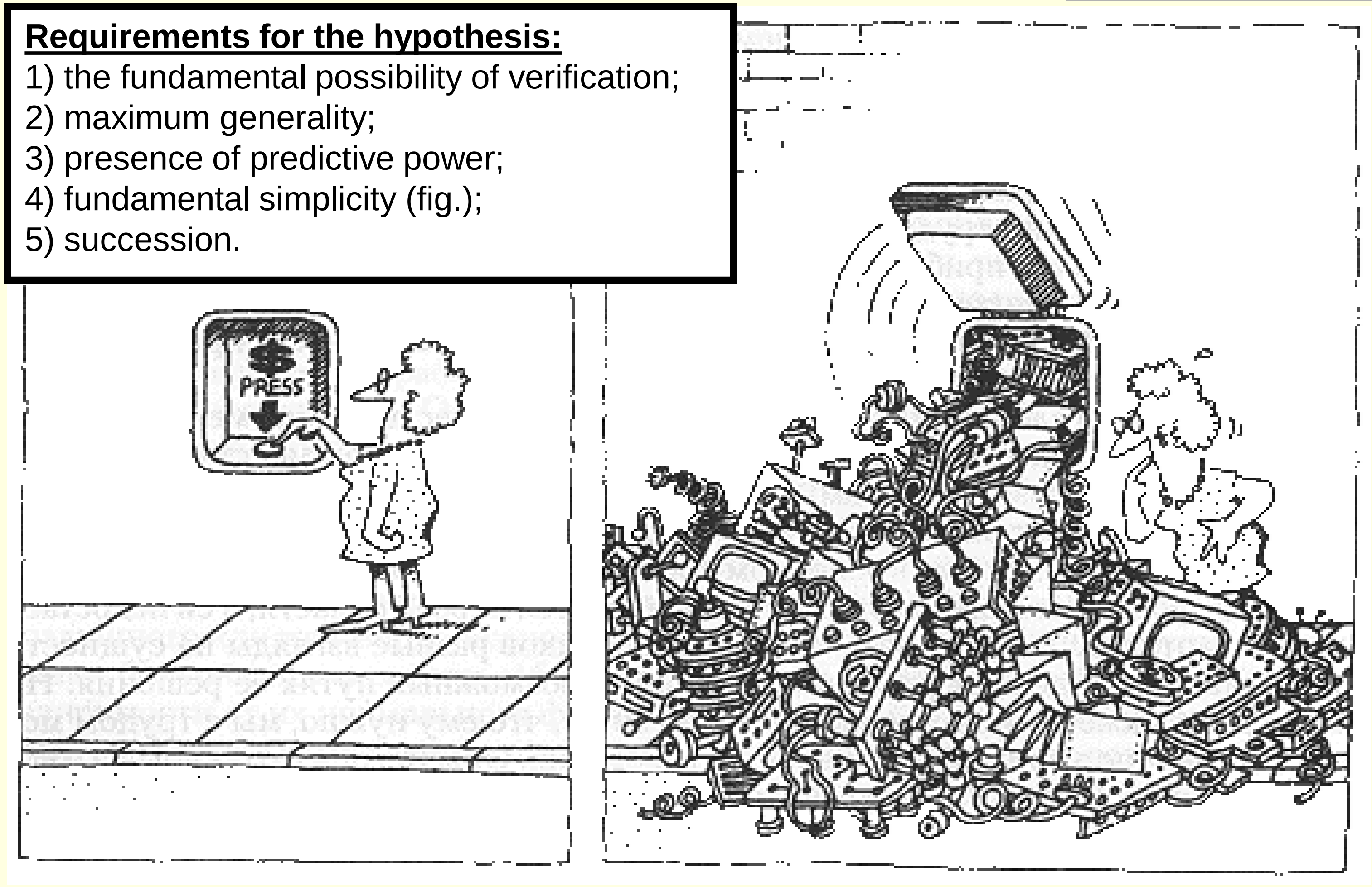
Classification of hypothesis



Requirements for the hypothesis

Requirements for the hypothesis:

1) the fundamental possibility of verification;
2) maximum generality;
3) presence of predictive power;
4) fundamental simplicity (fig.);
5) succession.

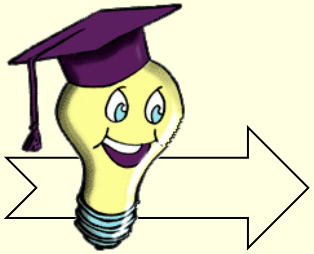


The hypothesis

Previous stages:
1) detection of hypothesis objects;
2) formulation of the problem;
3) selection and accumulation of facts;
4) preliminary analysis of the facts.

Stages of formation of the hypothesis:
1) **InitiaL** guess;
2) **Working hypothesis;**
3) **Scientific hypothesis;**
4) deduction of consequences from the hypothesis;
5) verification of conformity of consequences with facts.

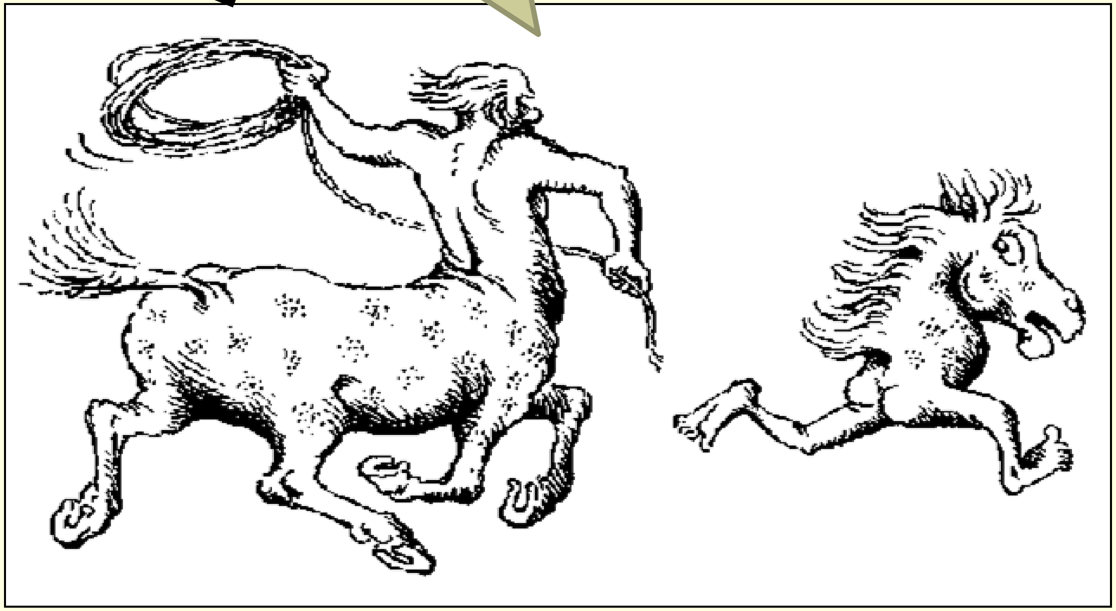
Ways of the emergence of the hypothesis:
1) **Before starting work on the topic;**
the hypothesis is already embedded in the formulation of the topic;
the hypothesis is taken from the works of other authors;
2) **In the process of working on the topic.**



Recommendations for hypothesis development

- To create a hypothesis, consider **related topics.**
- Formulate a hypothesis **in writing.**
- Develop **2 hypotheses**:

A) basic **B) counterhypothesis**



Example 2.3. Alternative hypotheses regarding the nature of information

Hypothesis 1: Information is a product of human activity.

A person determines the composition of information by his actions.

Hypothesis 2: Information is an immanent attribute of any phenomenon.

A person determines the composition of information by the ability to connect to the information field.

2.6. Development of methodology and work plan

Research methodology is a set of methods and techniques necessary for conducting research.

Recommendations

- Check the suitability of methods **of related sciences**.
- All methodological decisions should be **recorded**.

Example 2.4. **Techniques for diagnosing the syndrome of professional burnout in organizations**

(Source: Technologies of work of organizational psychologists: teacher . p . lyshnyk / . Scientific editor. L. M. Karamushki . - / K. : Firma "INKOS", 2005.- 366 c .)

The analysis of the problems of studying the syndrome of professional burnou, carried out by the authors in various organizations, showed that the main methods that can be used by organizational psychologists in the study of this problem include:

1. The method of diagnostics of the level of emotional burnout" by V .V. A fight
2. Methodology "Determination of mental "burnout" O. O. Rukavishnikova .
3. Methodology "Burnout syndrome in the professions of the man- to- man" system.
4. Methodology "Assessment of one's own potential of burnout".
5. Methodology "Research of the syndrome of burnout".

It should be noted that each of the specified methods makes it possible to first of all detect *the level of development of the syndrome and its individual components.* Despite the different terminological meaning of the concepts used by scientists, such as professional burnout, emotional burnout, mental burnout, burnou, etc., they are synonymous and reveal certain aspects of burnout, as in professional , as well as in other areas of human activity.

Example 2.4. (continuation)

Diagnostics of the level of emotional burnout method is the most comprehensive and makes it possible to systematically and in more detail analyze the severity of the twelve symptoms of the burnout syndrome, taking into account the components to which they relate. In particular, these are the following components and symptoms:

The first component is Stress: 1) Experiencing psycho-traumatic circumstances;

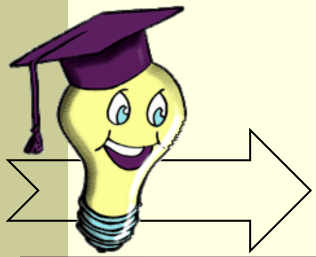
2) dissatisfaction with oneself; 3) backed into a corner; 4) anxiety and depression.

The second component is Resistance:. . .

The third component is Exhaustion:. . .

Taking into account the qualitative and quantitative indicators that are calculated according to the methodology for the various components of the burnou" syndrome, organizational psychologists can give a fairly meaningful description of the manifestations of the syndrome in an individual, as well as determine individual and group prevention and psychocorrection measures. For qualitative data interpretation, according to V .V. Boyka, you can use the following questions:

- which symptoms dominate;
- what formed and dominant symptoms are accompanied by exhaustion **. . .**



Work plan (this is a detailed research project in which the main parameters of the research work are determined)

WHAT?

WORK PLAN is a detailed research project.

ABOUT WHAT?

- **wording of the topic;**
- **tasks;**
- **stages of work** (scope, content, methodology, terms ...);
- **performers** (content and scope of work);
- **business trip;**
- **form of presentation of results** (report, article ...).

WHO?

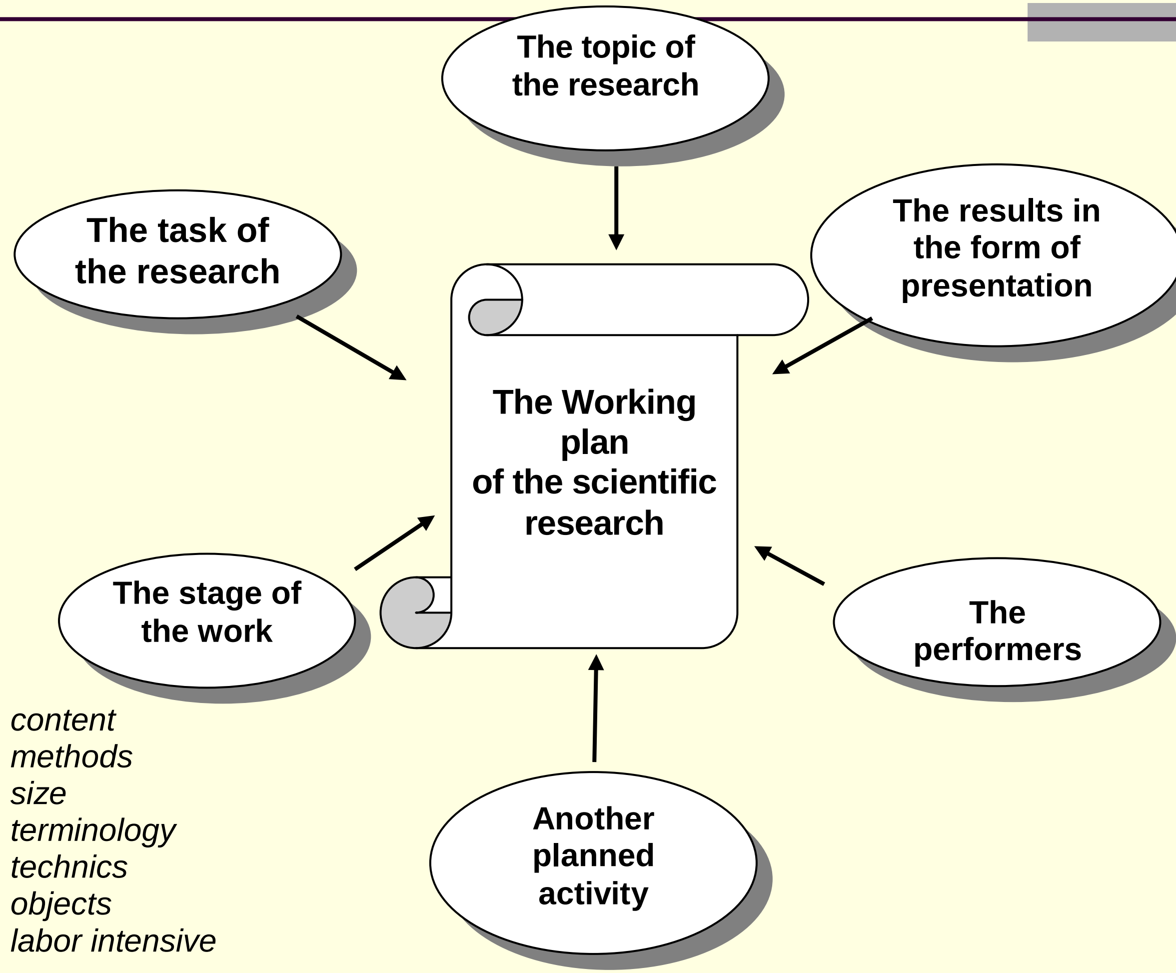
After developing the hypothesis and research methodology.

WHAT ELSE?

An explanatory note to the work plan:

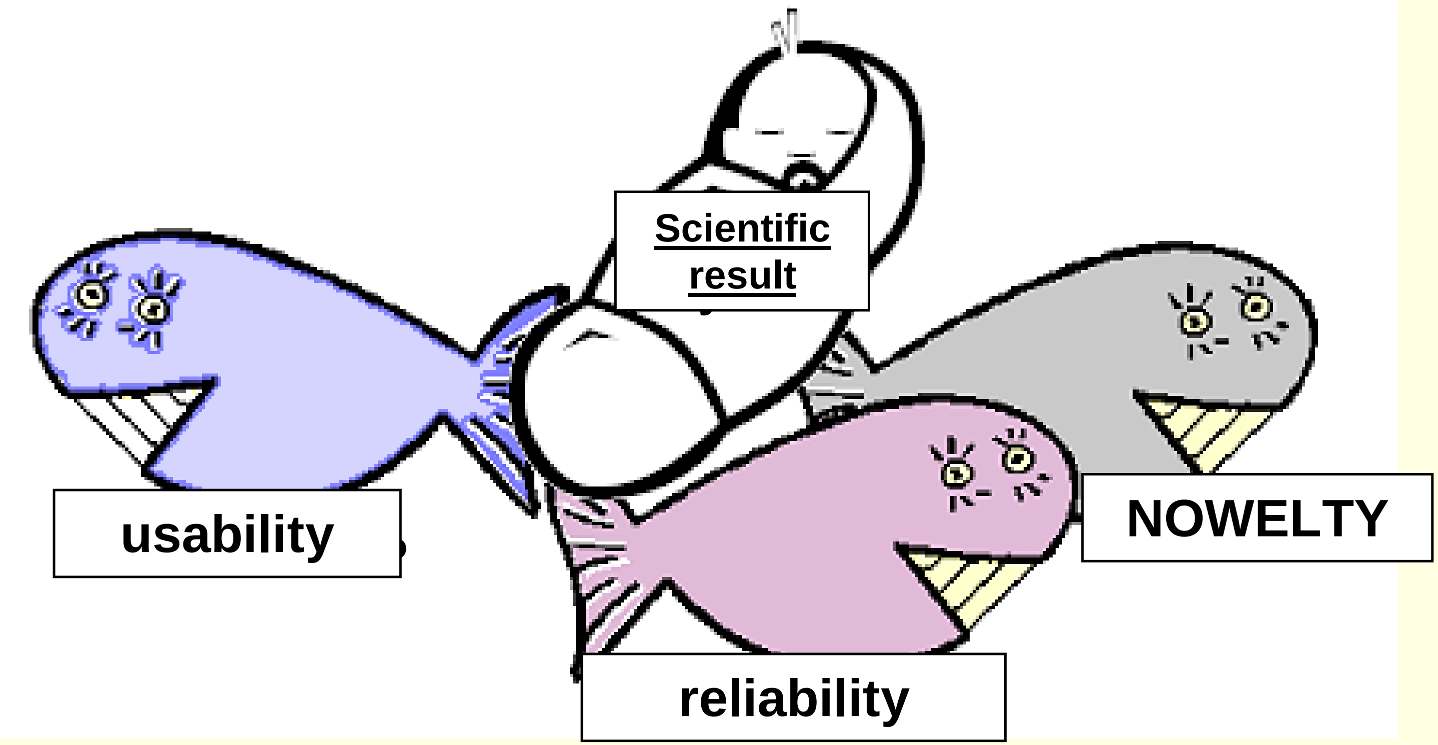
- justification of the topic;
- information about the current state of the problem;
- description of tasks and goals;
- statement of the working hypothesis.

The content of the work plan of the SR



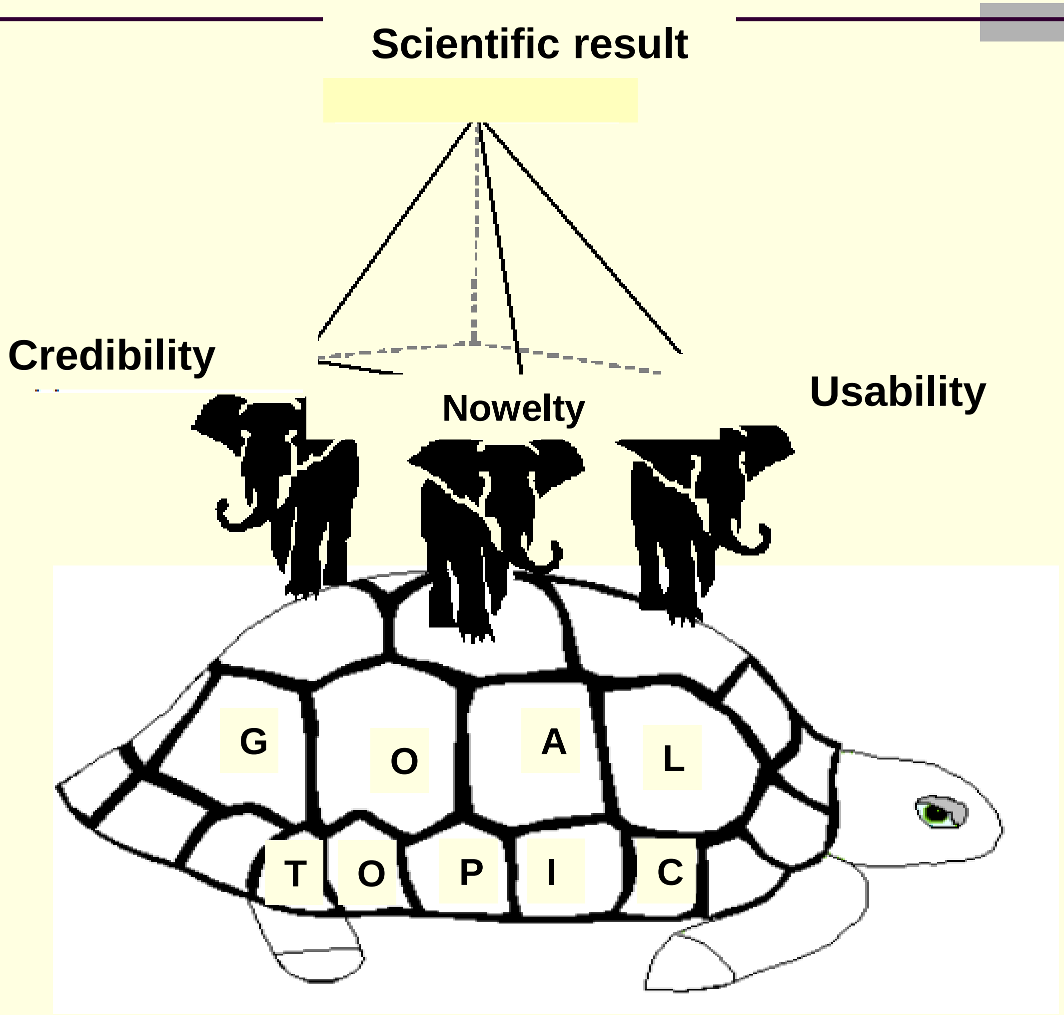
2.7. Results of scientific research

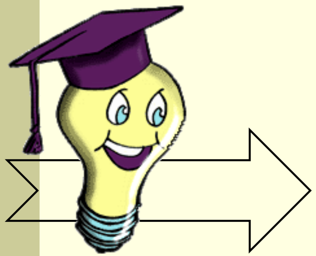
A scientific result is a result obtained on the basis of the application of one or another scientific and methodological apparatus



Three "whales" on which the scientific result rests

A visual metaphor.
Basic requirements for research results





Characteristics of the result of scientific research

★ **SCIENTIFIC RESULT** is knowledge that satisfies the following requirements:
novelty;
credibility;
practical value (usability).

★ **Reliability of a scientific result** is its legally expressed conditioning by objectively existing cause-and-effect relationships in the relevant subject area.
★ **Credibility of a scientific result** - the presence of convincing proof of its authenticity.
★ **Usability of a scientific result** is the demand for this result by science and/or practice. Allocate scientific and practical usefulness.

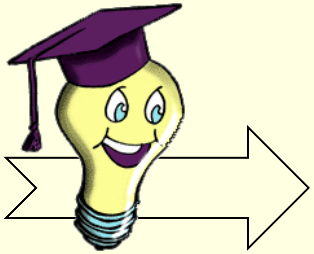
Characteristics of the result of scientific research

★ **THE NOVELTY OF A SCIENTIFIC RESULT** is a concept that characterizes the fact that a scientific result was obtained for the first time in the world.

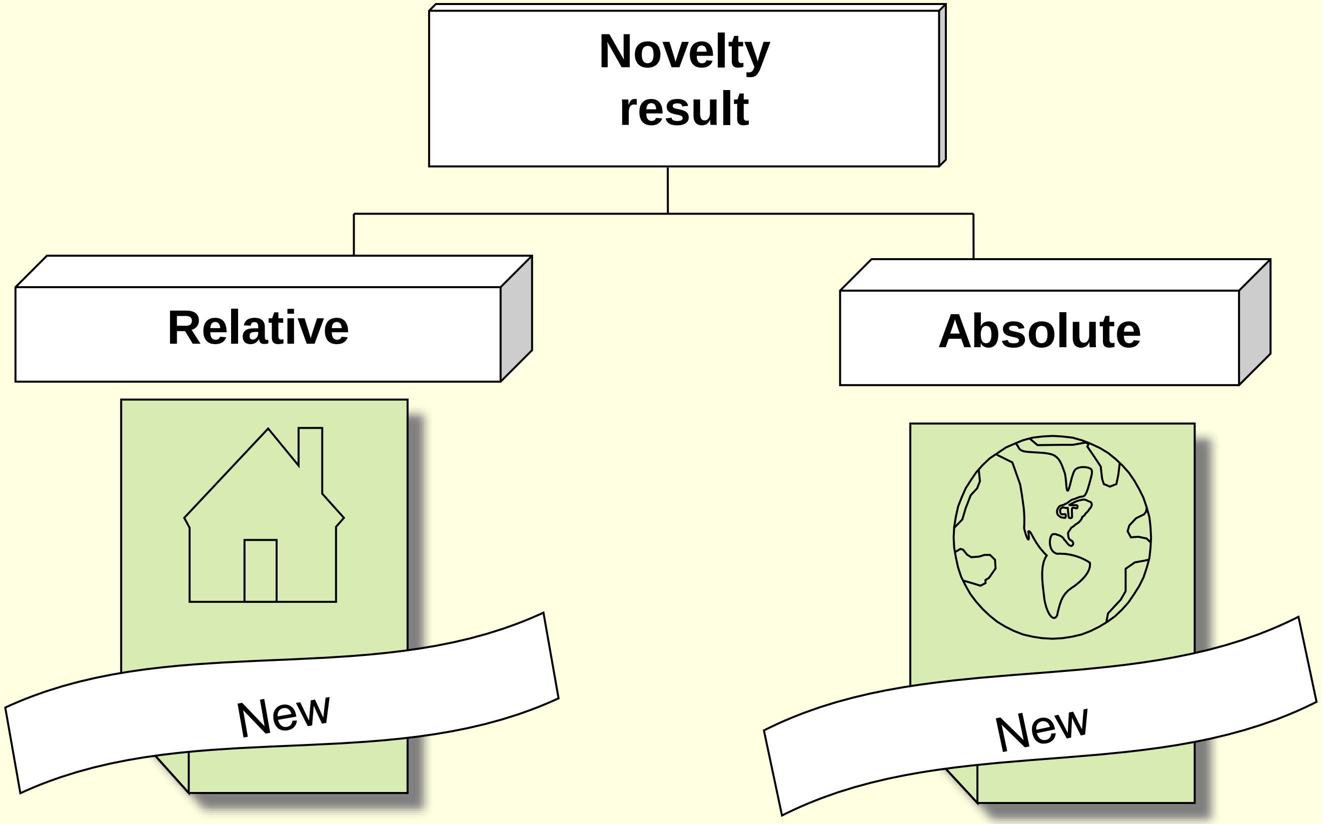
★ **A new scientific result** is a result that has global novelty, confirmed by the absence of a corresponding scientific result in earlier publications by other authors.

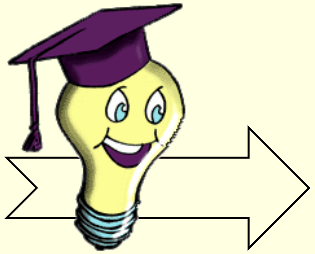
★ **A contribution to science** takes place if the obtained scientific result meets the following requirements:

- world novelty;
- scientific significance;
- non-trivialities.



Scientific novelty





Types of scientific results of research

Scientific results

Theoretical and methodological
(for theoretical studies)

- the concept
- the hypothesis
- the classification
- the law
- the method

Instrumental
(for applied and empirical studies)

- the way
- the technology
- the technique
- the algorithm
- the substance

Pay attention: not every useful scientific result is a contribution to science (that is, to theory, to methodology). Some results represent a contribution to the practice of the subject area. In this regard, scientific results are classified into theoretical and practical

Scientific result

Theoretical

Scientific position
(Result-knowledge)

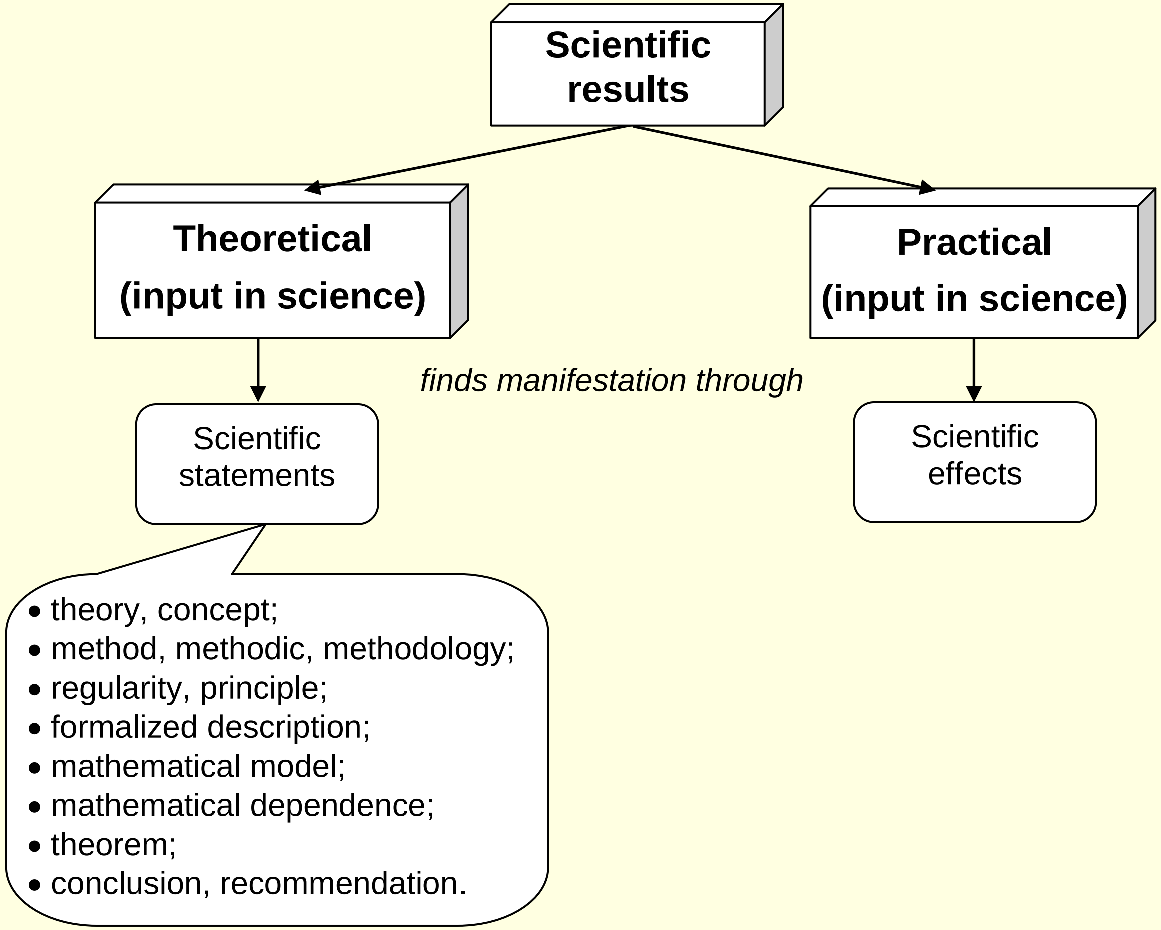
(Clear formulation of basic scientific ideas)

Practical

Effect
(Result-event)

(What science gives to practice)

Detailing of the theoretical scientific result



Some phrases typical of the formulation of scientific novelty

Dependence between… was derived.

The method developed...

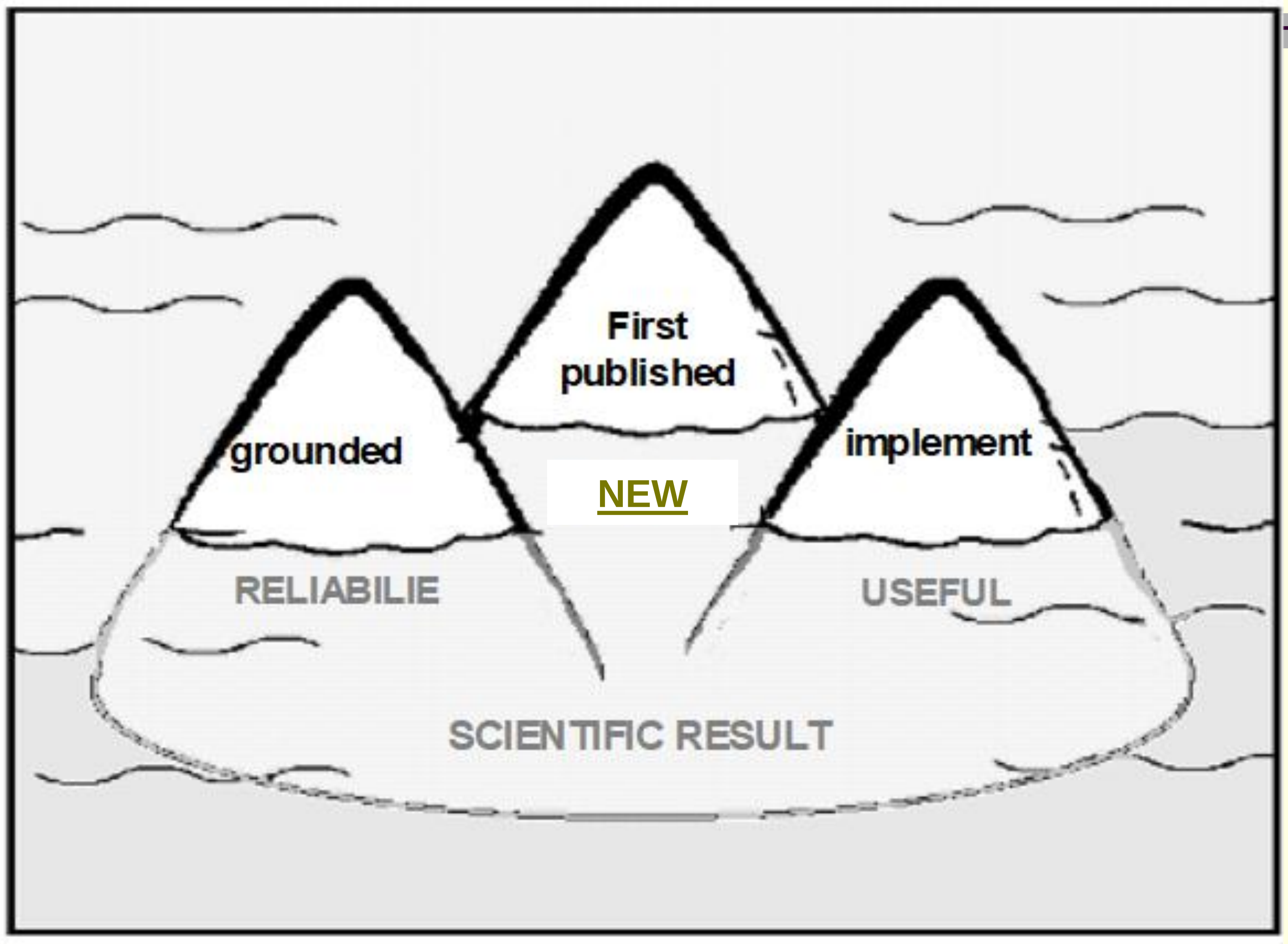
Formalized for the first time...

A concept that generalizes... and develops ... was created

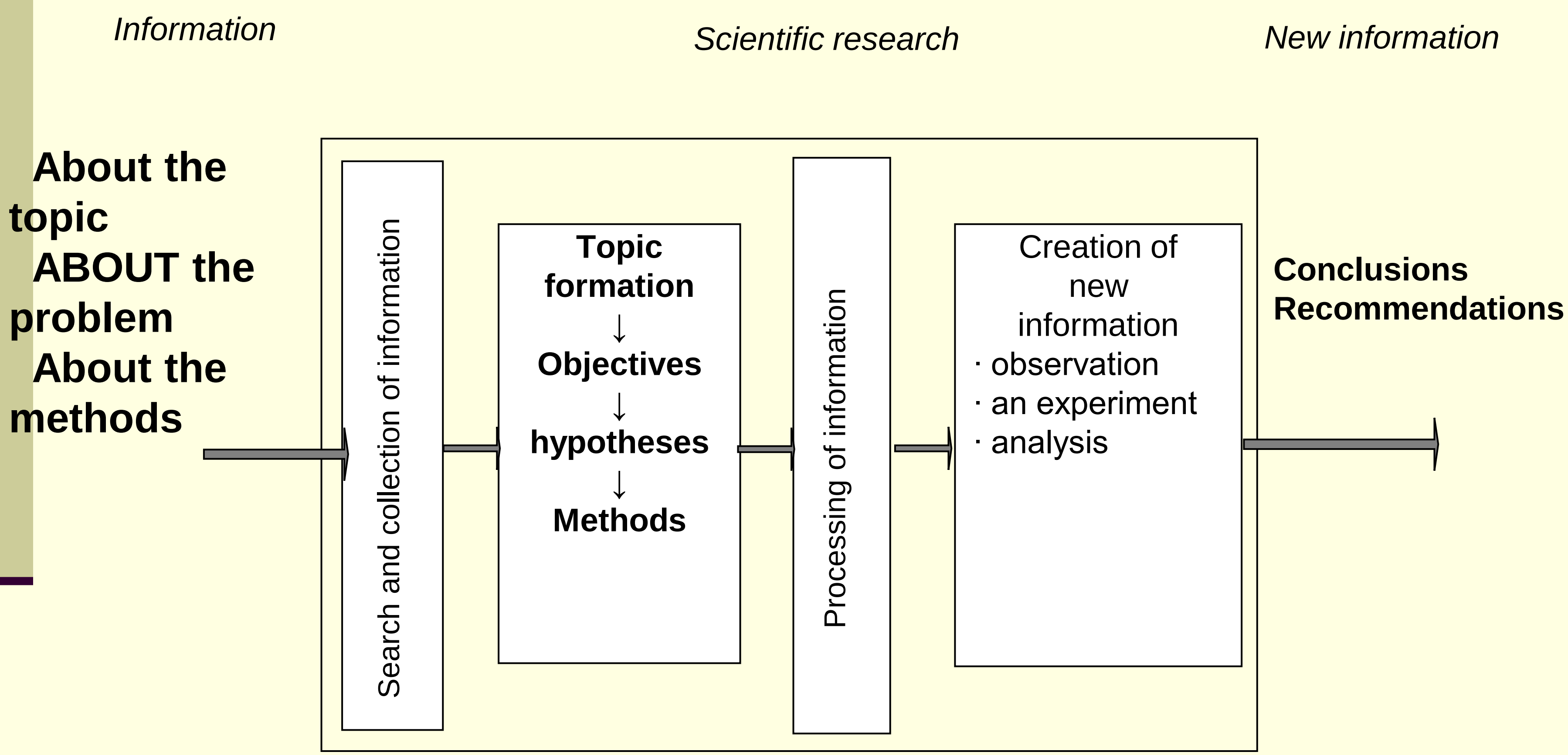
The well-known method ... modified in part ... and distributed to .. a new class of systems ...

A new system was developed ... using the principle of ...

Conclusion: Confirmation of the novelty, reliability and usefulness of the scientific result



Summary: Grouping of the stages of scientific research from the point of view of the information processing process



2.8. Errors in scientific research

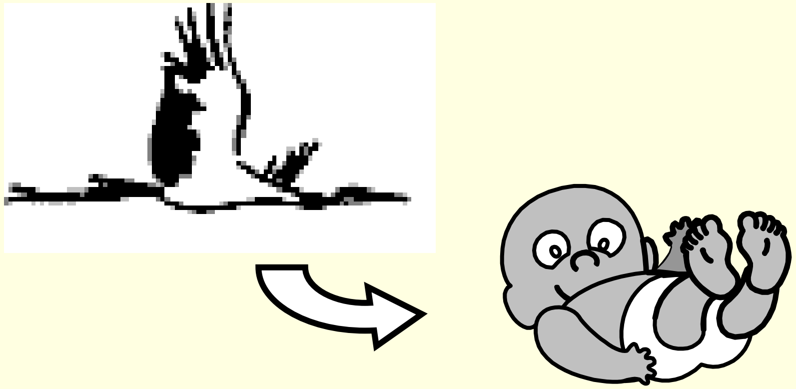
1. Preconceived notions.

2. Vague terminology:

gap between scientific economic terms and "household" economic concepts.

3. Logically erroneous constructions:

- Fallacy "What is true for a part is true for the whole".
- Error"After this, therefore as a result of this".
- ("Poct hos").



- The mistake of confusing correlation with causation.

Control questions

1. Define the subject of the methodology of science.
2. Describe the stages of research work.
3. Describe how the goal and task of the research are related.
4. Describe the main elements of the methodology of scientific research.
5. What is the basis of the choice of scientific research?
6. What is the purpose of planning research work?
7. What are the requirements for setting the research topic, problem, goal and objectives of the research.
8. What reflects the relevance of the topic?
9. How are different types of hypotheses used in scientific research?
10. Describe the requirements for hypotheses.
11. What is the concept of "Scientific novelty of research results" and how is it ensured and substantiated?
12. What is the practical significance of the work and analysis of interested organizations and individuals.
13. How is the structural model of the subject area built?
14. Describe the content and characteristics of the main stages and steps of the research.
15. How is the research methodology formed?
16. What formulations are used to describe the research results?

Practical component

Objectives of the task:

- to acquire skills in formulating the topic, goal and tasks of scientific research in their logical relationship;
- learn to describe the expected scientific results of research work;
- auxiliary material;
- as an example of formulating the topic, goal, tasks and results of scientific research, we will give a fragment of a dissertation for obtaining a scientific degree will be given.

Example 2.5

Topic : Strategic management of enterprise development.

- The purpose and tasks of the research.
- The purpose of the dissertation work is to generalize and clarify the theoretical provisions regarding the transition of industrial enterprises to strategic management in the development of methodological support for the formation of strategic potential.

Example 2.5 (continuation)

To achieve the goal, the following tasks were solved:

- generalization of the existing theoretical provisions of strategic enterprise management;
- clarification of the essence and role of the strategic potential of the enterprise in the conditions of the formation of market relations;
- identification of the main contradictions in the implementation of the strategic management process in modern conditions;
- justification of the expediency of purposeful formation of the strategic potential of the enterprise;
- determination of the state of management systems operating at enterprises ;
- offer for assessing the existing potential of the enterprise management system;
- development of a methodical approach to the formation of the strategic potential of the enterprise.

The object and subject of research

- The object of the research is the process of managerial activity on the development and implementation of the strategy of industrial enterprises.
- The subject of the research is the scientific and methodological support of the management of the strategic development of the enterprise and the formation of its potential in the conditions of reforming the economy of Ukraine.

Example 2.5 (the end**)**

The scientific novelty of the obtained results is as follows :

- clarified concepts of strategic management, strategic potential of the enterprise, which are the basis of the development of the concept of the future development of the enterprise;
- well-founded sequence of forming a strategic management system, which is based on ensuring the timely achievement of a sufficient level of management potential;
- the methodical approach to the formation of the strategic potential of the enterprise due to the balanced increase of production and management resources has been improved;
- for the first time, aimed at the mutual coordination of the components of this process and the resolution of the main contradictions that arise during its implementation;
- the process approach to determining the potential of the current management system was further developed, which makes it possible to substantiate the priority directions for its fuller use and proportional increase.

Example 2.6

Let's consider the problems accompanying the activity of a designer of printed publications.

- Designing a publication is a complex intellectual process in which the designer makes a number of important decisions regarding the selection of the publication format, paper, typeface of the main and auxiliary text, the size of the fields, design of the cover, headers, footers, illustrations, etc.
- A necessary condition for the designer to make good decisions on the design of the publication is to take into account a number of various factors. The designer must have a huge amount of information about the rules of artistic design of publications, publishing technologies, fashion trends in the printing market and the psychology of end buyers. Another requirement for the designer is the high speed of his work. Such requirements for a modern designer often come into conflict with his capabilities.
- The design of the publication must meet a number of criteria - utilitarian, aesthetic, hygienic, production, economic... At the same time, some of these criteria are in contradiction. Thus, improving the aesthetic characteristics of the publication can lead to the deterioration of its economic characteristics. These contradictions indicate the presence of such applied problems in the field of publishing design:

  - insufficient information support for decision-making in the field of publishing design;

  - there is a risk of making unsuccessful design decisions due to the difficulty of comparing different design options, their evaluation and choosing the most effective option.

Example 2.6 (the end)

- Note that the making inefficient design decisions leads to material and non-material damages to those entities involved in the creation, implementation and operation of the publication.
- **The applied problem** of insufficient information support for decision-making in the design of publications initiates the applied problem of developing an information system for decision-making support (DSS) in the field of publishing design. The solution of the specified applied problem is hindered by the existence of a scientific problem - the lack of a methodology for the development of DSS in the field of publishing design.
- The applied problem of the risk of choosing inefficient design solutions indicates the existence of a scientific problem, the essence of which is the lack of a holistic methodology for choosing optimal solutions in the field of publishing design.
- **The purpose of the research**, which is considered by us as an example, can be formulated in the form of a denial of the identified scientific problem. If the problem is related to the lack of a methodology for choosing optimal solutions from publishing design, then the formulation of the goal will sound like this:
- to develop a holistic methodology for choosing optimal solutions in the field of publishing design.
- **The structural model of the subject area of research** on the topic "Methodology for choosing optimal solutions in the field of publishing design" is presented on next slide.

Example 2.7. The problem

In the conditions of the market economy, there was a shift in priorities in the objects and target institutions of the management system of the economic object. While in a centrally planned economy, freedom in the manipulation of resources and their compensation was sufficiently limited, and enterprises were placed in strict frameworks and could not choose the most rational structure of the resources used by them, then in a market economy such restrictions do not exist in essence, and effective management of resources requires optimization of the enterprise's resource potential.

Example 2.7 (the end)

Considering all of the above, the solution to this problem, in our opinion, is the development of optimization models and their practical application. Unfortunately, issues related to the development of optimization models have not yet been widely used in Ukrainian enterprises. The formation of the capital structure (that is, the ratio of own and borrowed funds) at many enterprises is carried out intuitively, or according to traditions, without proper analytical and mathematical justification.

Example 2.8. Dissertation "Improving the management of the capital structure of an industrial enterprise"

- ***The goal*** is to develop methods of improving the capital structure of an industrial enterprise and to carry out their practical application.
- ***The object of the research*** is the process of managing the capital structure.
- ***The subject of the research*** is methods of improving the management of the capital structure.

Example 2.8 (the end)

Achievamant the set goal required solution to the following tasks:

- consideration of the main characteristics of capital, in particular:
  - the concept of enterprise capital;
  - capital structure of the enterprise;
  - features of formation and advantages and disadvantages of own and borrowed sources of capital;
- Formalization of the capital structure optimization process, development of an optimization algorithm;
- Study and analysis of capital structure optimization methods according to various criteria;
- Development and practical application of capital structure optimization methods.

Example 2.9. Dissertation: "Strategies for the development of highly qualified intellectual workers of a machine-building enterprise"

- ***The goal*** consists in theoretical substantiation, further improvement and development of scientific and methodological support for development strategies of highly qualified employees of machine-building enterprises.
- ***The object of research*** is the processes of development of highly qualified employees.
- ***The subject of the research*** is theoretical provisions, methodological approaches and scientific and practical recommendations for the formation of development strategies of highly qualified employees of machine-building enterprises.

Example 2.9 (continuation)

Achievement the set goal required solvution to the following tasks:

- to investigation of the essence and components of personnel development systems and the object of development;
- identification of a set of personnel development strategies based on existing theoretical approaches to personnel development and practical experience;
- development of provisions of the conceptual model of strategic development of highly qualified employees of machine-building enterprises;
- investigation of the state of development of personnel of Ukrainian machine-building enterprises and the main factors determining it;

Example 2.9 (the end)

Achievement the set goal required solutions to the following tasks:

- Improvement of the methodical approach to assessing the effectiveness of personnel development strategies, taking into account the social and informational nature of collective personnel development;
- to development of a methodical approach to ensuring the implementation of the strategy of individual leadership and self-development;
- to formation of a sequence of decision-making regarding the strategic development of personnel.

Task

Complete the following tasks on the topic of your research paper:

1. Based on the study of literary sources, identify the goals and scientific problems that take place within the framework of the researched topic. Justify the relevance of the topic.

2. Define the object and subject of research.

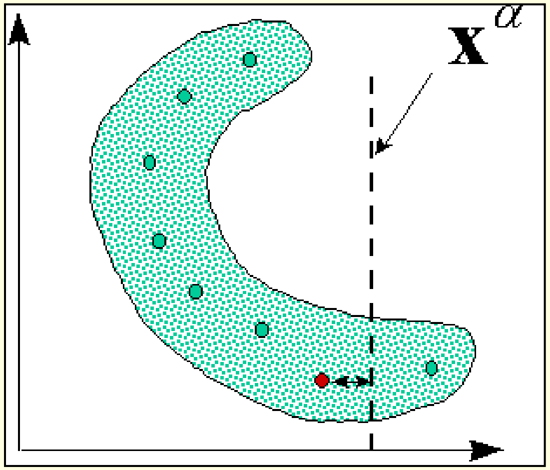
3. Formulate the purpose of the research.

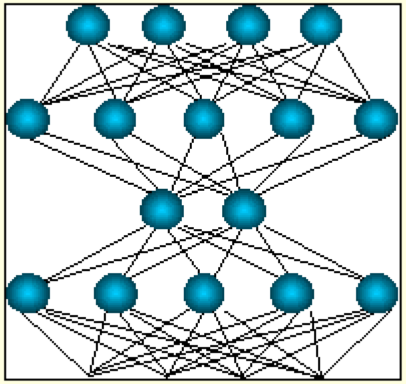
4. Specify the name of the research topic.

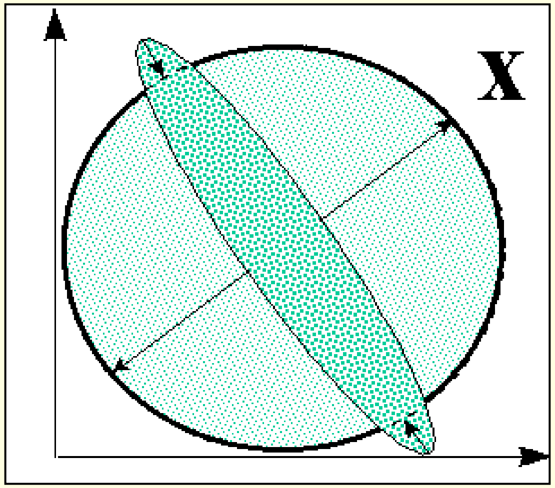
5. Carry out structuring and analysis of the subject area.

6. List the expected scientific results.

7. Justify the practical significance of the work, indicate possible interested organizations and individuals.

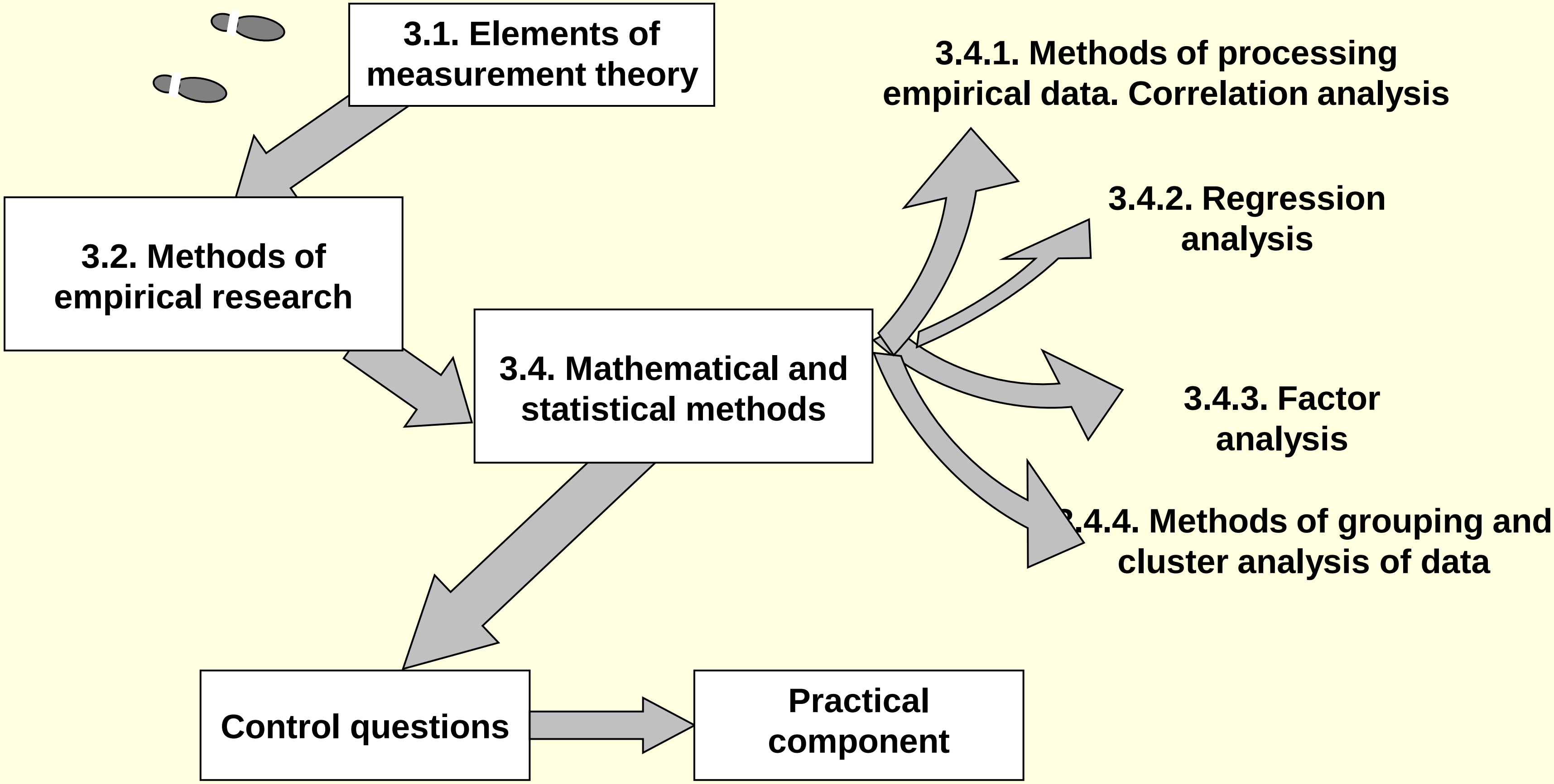


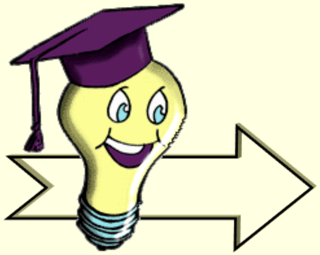




Methods of the empirical research

System elements of the topic





3.1. Elements of measurement theory

Measurement is a procedure for comparing objects according to certain indicators (characteristics).

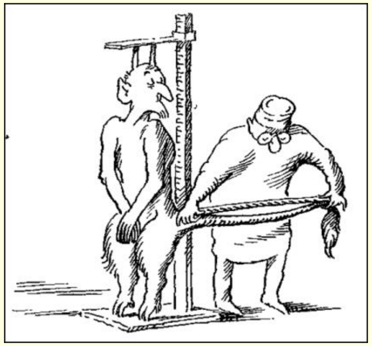
The main problems of measurement theory:

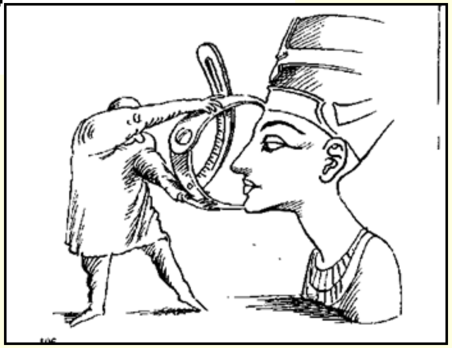
The presentation problem consists in proving the possibility of presenting an empirical system using a numerical system that preserves relationships between objects.
The problem of unity consists in determining all possible ways of presenting this empirical system by different numerical systems.

The scale is a combination of the empirical system SE, the numerical system SN and the display F: $< S_E, S_N, F >$

Measuring scales

Object	Result of measurement
Smyth	**1**
Jonson	**2**
Simons	**1**





The scale is a combination of the empirical system **SE** , the numerical system **SN** and the display **F** : **< SE , SN, F >**

- **Nominal scale**
  the measured property is gender (1 - male, 2 - female).

- **Ranking scale**
  the measured property is goodness (A is kinder than B).

- **Interval scale**
  the measured property is examination grade (1 ... 5 points).

- **Ratio scale**
  the measured property is number of childre.n

Nominal (classification, name scale) scale is the simplest, qualitative scale. It is used to describe the belonging of objects to certain classes.

Ordinal (ranking) scale is used to measure the orderliness of objects by one or a set of features.

Interval scale is used to display the difference between properties of objects. This scale can have arbitrary reference points and scale.

Ratio scale is a special case of the interval scale when choosing a zero reference point. In this scale, the numbers reflect the relationship between the properties of objects.

The scale of titles (the nominal scale)

- **The nominal scale (nominal scale)** is a scale that can be used to classify measurement objects. Therefore, measurements in the scale of names are based on classification concepts and ensure the grouping of objects that are identical to each other by a certain feature into classes.

- **An example of measurements on the nominal scale** is the grouping of students according to "knows - does not know", "knows - does not know", "attends circles - does not attend".

- **Nominal measurements are based on the logical operation** of determining whether a given object belongs to a certain class, all elements of which are identical to each other by a certain property (properties).

- Therefore, **the essence of the measurement method on the nominal scale consists in assigning different numbers to objects that differ from each other by a certain featur** . This sign in the nominative scale is chosen as a measurement indicator.

The ranking scale

- **A ranking scale** is a scale that allows you to compare objects of measurement according to indicators "more-less", "better-worse", "higher-lower", etc.
- **Measurements in the ranking scale** are based on ranking concepts that allow not only to determine the identity (or difference) of objects by a certain feature, but also provide an opportunity to arrange them in order of decreasing or increasing measured quality.
- **The levels of the difference in numbers do not reflect the levels of the difference in the quantity of the property**, i.e., when analyzing the results of the test work, it is not possible to say, for example, by how many units one student mastered a subject better than another.
- **Examples** : Ranking of students by grades, discipline, attitude to learning, and personality traits. A five-point (twelve-point) scale of school grades is also a typical ranking scale.

The interval scale

- **An interval scale** is a scale with which you can not only rank the measured property, but also determine exactly how many units more or less it is contained in different objects. Therefore, interval scale measurements rely on metric concepts that allow assigning numbers to students in such a way that equal differences in numbers reflect equal differences in the amount of the property being measured. This is achieved by introducing a unit of measurement.
- **Examples of interval scales** can be the Celsius scale for measuring temperature, the calendar time scale.
- **The essence of measurements in the interval scale** is the comparison of the studied property with the unit of measurement. At the same time, the object of measurement is assigned a number equal to the number of measurement units.
- **The boundary conditions of the interval measurement** are due to the arbitrariness of choosing the zero reference point. This means that the property being measured does not vanish (that is, has a non-zero value) even when the measurement result is zero.

The ratio scale

- **The ratio scale** is a scale by which it is possible not only to determine how many units more or less of the measured property is contained in various objects, but also to indicate how many times it is more (less).
- This is achieved due to the fact that **there is an absolute zero reference point on the ratio scale** (that is, the measured property at the zero reference point is itself zero).
- Therefore, when measuring **on the ratio scale, it is possible to use all arithmetic operations**. At the same time, as in the interval scale, measurements in the ratio scale are based on metric concepts and are carried out using a unit of measurement.
- **Examples of ratio scales** are the length scale or the Kelvin scale for measuring temperatures.
- **Examples of use**: measurement of the duration of training procedures (the unit of measurement is 1 minute), cost of training (the unit of measurement is 1 hryvnia), assessment of test results (the unit of measurement is 1 point, which is awarded for one correctly completed task.

An absolute scale is such in which the zero point of reference is taken and there is only one display of objects in the numerical system.

Qualimetry is the theory of measuring quality indicators, or more strictly, the theory of measuring the properties of a thing, which are determined by qualities.

The object of study of qualimetry is "things", that is, education and phenomena of any nature, knowledge of which consists in describing and measuremen of a set of properties.

Formalization is reflection of the results of thinking in precise concepts or statements.

Structuralization is material formations and phenomena reflected in a formalized language in the form of stable concepts, symbols and formulas.

Operationalization reduces theoretical knowledge to empirical measurement procedures. According to this procedure, any theoretical concept must be reduced to other concepts and, finally, to such characteristics that can be measured in experience.

Principles and methods of measurement

Quantitative analysis consists in measuring the numerical values of the properties of certain objects and phenomena.
The measurement of extensive quantities is based on the principle of additivity of elements of a set.

3.2. Methods of empirical research

- Observation
- Comparison
- Measurement
- Experiment

3.2.1. Observation

- *Observation* is a descriptive research method, which consists in purposeful and organized perception and registration of the behavior of the object under study (obtain information about its form, properties, relations, behavior).

- *Scientific observation* is widely used in the following areas of scientific knowledge:
  - where the fixation of the features of the object's behavior in different conditions is of particular importance;
  - when it is either impossible or not allowed to interfere with the natural flow of the process.

What is required for observation:

- formulation of the purpose of observation;
- choice of the observation method;
- development of an observation plan;
- control over the correctness and reliability of the obtained results;
- processing, comprehension and interpretation of the received information.

3.2.2. Comparison

- *Comparison* is establishing the similarities and differences of objects and phenomena of reality.
- As a result of comparison, something common is established that is inherent in two or more objects.
- the comparison must meet two main requirements:

1. It is necessary to compare only such phenomena between which there may be a certain objective commonality. You cannot compare consciously incomparable things.

2. The comparison should be made according to the most important features.

3.2.3. Measurement

- ***Measurement*** is a technique in cognition, with the help of which a quantitative comparison of values of the same quality is carried out.

- **Qualitative characteristics** of an object are usually fixed by devices, quantitative specificity on object is established by means of measurements.

The measurement assumes the presence of the following basic elements:

- an object of measurement;
- a unit of measurement, i.e. a reference object;
- a measuring device (devices);
- a measurement method;
- an observer (researcher).

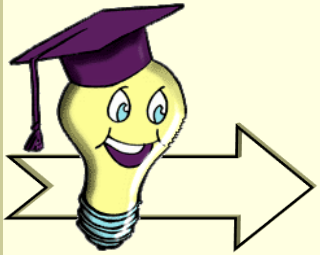
3.2.4. Experiment

- An experiment is a study of any phenomena:
  - by actively influencing them through creating new conditions that correspond to the purpose of the study;
  - or by changing the course of the process in the desired direction.
- This is the most complex and effective method of empirical research.
- It involves the use of the simplest empirical methods – observation, comparison and measurement.

Situations requiring experimental research

- A situation when it is necessary to discover previously unknown properties of an object . The result of such an experiment is statements that do not follow from existing knowledge about the object (Such experiments are called research).

- A situation when it is necessary to check the correctness of certain statements or theoretical constructions.



3.3. Methods of expert evaluation

The method of expert evaluation is usually understood as a set of logical and mathematical procedures aimed at obtaining information from experts, its analysis and generalization of information for the purpose of choosing rational solutions.

Judgments are processed using the appropriate mathematical apparatus and receive ***an expert assessment.***

1. If the initial information base is insufficient or the task is unique, then the methods of ***individual expert assessment are used***: interviews, analytical reports, scenarios.

2. For a large amount of information, the method of group ***expert evaluation is used***: questionnaire, commission.

Expert methods of collective assessment are divided into the following groups:

- **The method of expert evaluations "Delphi"** (link).
- **The method of software forecasting.**

It is a combination of Delphi and PERT methods. It serves to determine the probability of occurrence of events and estimate the probable time of their occurrence.

- **The heuristic forecasting method.**
- **The method of collective generation of ideas.**

The "brainstorming" method is an avalanche-like process, when the announced idea generates either a creative or a critical positive reaction (a negative reaction is prohibited).

- **Qualimetry method.**

The method of quantitative assessment, which aims to formalize the qualitative characteristics of relevant phenomena and processes through their division into simpler ones, to determine their normative or standard course through a system of criteria – indicators of the activity of a process or phenomenon.

The organization of expert evaluation is complex interrelated activities that determine the purpose of the work, conditions and methods of implementation, ensuring the process of expert evaluation, rights and obligations of the involved persons.

The main stages of expert evaluation:

- formation of the purpose and task of evaluation;
- formation of a management group;
- the choice of the method of obtaining expert information, the method of its processing the information;
- selection of an expert group and formation of questionnaires for the survey;
- survey of experts (expertise);
- interpretation of the obtained results;
- drawing up a report.

Competence is determined by the degree of experet's qualification in a certain field of knowledge based on the analysis of his professional activity, the breadth of his outlook on the prospects for the development of this problem.

Processing and analysis of rankings is conducted with the aim of building group relations mainly on the basis of individual preferences.

Tasks:

1) determining the closeness of the relationship between the rankings of two expert's;
2) determining the relationship between elements based on the individual opinions of group members regarding various characteristics of these elements;
3) assessment of the consistency of opinions of experts in the group.

Determining the closeness of the relationship between the rankings of two experts

The measure of closeness of connection is the rank correlation ratios:

For loose ranking - the Kendall ratio :

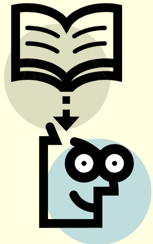
$$\tau = \frac{2}{m(m-1)} \sum_{i<j} sign(r_{1j} - r_{1i}) \times sign(r_{2j} - r_{2i})$$

where m is the number of elements, r1i is the rank assigned by the first expert to the i-th element; r2i - also the second expert.

For strict ranking the Spearman ratio

correlation coefficients vary in the range from -1 to +1.

$$\rho = 1 - \frac{6}{m(m^2 - 1)} \sum_{i=1}^{m} (r_{1i} - r_{2i})^2$$



Evaluation of the consistency of opinions of experts in the group

<u>Evaluation of the consistency of opinions of experts in the group:</u>

1) <u>Calculation of average values of pairwise correlation</u>

$$\bar{\tau} = \frac{2\sum\limits_{l\langle i} \tau_{li}}{n(n-1)}; \qquad \bar{\rho} = \frac{2\sum\limits_{l\langle i} \rho_{li}}{n(n-1)},$$

l i – number of experts (l,i= $\overline{1,n}$); $\tau_{li} u \rho_{li}$ - pairwise correlation ratio by Kendall or Spyrman.

2) Calculation of consistency coefficients: Kendall's SC concordance coefficient and the entropy coefficient of agreement Se.

With strict ranking $C_k = \dfrac{12S_c}{n^2 m(m^2-1)}, \qquad - S_c = \sum\limits_{j=1}^{m}\left(\sum\limits_{l=1}^{n} r_{lj} - \dfrac{n(m+1)}{2}\right)^2,$

r_{ij} – rank of *j*-element, done by *l* – expert; *m* – number of evaluating elements; *n* – число експертів.

In case of loose ranking

$$C_k^{н} = \frac{12S_c}{n^2 m(m^2-1) - n\sum_{l=1}^{n} S_l} \quad ` \quad - S_c = \sum_{k=1}^{T_l} \left(t_k^2 - t_k\right)$$

t_k - is the number of identical ranks in the k-th group of loose ranks in the ranking *l* –expert; t_l - is the number of groups of the same ranks in the ranking of the lth expert.

The coefficients are equal to 1 in case of complete agreement of experts' opinions.

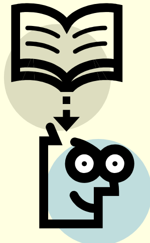
The entropy coefficient of agreement varies from 0 to 1:

$$C_E = 1 - \frac{H_E}{m \times \log m}, \qquad H_E = -\sum_{j=1}^{m}\sum_{l=1}^{n} P_{lj} \times \log P_{lj},$$

3.4. Mathematical and statistical methods in scientific research

Stochastic analysis

- **is aimed at the study of indirect relationships** , that is, mediated factors (in the case of the impossibility of determining a continuous chain of direct communication);
- acts as a tool **for deepening the deterministic analysis of factors** that cannot be used to build a deterministic model;
- **is based on the generalization of patterns of variation** in the values of economic indicators **–** quantitative characteristics of factors and results of economic activity;
- the quantitative parameters of the relationship are revealed on the basis **of the comparison of the values of the investigated indicators** in the totality of economic objects or periods.



Prerequisites of stochastic modeling

1. The availability **of the opportunity to compile a set of observations**, that is, the opportunity to repeatedly measure the parameters of the same phenomenon in different conditions.

2. **Qualitative homogeneity of the population** (regarding the relationships under study) **–** within the limits of variation, **there should not be a qualitative jump** in the nature of the reflected phenomenon.

3. **Sufficient dimension (number) of the totality of observations**, which makes it possible to detect the studied regularities (simulated connections) with sufficient reliability and accuracy. The level of reliability and accuracy of the model is determined by the practical goals of using the model in management.

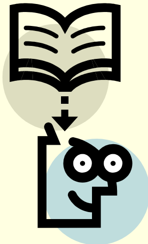
The researched regularity of changes in economic indicators appears in a hidden form. **The law of large numbers,** works only in a large population, a regular relationship is more stable than a random coincidence of the direction of variation (random covariance).

Availability of methods that allow a researcher to identify quantitative parameters of connections of economic indicators from mass data of variation of the level of indicators.

The main feature of stochastic factor analysis is that in stochastic analysis it is not possible to make a model by means of qualitative (theoretical) analysis, quantitative analysis of empirical data is necessary.

Mathematical and statistical methods of stochastic modeling of phenomena and processes:

- assessment **of connection and correlation** between indicators;
- assessment **of statistical significance of connections**;
- **regression analysis**;
- detection **of parameters of periodic fluctuations** of economic indicators;
- **grouping** of multidimensional **observations**;
- **dispersion analysis**;
- **factor** (component) **analysis**.



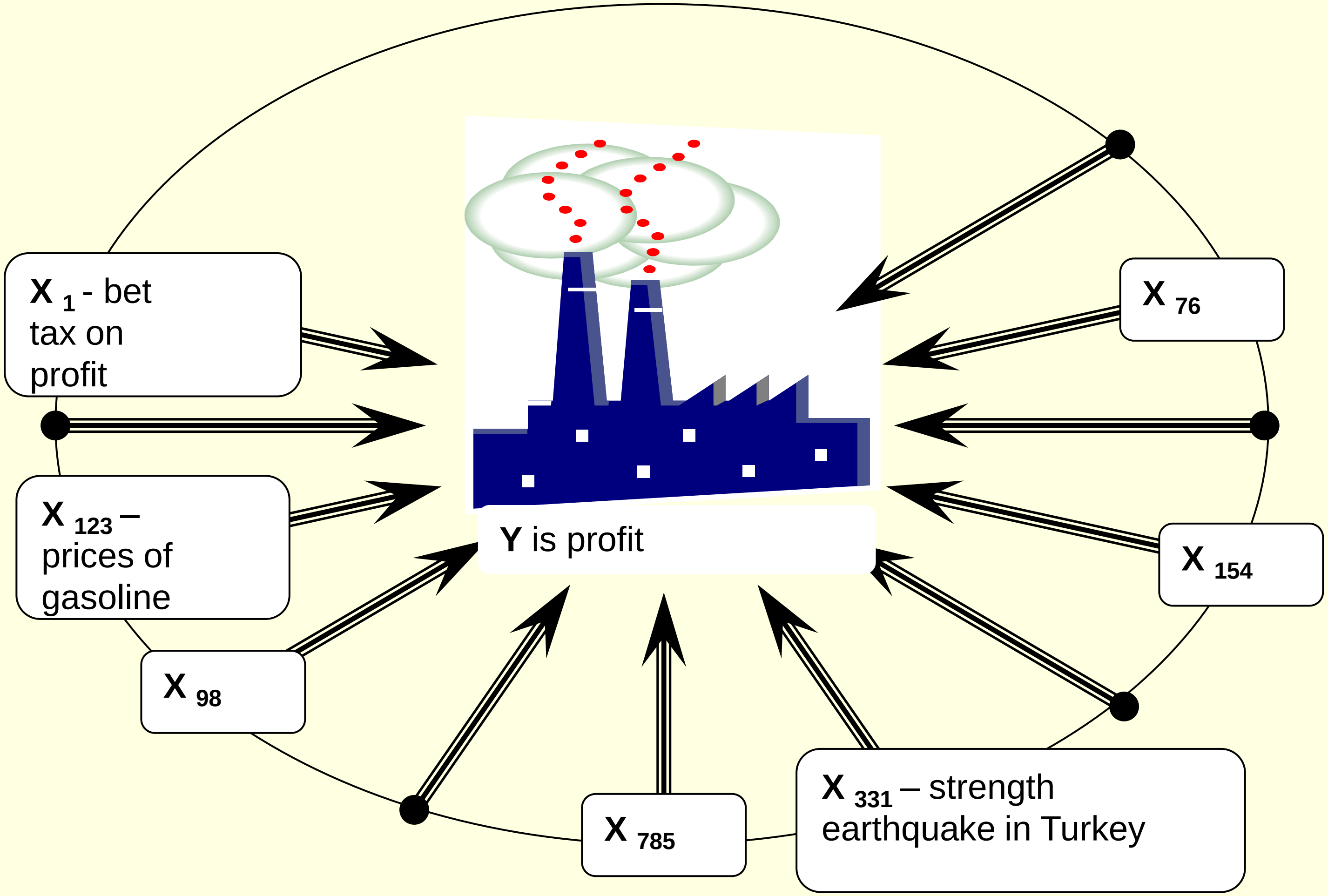
Typical classes of tasks in economic analysis:

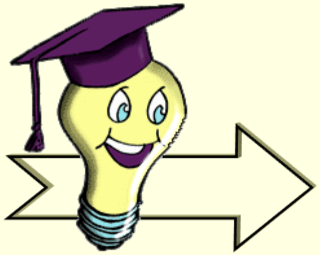
- **study of the presence, direction and intensity of the connection** of economic indicators;
- **ranking and classification** of factors of economic phenomena;
- identification **of the analytical form of the relationship** between indicators;
- **smoothing** (trend detection) **of the dynamics** of changes in the level of indicators;
- detection of parameters **of regular periodic fluctuations** in the level of indicators;
- **ranking and classification** of enterprises, firms, divisions;
- **studying the dimensions** (complexity, multifacetedness) of economic phenomena;
- **identification** of the most informative **(generalizing)** synthetic **indicators**;
- study **of the internal structure of connections** in the system of economic indicators;
- **comparison of the structure of connections in different populations**.

Methods of correlation analysis:

- **assessment of pairwise correlation** between indicators with a digital measurement scale;
- **rank correlation** and coefficients calculated according to conjugation matrices for the analysis of relationships between qualitative indicators;
- **canonical correlation** for analyzing the relationship between groups of indicators;
- **partial correlation** that allows you to examine the relationship between two indicators, eliminating the influence of other indicators;
- **multiple correlation** for assessing the dependence of one indicator on a group of indicators .

Tasks of economic analysis





Mathematical methods statistics (generalization)

- study of the presence and intensity of the connection of indicators;
- detection of the analytical form of the relationship of indicators;
- study of the structure of connections in the system of indicators;
- ranking and classification of factors;
- identification of general indicators, etc.

Objectives application

Methods
- correlational
- regressive
- dispersive
- factor analysis

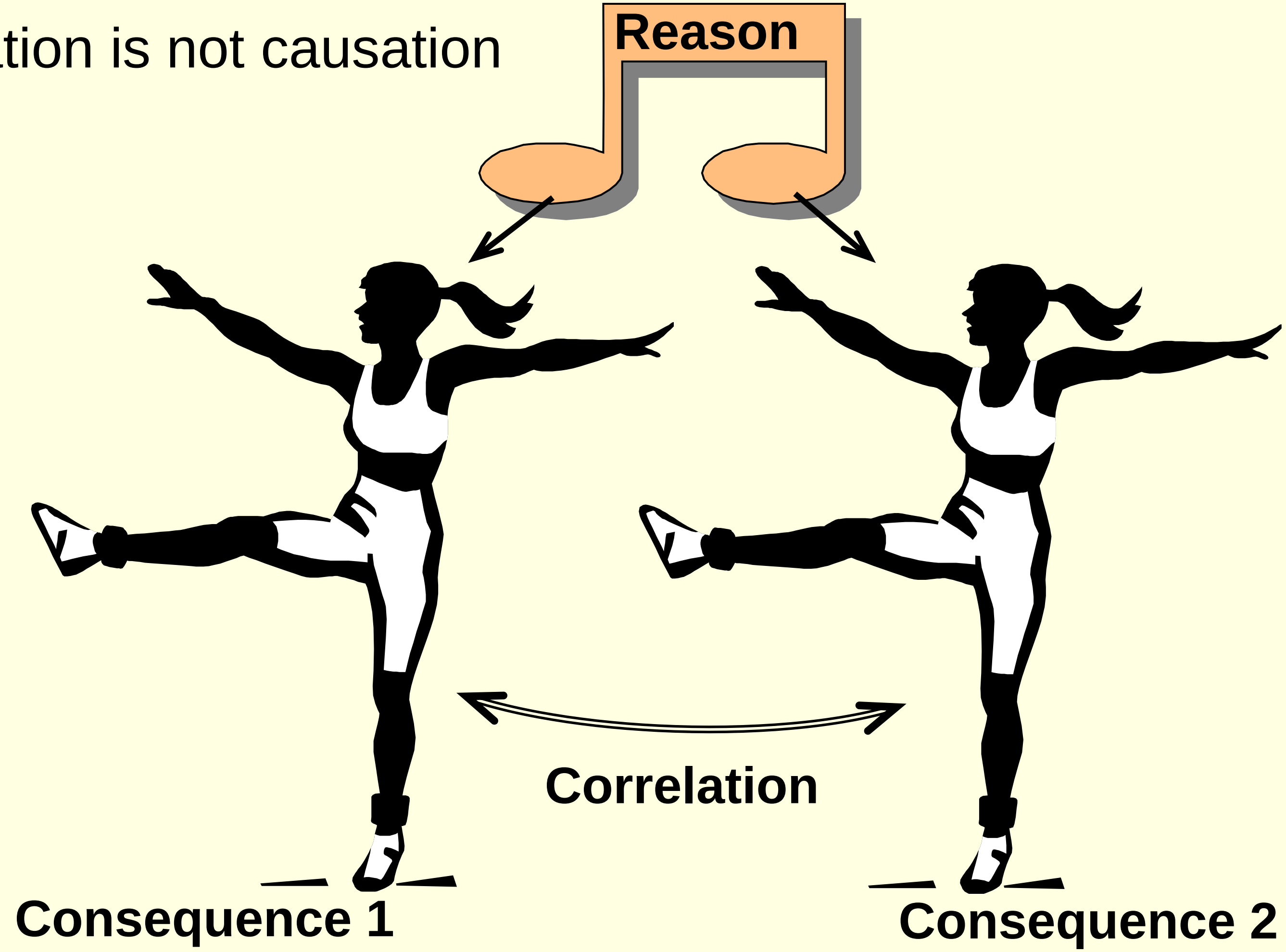
Subject of study
stochastic (probable) dependencies

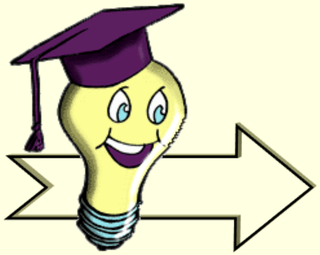
Conditions application

- Ability to compile a set of observations.
- **Qualitative homogeneity** of the set of observations.
- **Sufficient size** of the set of observations.

3.4.1. Methods of empirical data processing. Correlation analysis

Correlation is not causation





Pairwise correlation coefficient

$$r_{xy} = \frac{\sum_{i=1}^{n}(x_i - \bar{x}) \cdot (y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2 \cdot \sum_{i=1}^{n}(y_i - \bar{y})^2}}$$

$(-1 \le r_{xy} \le +1)$

x, **y** – random variable

x_i, y_i – **i** –monitor indicators x, y

$\bar{x}$, $\bar{y}$ – sample average of indicators x, y

Pairwise correlation

- **A positive sign of the coefficient** of pair correlation means that with an increase in the values of one studied variable, the value of another also increases, a negative sign means that with an increase in one variable, the other decreases.
- The absolute value (module) of the correlation coefficient means **the strength of the connection.** Conditionally accept:

$0 \le |r| \le 0.3$ - weak connection;

$0.3 < |r| \le 0.7$ - connection of medium strength;

$0.7 < |r| \le 1$ - strong connection.

- The connection between indicators can be complete, that is, functional, then the coefficient is equal to 1 or -1, or it can be completely absent, then the coefficient is equal to 0.
- If the dependence is incomplete, because it is distorted by the influence of other extraneous factors, then the coefficient will take intermediate values (between -1 and 0, or between 0 and 1) depending on the closeness of the connection.
- Yes, the labor productivity of workers depends on the length of service, but there are other factors that change this dependence (the health of the worker, for example).

Correlation analysis. Example 3.1 .

Formulation of the problem

To evaluate the closeness of the relationship of a number of indicators characterizing students of the university N :

Y – Success in the subject (points)

X_1 – Lecture attendance (%)

X_2 - Material situation (points)

X_3 – Attitude towards the teacher (points)

Example 3.1 (continuation)

Researched people (students)	Y	X_1	X_2	X_3
1	**5,0**	100	7	10
2	**4,5**	84	5	9
3	**4,6**	90	7	7
4	**5,0**	93	5	10
5	**3,2**	60	9	5
…				
26	**4,2**	89	5	8
27	**3,6**	68	8	8
28	**4,8**	95	10	9
29	**4,0**	96	7	6
30	**3,4**	89	5	4

Example 3.1 (continuation)

Content of correlation analysis

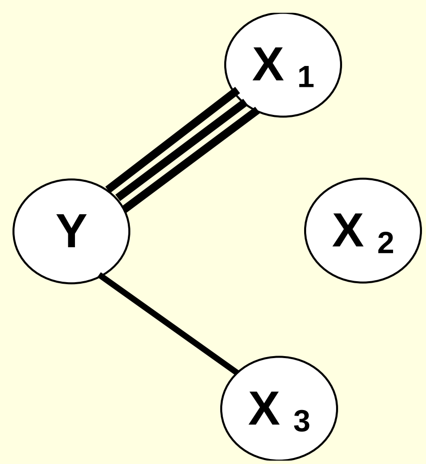
№	Y	X_1	$X_1 - \overline{X}_1$	$Y_1 - \overline{Y}_1$	$(X_1 - \overline{X}_1)^2$	$(Y_1 - \overline{Y}_1)^2$	$(X_1 - \overline{X}_1) \times (Y_1 - \overline{Y}_1)$
1	**5,0**	**100**	20,2	1,1	409,4	1,1	21,5
2	**4,5**	**84**	4,2	0,6	17,9	0,3	2,4
3	**4,6**	**90**	10,2	0,7	104,7	0,4	6,8
30	**3,4**	**89**	9,2	-0,5	85,3	0,3	-5,0
Average Sum	**3,9**	**79,8**					

Example 3.1 (the end)

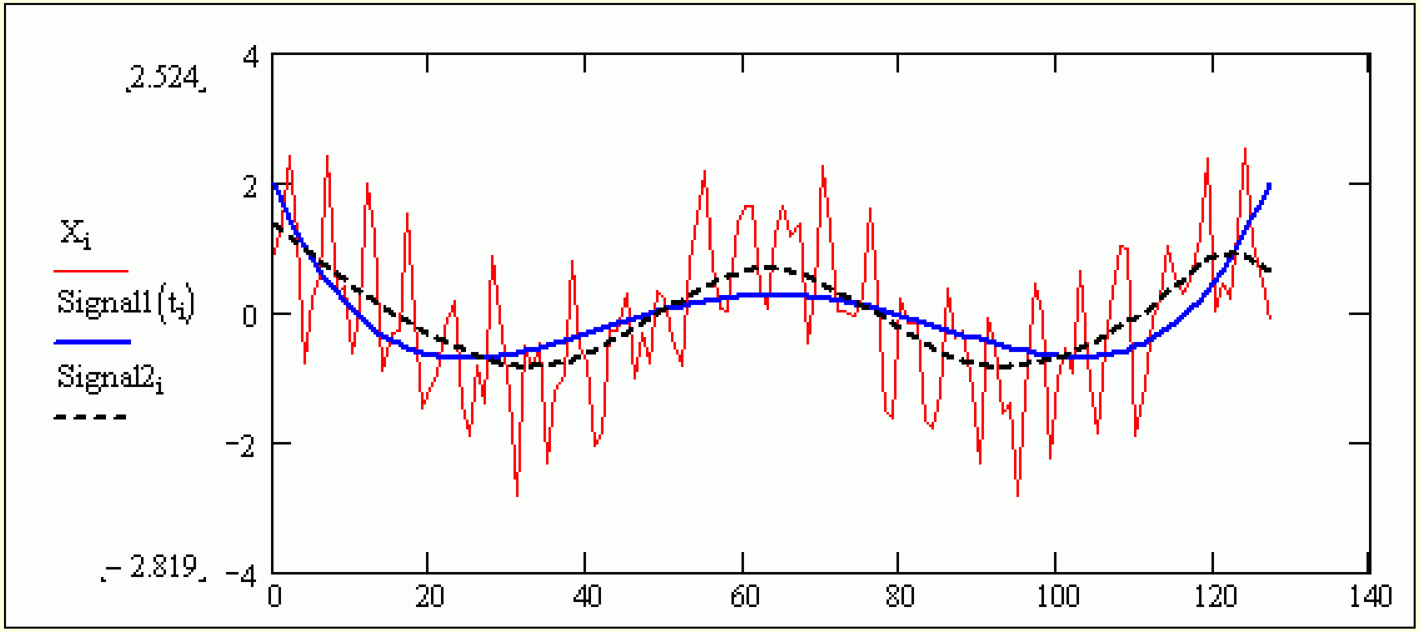
$$r_{xy} = \frac{\sum_{i=1}^{n}(X_{1i} - \overline{X}_1)\cdot(Y_i - \overline{Y})}{\sqrt{\sum_{i=1}^{n}(X_{1i} - \overline{X}_1)^2 \cdot \sum_{i=1}^{n}(Y_i - \overline{Y})^2}} = \frac{350{,}4}{\sqrt{7109{,}4 \times 25{,}1}} = 0{,}83$$

Result

	Y	X 1	X 2	X 3
Y	1	**0,83**	-0,23	**0,30**
X 1	**0,83**	1	-0,19	0,25
X 2	-0,23	-0,19	1	0,01
X 3	**0,30**	0,25	0,01	1



3.4.2. Regression analysis



Regression analysis. Example 3.2.

Formulation of the problem

Make a sales forecast for the next month, based on the planned costs for advertising in the press, on radio and television

Output data:

Y – Demand (pcs)

X_1 – Expenses for advertising on TV (UAH)

X_2 – Expenses for advertising in the press (UAH)

X_3 – Radio advertising expenses (UAH)

Month	**Y**	**X_1**	**X_2**	**X_3**
1	656	1000	5000	1000
2	921	0	6000	2000
3	1157	3000	7000	3000
4	1934	8000	7000	2000
5	1356	5000	6000	1000
6	800	2000	5000	1500
7	1560	7000	5000	2500
8	2543	15000	3000	2000
9	3351	20000	3000	1000
10	1269	5000	5000	1000

Planned advertising costs

$X_1 = 10000$

$X_2 = 5000$

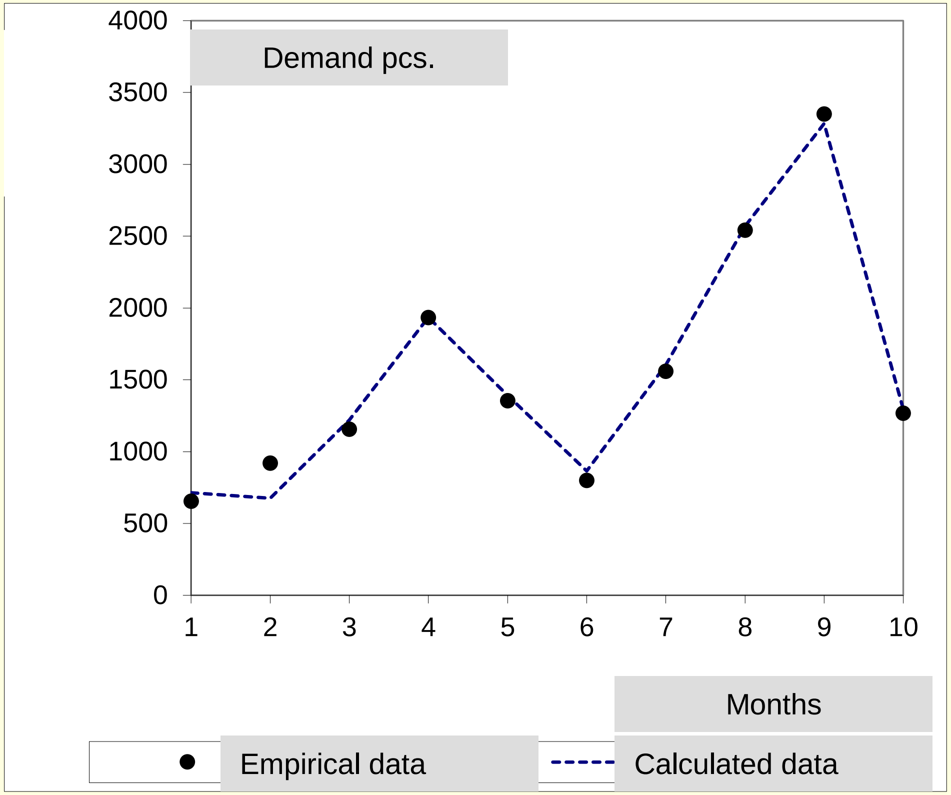
$X_3 = 2000$

Example 3.2

Content of regression analysis

Multiple linear regression equation

$$Y=76.72+0.1454 \cdot X_1 +0.09604 \cdot X_2 +0.01129 \cdot X_3$$



Result

Forecast: **Y=2033.5**

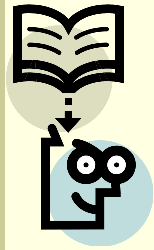
3.4.3. Factor analysis (FA)

The main assumption of FA: phenomena in a certain field of research, despite heterogeneity and variability can be described by a small number of functional units, parameters or factors.

Two ways of research using FA:

1. Put forward a hypothesis related to the fundamental reasons for the variation of the studied phenomena, and for its verification resort to factor analysis to verify this hypotesis.

2. Abandon any hypotheses and limit yourself to collecting the maximum amount of accurate data. Then, use factor analysis on the set of observations obtained to reveal the nature of hidden patterns.



General characteristics of the FA method

1. Collection of observations on the variation of variables.

2. All possible correlations between the observed variables are calculated to determine the fact of the existence of a relationship and its measures.

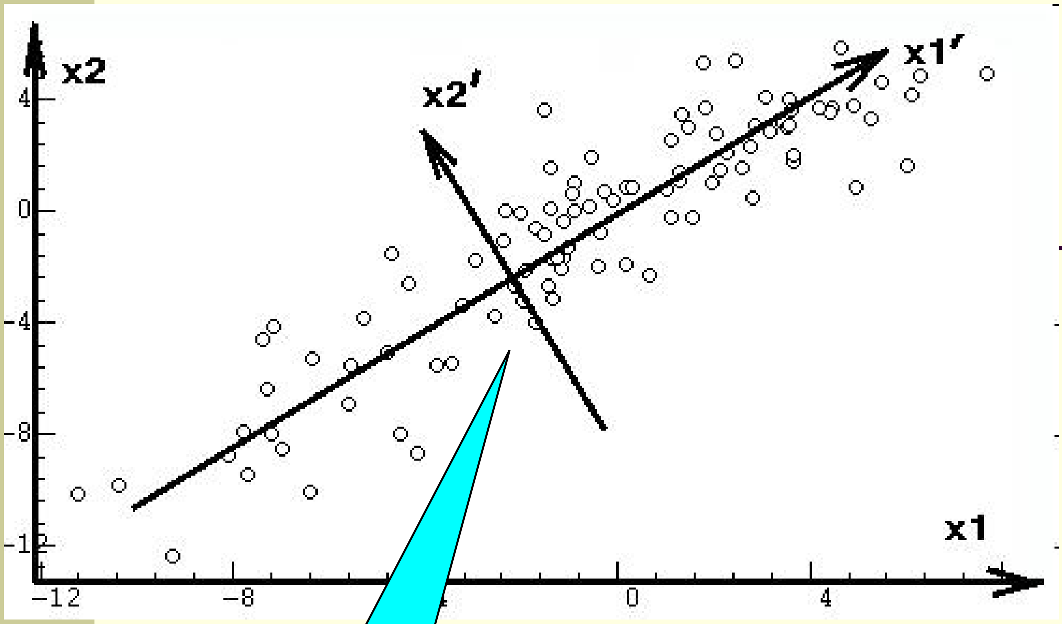
3. Based on the correlation coefficients, a factor analysis is performed:

how some variables that behave in the same way are combined into groups;

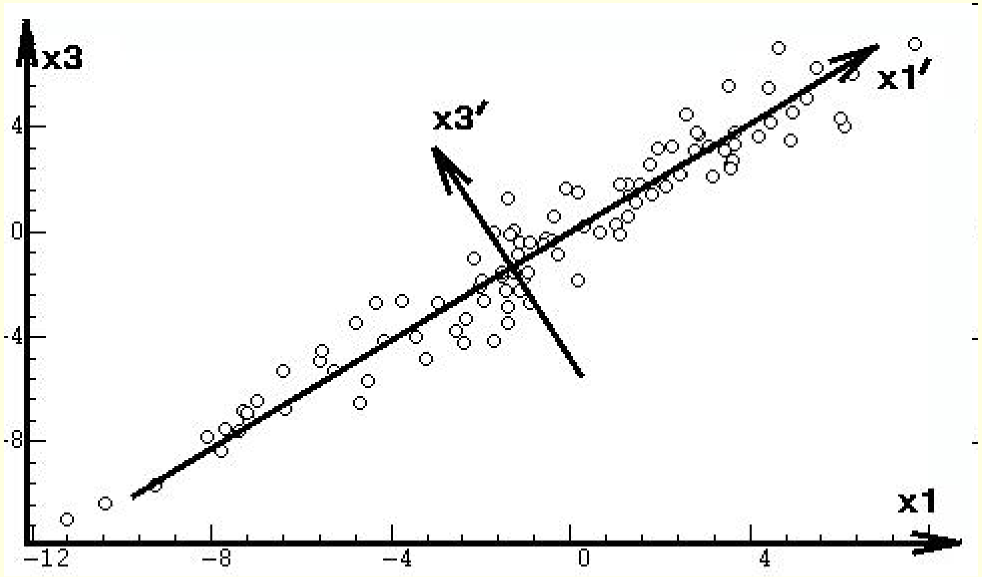
the main general factors affecting the formation of these groups are revealed.

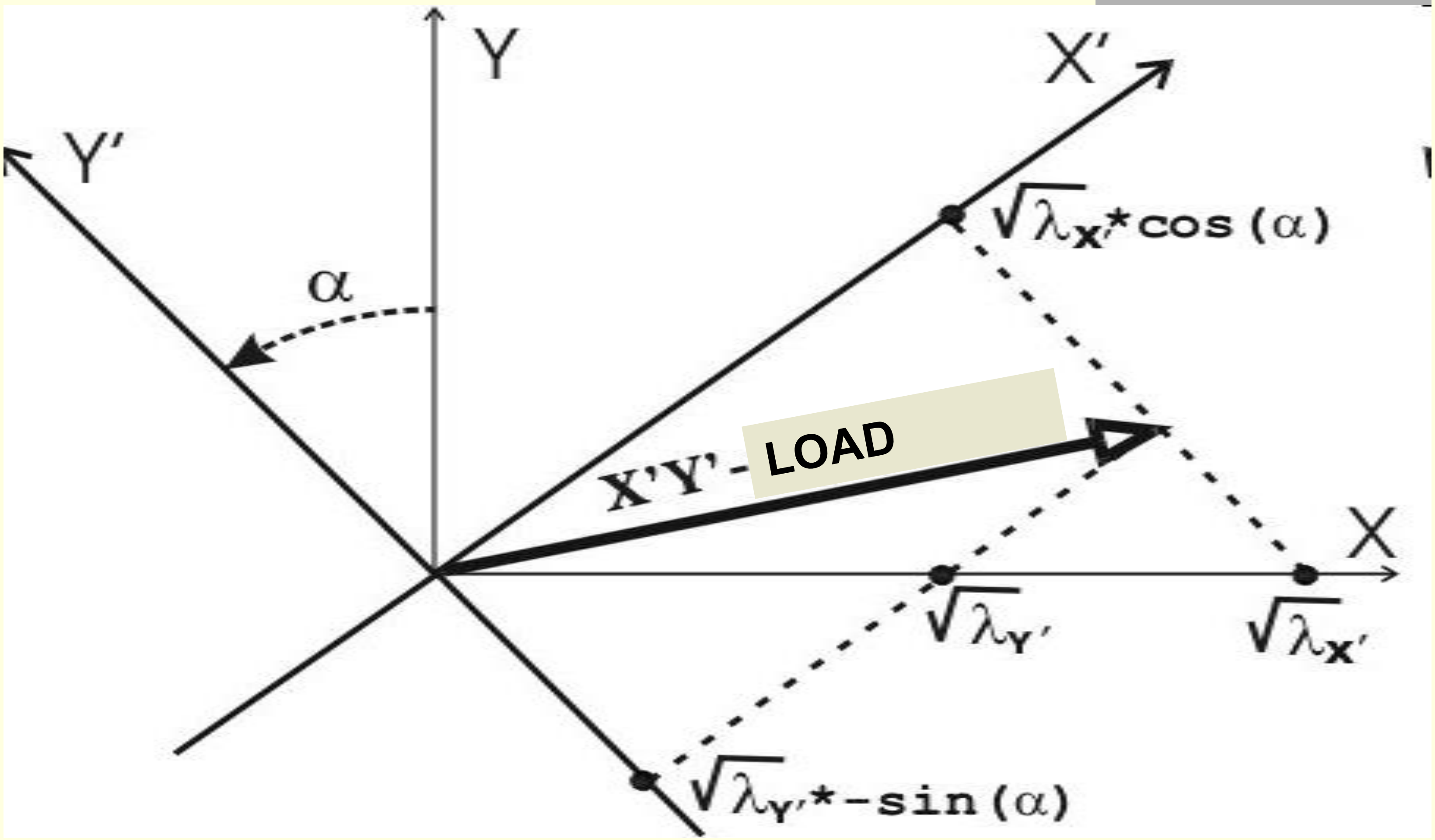
4. Revealed factors are interpreted as higher-order variables that are used to explain the variation of numerous initial data.

Projections of objects on the plane of output variables with a new factorial coordinate system



The main axes of the scattering ellipsoid





Y
X'
Y'
α
$\sqrt{\lambda_{X'}}$*cos(α)
X'Y' -
LOAD
X
$\sqrt{\lambda_{Y'}}$
$\sqrt{\lambda_{X'}}$
$\sqrt{\lambda_{Y'}}$*-sin(α)

Factor analysis. Example 3.3

Formulation of the problem

The task of classifying enterprises is solved based on the following characteristics: 1) profit; 2) production development costs; 3) expenses for the development of the marketing system; 4) speed of renewal of fixed assets; 5) expenses for maintaining the management apparatus; 6) advertising expenses; 7) average age of personnel; 8) tax arrears.

To facilitate the classification of objects, it is necessary to reduce the number of indicators without losing information.

Example 3.3 (the end)

Content of factor analysis

Characteristic (indicators)	Factor loads	
	factor 1	factor 2
profit	0,5631	0,6170
expenses on development	**0,8463**	0,1781
expenses on marketing	0,3025	**0,7704**
speed of renovation	**0,7937**	0,3026
administrative expenses	0,2127	**0,7556**
cost of advertising	0,2298	**0,7628**
average age of employees	**0,6053**	0,4150
debts on taxes payment	**0,7474**	0,3424

Two factors were identified:

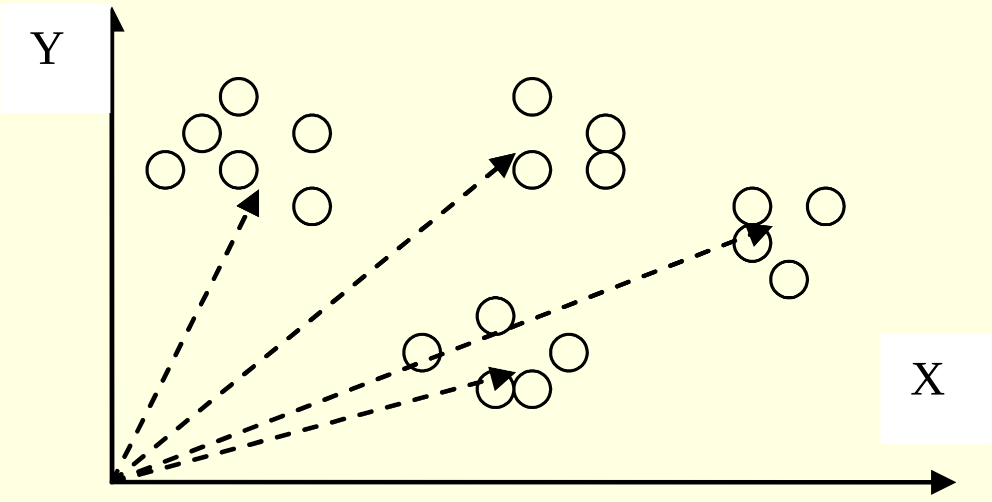
factor 1 – the degree of production development efforts,

factor 2 – the degree of efforts to create the image of the enterprise by non-production methods.

3.4.4. Methods of grouping and cluster analysis of data

Cluster analysis is the process of dividing (classifying) a set of observed objects into subsets of closely related objects.

Selected subsets of objects have the form of compact clusters of points in metric space, where the distance between any two objects is defined. These spaces are called clusters .



Cluster analysis. Example 3.4

Output data

Indicators / Objects	x_1	x_2	y_1	y_2	y_3
q_1	2,8	1,1	1	1	0
q_2	4,7	2,1	0	1	0
q_3	4,1	1,6	0	1	1
q_4	4,1	1,8	0	0	1
q_5	4,2	1,8	0	0	1
q_6	7,8	4,6	0	0	0
q_7	2,5	1	1	1	0
q_8	2,9	1,3	1	0	1
q_9	2	0,7	1	1	1
q_{10}	4,4	1,8	0	1	0
q_{11}	7,3	3,5	0	0	0

Example 3.4 (continuation)

$$\rho_{1,2} = \sqrt{\sum_{k=1}^{m}(x_{1k} - x_{2k})^2} = \sqrt{(2{,}8 - 4{,}7)^2 + (1{,}1 - 2{,}1)^2} = 2{,}147$$

$$S1_{1,2} = 10/(10 + \rho_{1,2}) = 0{,}8232$$

$$S2_{1,2} = b_{1,2}/p = 2/3$$

$$S_{1,2} = \frac{f}{f+p} S1_{1,2} + \frac{p}{f+p} S2_{1,2} = 2/5 * 0{,}8232 + 3/5 * 2/3 = 0{,}7292$$

Example 3.4 (the end)
Combined object similarity matrix

	q_1	q_2	q_3	q_4	q_5	q_6	q_7	q_8	q_9	q_{10}	q_{11}
q_1	1	0,7292	0,5510	0,3486	0,3458	0,4484	0,987	0,5912	0,7671	0,7404	1,4648
q_2	0,7292	1	0,7710	0,5748	0,5779	0,6860	0,7210	0,3341	0,5067	0,9837	0,7096
q_3	0,5510	0,7710	1	0,7921	0,7912	0,4916	0,3708	0,5549	0,7256	0,7860	0,4914
q_4	0,3486	0,5748	0,7921	1	**0,9960**	0,6732	0,3392	0,7539	0,5233	0,5833	0,6936
q_5	0,3458	0,5779	0,7912	**0,9960**	1	0,6746	0,3367	0,7510	0,5210	0,5921	0,6955
q_6	0,4484	0,6860	0,4916	0,6732	0,6746	1	0,4436	0,4514	0,2354	0,6800	0,9568
q_7	0,9870	0,7210	0,3708	0,3392	0,3367	0,4436	1	0,5809	0,7779	0,7316	0,4595
q_8	0,6912	0,3341	0,5549	0,7539	0,7510	0,4514	0,5809	1	0,7609	0,3453	0,4680
q_9	0,7671	0,5067	0,7256	0,5233	0,5210	0,2354	0,7779	0,7609	1	0,5164	0,2508
q_{10}	0,7404	0,9837	0,7860	0,5833	0,5921	0,6800	0,7316	0,3453	0,5164	1	0,6993
q_{11}	0,4648	0,7096	0,4914	0,6936	0,6955	0,9568	0,4595	0,4680	0,2508	0,6993	1

$S(q_i, q_j) = 0.9960 = S_{4.5}$

q_4 and q_5

$S(q_4, q_j) =$

Control questions

1. What does the term "method" mean?
2. Reveal the main content of empirical research methods.
3. Describe the measurement scales used in science.
4. What is the essence of expert evaluation methods?
5. How is the consistency of experts' opinions measured?
6. What methods of empirical data processing do you know?
7. Define and characterize correlation analysis.
8. Give the analytical form of determining the correlation coefficient.
9. Define and characterize regression analysis.
10. Give the general form of the linear regression function.
11. Reveal the essence of the method of factor analysis.
12. Reveal the essence of cluster analysis.
13. Describe the main problems of measurement theory.

Control questions (the end)

14. State the limitations on the use of regression models within scientific research.
15. How does the experiment manifest itself as a special form of scientific knowledge?
16. What types of experiments are distinguished by the goals of the experiment?
17. How does a natural experiment differ from an artificial experiment?
18. What types of experiments are distinguished according to the method of their organization?
19. What is a passive experiment?
20. In which fields of science has the information experiment become widespread?
21. What is a computational experiment?
22. What is determined at the process of the experiment conducting ?
23. What does the plan (program) for conducting the experiment include?

Practical component

Example 3.5. Measuring scales and their transformations

At some enterprises, employees are tested in order to analyze their communication skills. The results of testing six subjects according to the "extrovert-introvert" scale of the Eysenck test are presented in the table. 3.1.

Table 3.1.

Test results of subjects

Researched	Scale of the interval	Scale of the rank	Nominal scale
A	20	5	E
B	15	4	E
C	22	6	E
D	9	3	I
G	3	1	I
F	4	2	I

The practical component (continuation)

- The first column of the table shows the names of the test subjects, the second column contains the score describing the degree of extroversion in each test subject, the third column assigns ranks to the test subjects (the first rank was given to the test subject with the lowest score), the fourth column according to the initial scores subjects are divided into two classes: the class of introverts "i" (scores from 0 to 12) and class of extroverts "E" (scores from 13 to 24).
- Thus, the table presents measurements of the quality of extraversion – introversion of employees according to the interval scale (column 2), rank scale (column 3) and nominal scale (column 4).
- Using the example of the given table, it is easy to see that when moving from one scale to another, part of the information about the studied objects is lost. For example, as a result of the ranking, employees D and E, who have a difference in interval evaluations of one point, and employees B and G, who have a difference in interval evaluations of six points, receive a difference of one rank.
- When the test subjects are divided into classes, employees with very different grades fall into one class.

The practical component (the end)

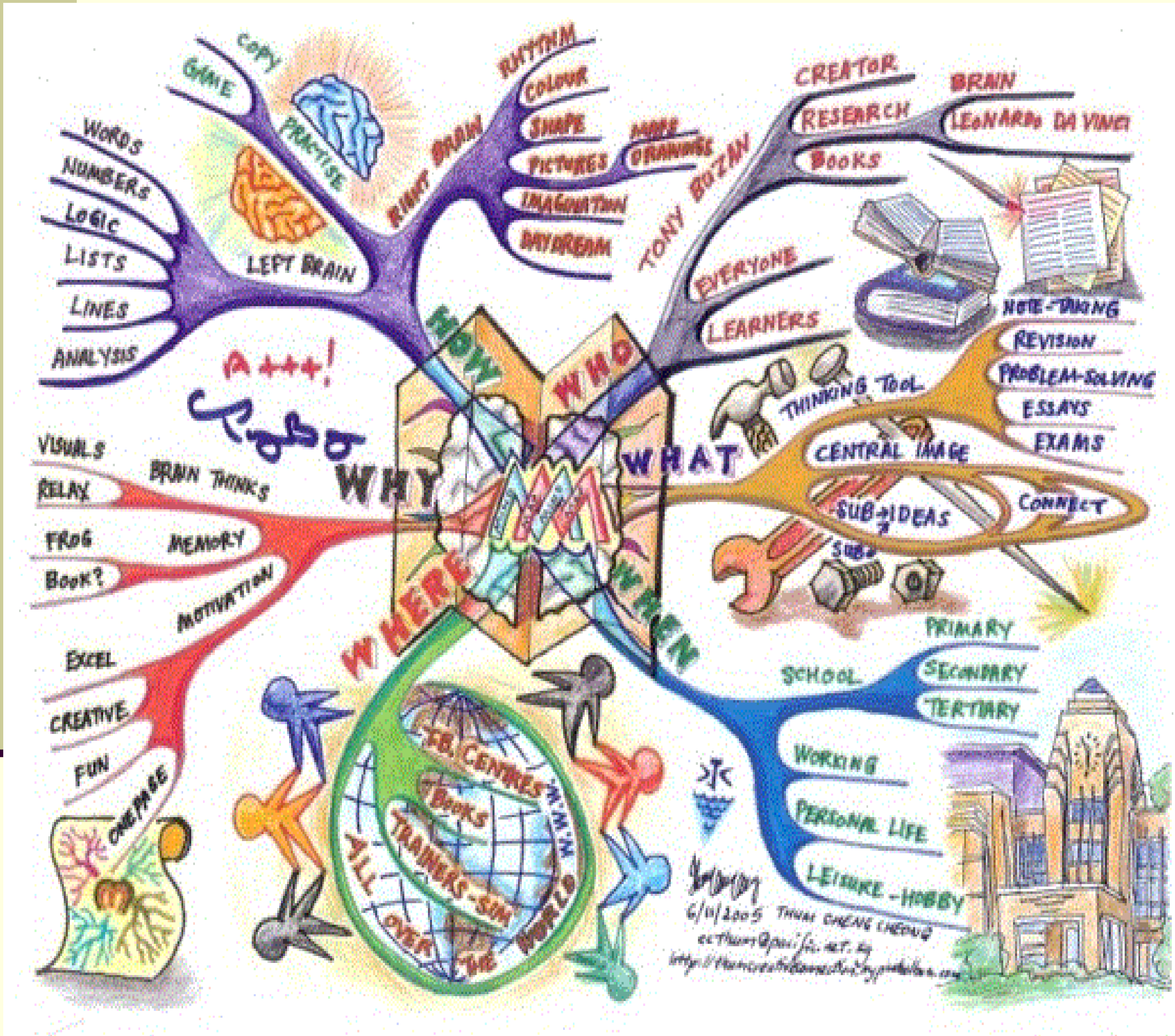
Task 3.1. Based on the studied material, build a map of key concepts and questions of the topic "Methods of empirical research".

- The essence of the method of mental maps is that the main concept is highlighted, from which tasks, ideas, separate thoughts and steps necessary for the implementation of a specific project or idea branch out.
- In exactly the same way as the main one, all smaller branches can be divided into several more sub-branches. A mental map reflects associative connections in the brain of its creator.
- A mental map is a special kind of diagram presented in the form of a tree diagram. It depicts words, tasks and other concepts that are connected by branches that depart from the central branch. The central branch represents the main idea or concept.

Structuring and annotating in the form of a memory card

- Maps of visual images are being built that create a deep emotional impression.
- The main ideas of the received information become more concise, clear and understandable.
- Logical connections between ideas are indicated.

Example 3.6. Advantages of mind maps



Example 3.7. **Contexts in which mind maps can be used**

Task 3.2. Solve the problem

Build a regression model of the relationship between the outcome feature and a set of explanatory variables characterizing the phenomena of the subject area of your dissertation research.

According to the conditions of the problem, it is necessary to build a simple regression model of the dependence of the resulting characteristic on a set of explanatory variables by the method of least squares (LSM):

- present a table of intermediate and final calculation results;
- present a formalized form of the regression equation (with defined coefficients and a permissible error);
- plot graphs of the dependence of the resulting characteristic on a set of explanatory variables according to the simple regression equation obtained as a result of the application of MNC;
- on the basis of the constructed graph and the value of the standard error of the model, evaluate the quality of the obtained regression equation.

Using the spreadsheet editor MS Excel, it is necessary to approximate the results of the experiment by adding a trend line to the appropriate graph, choosing its type yourself (the degree of smoothing should be at least 5). Draw a trend equation and the value of the approximation reliability on the figure.

4. Theoretical methods research

System elements of the topic

4.4. Peculiarities of using theoretical methods in economics

Control questions

Practical component

4.3. Methods of establishing causal relationships

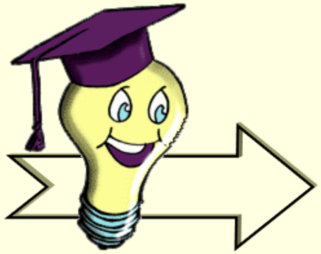
4.2. Theoretical research methods. Analysis. Synthesis. Deduction. Induction. Analogy. Idealization. Abstraction. Ranking. Logical method. Hypothetical method. Axiomatic method, mathematical methods.

4.1. Principles are tools of knowledge

4.1. Principles are tools of knowledge

The scientific method is a set of techniques and operations used in building a system **of scientific** knowledge

- **A scientific principle** is one of the elements of the foundations of a scientific theory, which performs integrating, synthesizing and organizing functions in relation to the entire array of true statements of a certain field of science.
- The principles of science are statements not of the object language of science, but of its metalanguage, which asserts something about the rules, requirements for the elements of scientific theories themselves.
- **The basic principle of the scientific method** is to take nothing for granted. Any claim or refutation of something should be verified.



Principles are tools of knowledge

The principle of causality – *the cause precedes the effect* .

The principle of correspondence – the theory *passes into a previous less general theory in the conditions in which this previous one was established.*

The principle of observability v *only those statements that can be at least mentally, at least in principle verified by experience, should be introduced into science.*

The principle of complementarity -v *some concepts* are incompatible and *should be perceived only as complementing each other.*

The principle of simplicity.
The principle of constructiveness of mathematical objects.
The principle of non-contradiction.

The requirement of the beauty of scientific theory.

4.2. Theoretical research methods

The main methods of theoretical research:

Induction and deduction. **Analysis and synthesis.** **Analogy.** **Idealization.** **Abstraction.** **Ranking .** **Formalization.** **Historical method.** **Axiomatic Ascent from the abstract to the concrete.** **Structural and genetic analysis and synthesis.** **Mathematical method.** **Modeling.**	**Hypothetical and hypothetical – deductive methods.** **A thought experiment** **Terminological.** **Functional.** **Systematization.** **Content analysis.** **Generalization.** **Aggregation method.** **Methods of establishing causal relationships:** **(**similarities, differences, similarities and differences (combined), concomitant changes, residuals**)**

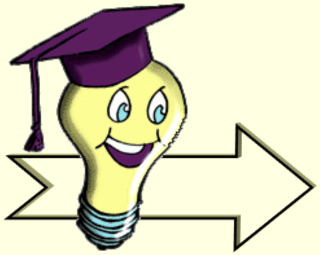
4.2.1. Deduction

Deduction is **a logical transition from** more **general knowledge to partial knowledge** . This is a method of research in which partial propositions are deduced from general ones.

An example. With the help of deduction, the following new knowledge is obtained:

1. Bread is an essential commodity. Essential commodities are inelastic. **Therefore** bread is an inelastic commodity.

2. Fiberglass is a non-meta, non-metals are not electrically conductive. **Therefore** glass plastic is not electrically conductive.



Another definition

Deduction is an inference in which a logical transition is made from the original valid statements to new **valid** statements.

A typical deduction is an inference **from general knowledge to partial knowledge** .

All subjects of economic activity are taxed

link

Company A pays taxes

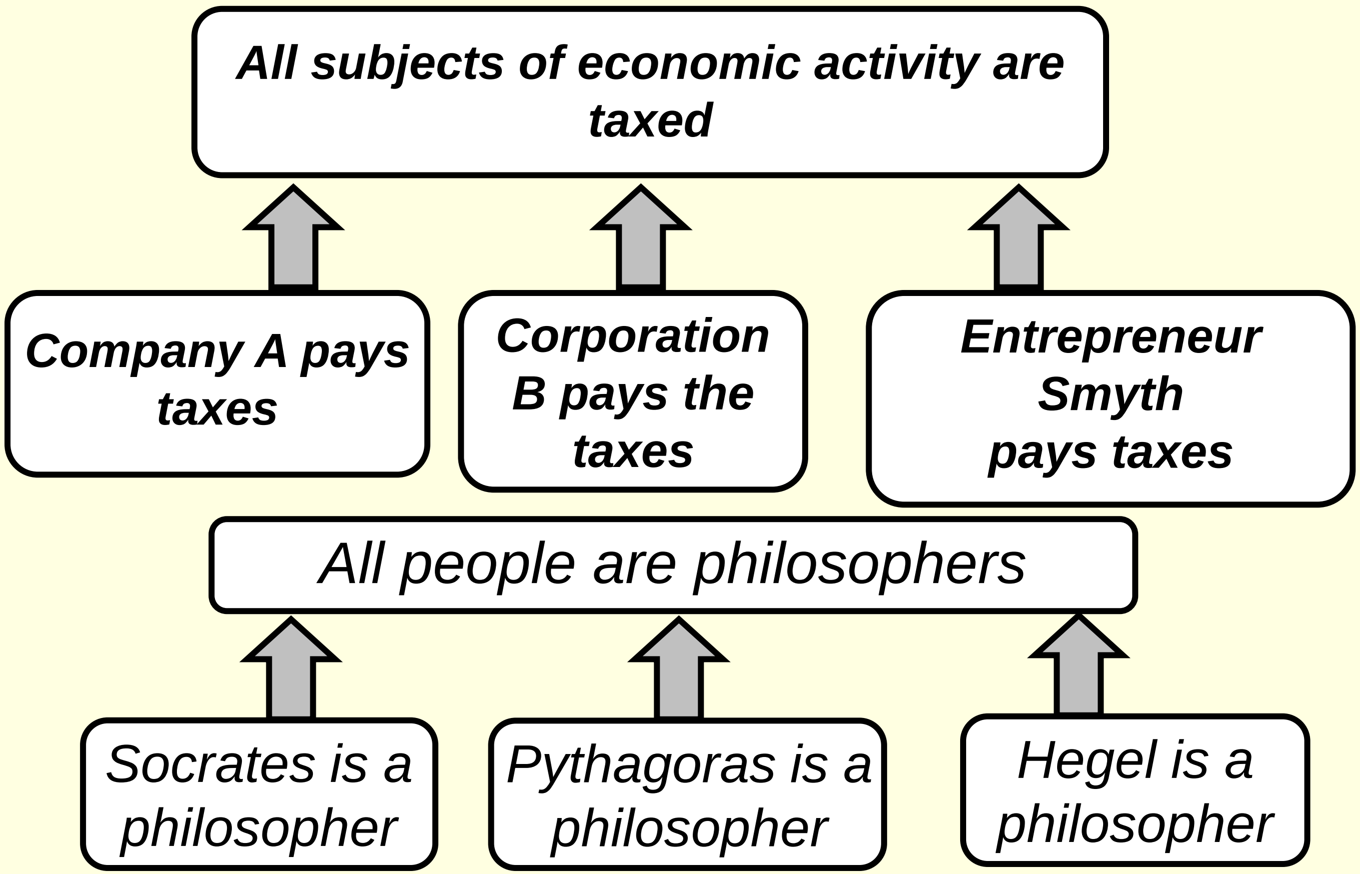
Corporation B pays the taxes

Entrepreneur Smyth pays taxes

Conclusions, consequences

4.2.2. Induction

Induction - inference from **partial to general knowledge**.
Induction is a logical transition from true to probable statements. The method of constructing hypotheses.



Types of induction (1)

Depending on the completeness of the empirical research, the following types of induction are distinguished

- Full induction.
- Incomplete induction:
  - popular induction;
  - scientific induction.

Inference in which **a general conclusion about a class** of objects is made **based on the study of all objects of this class** is called ***full induction***.

Incomplete induction *is* a type of inductive inference in which a general conclusion about the characteristics of the entire class of objects is made as a result of the study of only a part of the objects of this class.

Examples.

1. Observing the appearance of heat during mechanical movement (friction, impact, compression), they conclude that *any mechanical movement generates heat*.

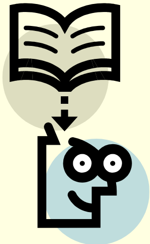
2. Repeatedly observing the increase in price when demand increases, a general conclusion is obtained: *the price of all goods increases when demand for them increases*.

The scheme of incomplete induction has the form:

Link:
S1 has the sign *P.*
S2 has the sign *P.*
Sn has the sign *P.*
S1, S2, Sn belong to class *K.*

Conclusion:
Class *K is probably a feature P.*

There are two types of incomplete induction:
Popular - by listing; **scientific** - by selection.



Popular induction is an inference in which a general conclusion about a class of objects is made on the basis that none of the observed facts contradicts the generalization.

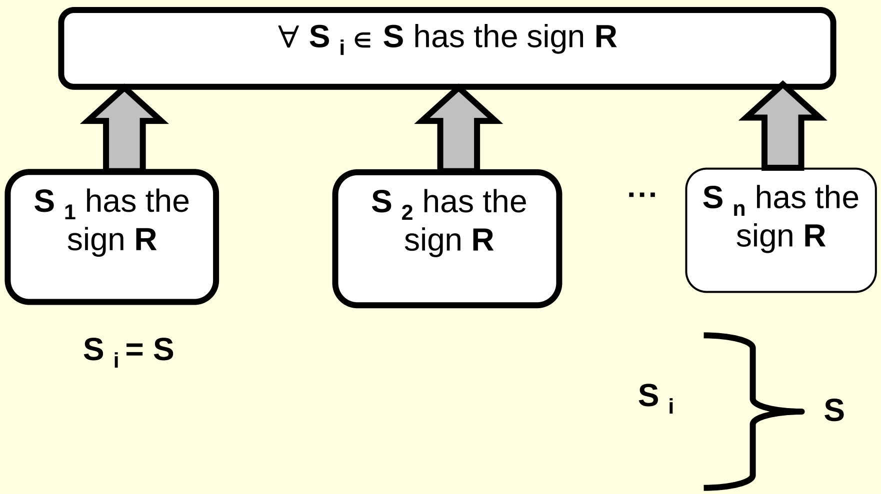
Scientific induction is a conclusion in which a generalization is built by selecting necessary and excluding accidental circumstances.

According to the method of research, the following type of induction are distinguished:

- **induction by the method of selection (selection)**;
- **induction by the method of exclusion (elimination)**.

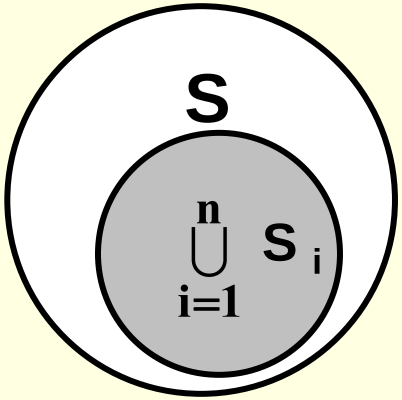
Types of induction (2)

Full induction



Incomplete induction

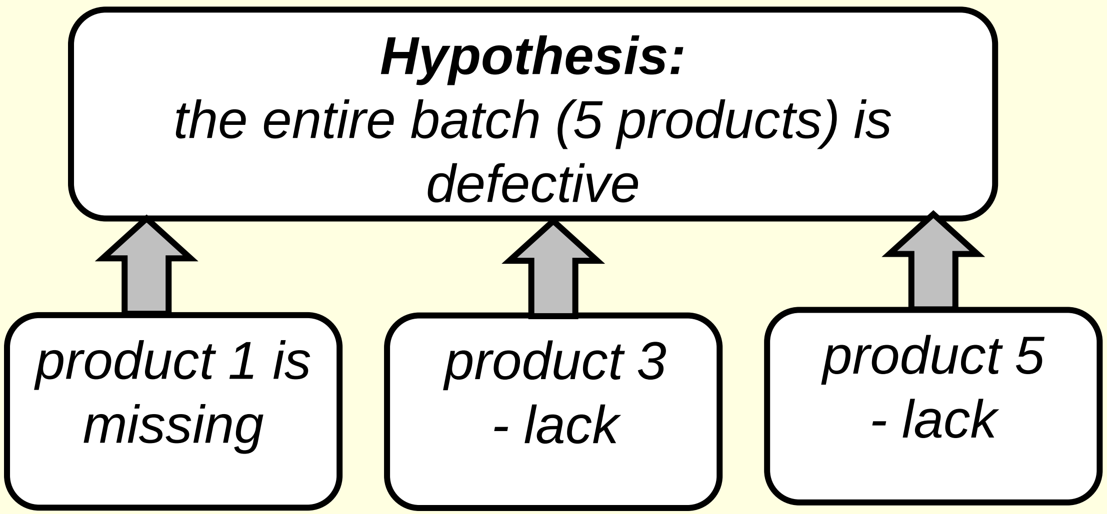
$$\bigcup_{i=1}^{n} S_i \in S$$



Types of induction (3)

Incomplete induction

Simple (popular) **- a random selection of facts.**
Scientific **- scientifically based selection of facts.**



Full induction

Valid statement:
the entire batch (5 products) is defective

product 1 - lack

product 2 - lack

product 3 - lack

product 4 - lack

product 5 - lack

Deduction

The whole batch is defective

product 4 - lack

If there is a shortage - a fine

There is a shortage

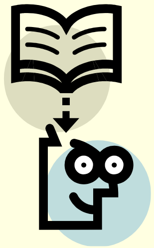
Fine

4.2.3. Analogy

Analogy is an inference in which a characteristic of one object is transferred to another **similar object** to the first object

Examples

- Development trajectory.
- Financial leverage (taxes, profit).
- Enterprise potential (innovative, strategic).



The method of analogy

A condition by analogy is a logical conclusion, as a result of which knowledge about the characteristics of one subject is achieved based on the knowledge that this subject has similarities with other subjects.

An example. The nature of sound was established by analogy with a sea wave, the nature of light – by analogy with sound, the nature of electricity – by analogy with light, the corpuscular-wave character of light was extended by analogy to the structure of matter.

An example. Let's consider the dialogue from L. Carroll's fairy tale "Alice in Wonderland".

Alice asks the Cheshire Cat:

– How do you know that you are not in your right mind?

– Let's start with the fact that the dog is in his mind. Do you agree?

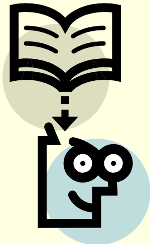
Suppose, agreed Alice.

Next, said the cat. – A dog growls when it is angry, and when it is satisfied, it wags its tail. Well, I growl when I'm happy and wag my tail when I'm angry. So, I'm not in my right mind.

Rules of inference by analogy

The general scheme of inference by analogy:

subject *A* has features *a, b, c, d, e*;
subject *B* has features *a, b, c, d*;
probably subject *B* also has feature *e*,
that is, based on the commonality of a number of features inherent in these objects (*A, B*), it is possible to transfer the feature *e* to the object *B.*



Scheme of deduction by analogy:

- object **A** has features **P1, P2, P3, P4, P5**;
- subject **B** has features **P1, P2, P3, P4**;
- **probably**, object **B** also has a feature of **P5**.

Analogy is a way of building **Hypotheses**.
But: the truth of the conclusion by analogy is unreliable.

The 1st condition for an analogy is a careful identification **of essential** similar features of the compared objects.
The 2nd condition is to find out the differences between the compared subjects.
The 3rd condition is a thorough study of both the objective interrelationship and interrelationship of similar features , as well as the connection of these similar features with the one that we transfer to the subject under study.

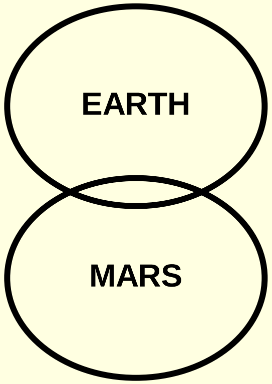
Analogy. Examples

Example 1

An example of similarity in dissimilarity:

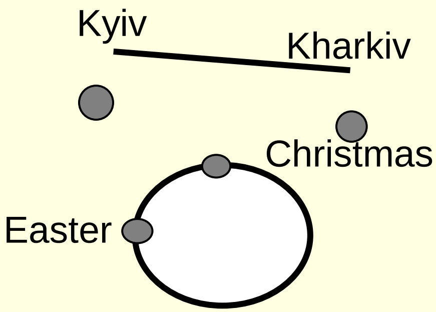
Competition, like love, is harmful to individuals, but beneficial to society as a whole.

Example 2



Indicators	Earth	Mars
P_1- water	**+**	**+**
P_2- atmosphere	**+**	**+**
P_3- temperature $\pm 60°C$	**+**	**+**
P_4- life	**+**	**?** hypotrsis

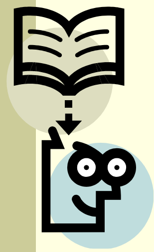
Example 3



4.2.4. Idealization, abstraction, ranking

The methods of theoretical research or cognitive techniques include:

- **Abstraction.**
- **Idealization.**
- **Formalization.**
- **Generalization.**
- **A thought experiment.**
- **Axiomatic method.**
- **Hypothetical method.**
- **Modeling.**



Abstraction is an imaginary distraction from bearing physical properties , connections, relations of objects and selection of several sides that are of interest to the researcher.

<u>The process of abstraction goes through two stages.</u>

The first stage: the isolation of the most important features in the phenomena and the establishment of the independence of the studied phenomena from certain factors.

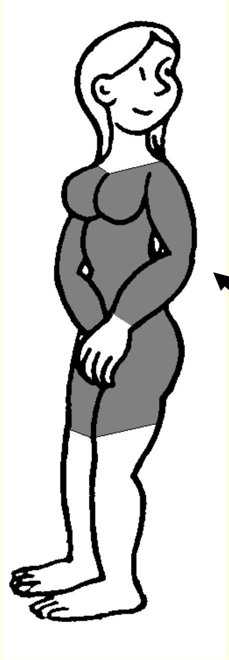
The second stage: implementation of the possibilities of abstraction – one object is replaced by another.

The main types of abstraction:

1) **identification**;
2) **isolation** (reliability, technology);
3) **constructivization** (stop continuous movement, etc.);
4) **actual infinity**;
5) **potential feasibility**.

Idealization

Idealization is imaginary construction of objects that do not exist in reality or are practically impossible.



90 × 60 × 90
IQ = 200

Examples of idealized concepts:

- in mathematics: point, straight line and circle
- in the economy: an economic person, full rationality in decision-making by a person;
- in physics – an absolutely black body and an ideal gas;
- in mechanics – an absolutely rigid body, a perfectly plastic body.

The goal of idealization : is to deprive real objects of some of their inherent properties and to endow (imaginatively) these objects with certain unreal and hypothetical properties.

Achievement the goal is carried out through :

1) ***multi-level abstraction*** (for example, abstraction from thickness leads to the concept of plane);

2) ***an imaginary transition to the limiting case*** in the development of some property (absolutely solid body);

3) ***simple abstraction*** (incompressibility of a liquid).

Generalization is **the method of obtaining new knowledge** through an imaginary **transition from partial conclusions to more** general ones in order to reflect to the greatest extent reflect the essence of the researched process.

An imaginary experiment is a cognitive technique of theoretical thinking, which is given the form of experimentation in the mind.
The essence of the imaginary experiment is that with the help of imagination alone, the research object is considered in its "pure form", regardless of the specific form of its interaction with the environment.

Ranking is a method by means of which all secondary factors that do not significantly affect the studied phenomenon are excluded.

4.2.5. The aggregation method

The essence of the method:

- The original model **is transformed into a model with fewer variables** or constraints.
- This **leads to an approximate description** of the studied object or process in comparison with the original model but **allows you to get** a specific **result** .

An example
(Humorous use of the Aggregation Method in life)

A gradual decrease in the number of requirements (aggregation) for a potential groom (bride) with an increase in the age of the bride (groom):

- At the age of 16, the "prince model" assumes that HE should be smart, tall, handsome, kind, promising, etc. (up to 20 requirements);
- At the age of 20 - to be smart, tall, handsome, kind, promising;
- At the age of 30 - to be smart, promising;
- At the age of 40 - to be smart;
- At the age of 50 – just to be.

4.2.6. Formalization

Formalization is **a method of studying** various **objects** by **displaying their structure in symbolic form** using artificial languages, in the form of formulas and special symbols, for example, in the language of mathematics.

Advantages of formalization:

1) it **ensures generalization of the approach** to solving problems;

2) symbolism **provides brevity and clarity of fixation of values**;

3) **unambiguity of symbols** (there is no ambiguity in ordinary language);

4) it allows you **to form iconic models of objects** and replace the study of real things and processes with the study of these objects.

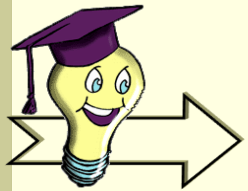
4.2.7. The hypothetical and hypothetical-and-deductive methods

The following methods are possible in theoretical research:

- ***Logical:***
  - ✓ ***Hypothetical;***
  - ✓ ***Axiomatic;***
- ***Historical .***

The hypothetical method is based on the development of a hypothesis, a scientific proposal containing elements of novelty and originality.

The historical method allows you to investigate the emergence, formation and development of processes and events in a chronological sequence (in time) with the aim of identifying internal and external connections and patterns.



Hypothetical-and-deductive method

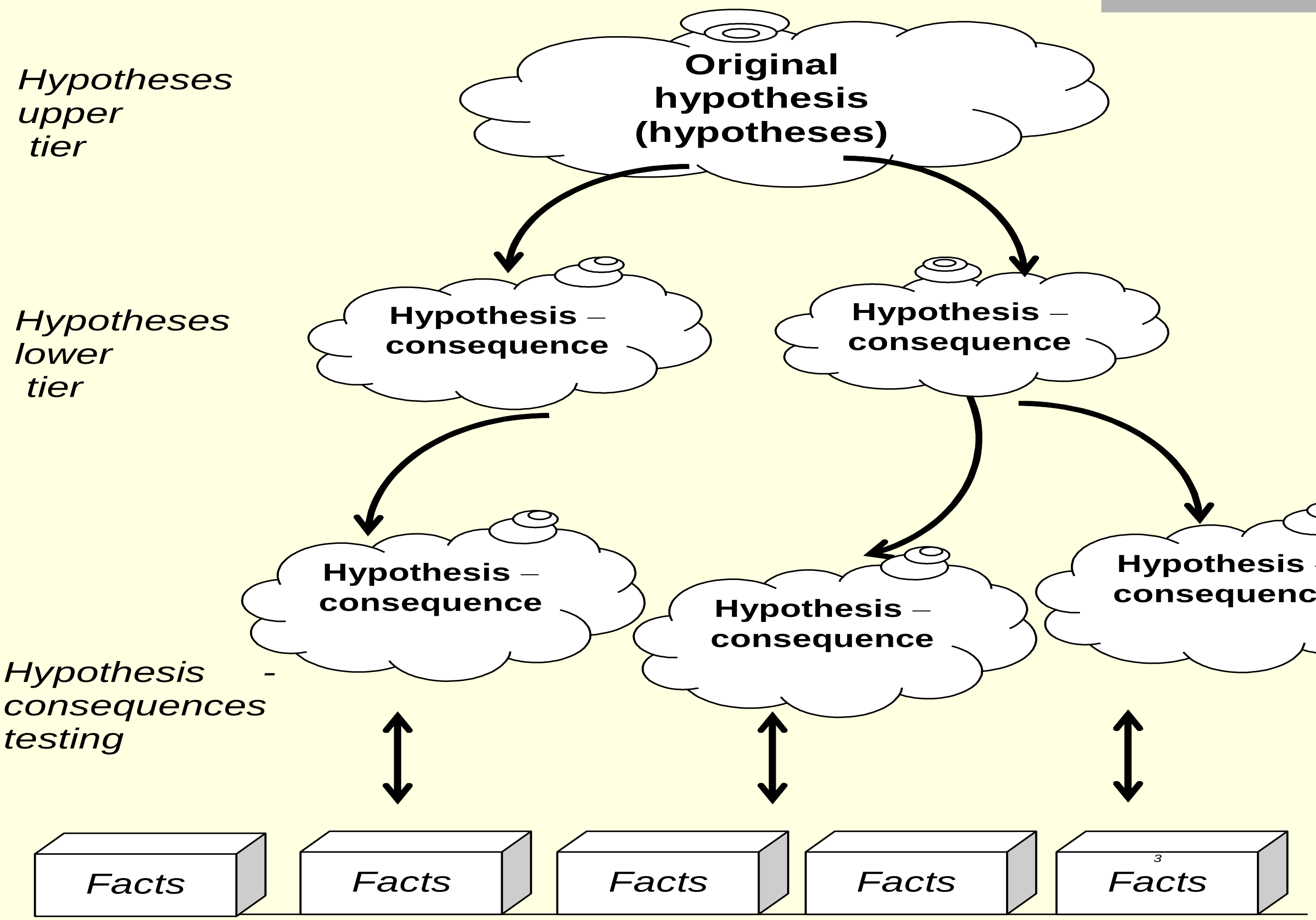
The hypothetical-and-deductive method *consists of putting forward some hypotheses and further testing these hypotheses by deriving consequences from them and comparing these consequences with the facts. In the hypothetical-and-deductive method, hypotheses are used as references, and consequences from hypotheses are deduced by the method of deduction.*

The hypothetical-and-deductive method involves **putting forward** some **statements in the form of hypotheses and testing these hypotheses by drawing consequences from them** (together with other available knowledge) and comparing them with the facts.

It is used as a rule to build a scientific theory in empirical sciences.

With the hypothetical-and-deductive method, the theory is not built "bottom-up" – from scientific facts to inductive generalizations and theoretical conclusions, but "top-down" – from initial hypotheses to their consequences and further to empirical data.

A scheme of hypothetical-and-deductive construction of the theory



Hypotesys (continuation)

- The reason for the spread of the hypothetical-and-deductive method: the possibility of directly testing a hypothetical assumption is quite rare in science.
  For example, in order to test the hypothesis that a prototype of modern money already existed even in the primitive communal system, it would be necessary to go back in time for many millennia, which is still impossible.

4.2.8. The axiomatic method

The axiomatic method is a method of theoretical research based on the fact that a number of obvious propositions (axioms) are accepted without proof.
At the same time, axioms act as references of inferences, and consequences are formed from them in a purely logical way based on the principle of deduction.

An axiom is a statement that does not need to be proven true.

Axiomatic construction of a theory

The axiomatic construction of a theory is carried out as follows:

1. First, **a set of initial propositions is given**, which do not require proof (within the given system of knowledge). These provisions are called axioms or postulates.

2. Then **the rules for the formation of consequences with the axiom are set**.

3. Finally, **a system of conclusions is formed with the axiom in accordance with the given rules**.

4. **The set of** initial **axioms** and **propositions derived on their basis form** an axiomatically constructed **theory**.

Three types of an axiomatic approach to construction of the theory

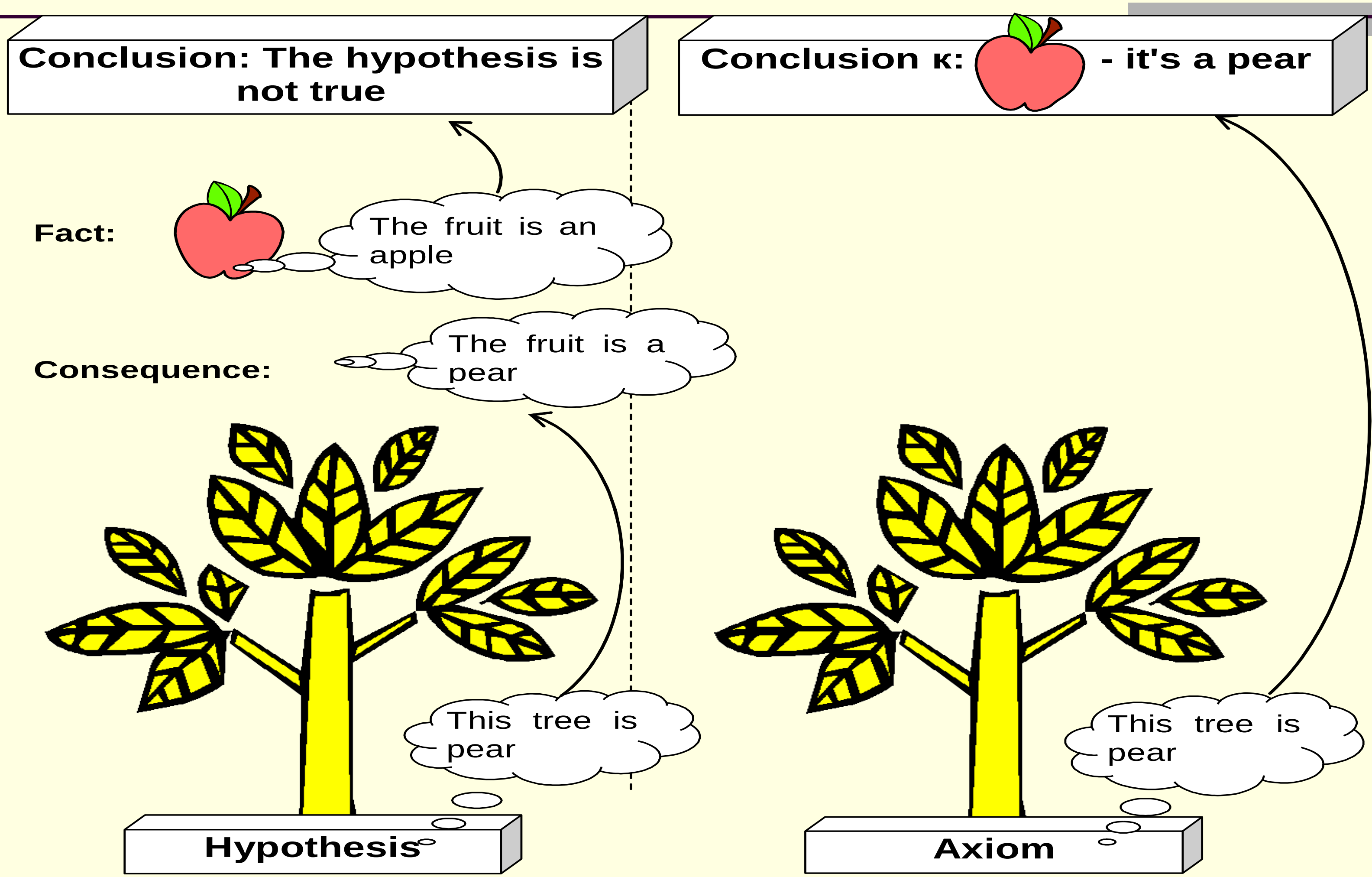
- **The content-axiomatic approach** – intuitively obvious propositions act as axiomsЮ
- **Examples:**
- **Euclid's** geometry,
- economic **theory of expected utility.** This theory is based on the axiom that *a person makes economic decisions based on the desire to maximize the expected benefit*.

Axiomatic construction of a theory (continuation)

- **Formal** – **axioms are introduced formally,** they are not required to be intuitively obvious. **Axioms** are considered as original **definitions of the initial concepts** (terms) of the created system.

- **Formalized** – **the use of mathematical logic** as a means that provides strict rules for deriving consequences from proven statements. When building a formalized axiomatic system, **initial signs** – **terms are introduced, the rules for their combination into formulas are defined,** a list of initial formulas (which are accepted without proof) and rules for deriving consequent formulas are given.

Comparison of the hypothetical-and-deductive and axiomatic methods



4.2.9. The mathematical method

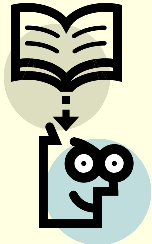
- The mathematical method is deductive, synthetic and formal.
- The synthetic nature of the mathematical method is manifested in the choice of axioms.

- The peculiarity of mathematics lies in the definitions it introduces.
- The definition boils down to the fact that instead of some combination of old symbols, one new symbol is used.

(Example: variable x, vector $X = (x_1, x_2, .. x_n)$, matrix $M = (X_{ij})$.

- This allows you to shorten the formulation of statements and theorems which would otherwise be difficult to access for review.

The formalism of the mathematical method is based on the fact that in mathematical reasoning the concept is allowed to be used only in the sense that is invested in it by the definition. It is forbidden to attribute any other meaning that is not contained in the definition.

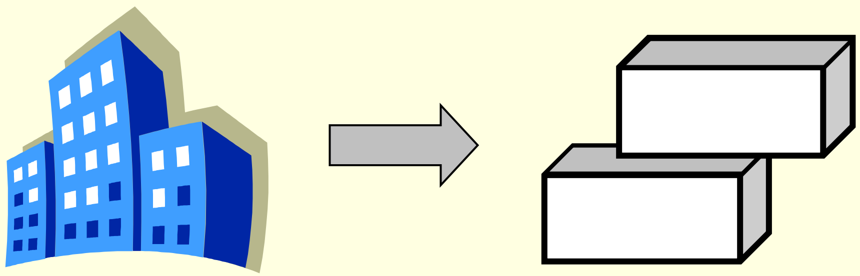


The nature of the mathematical method

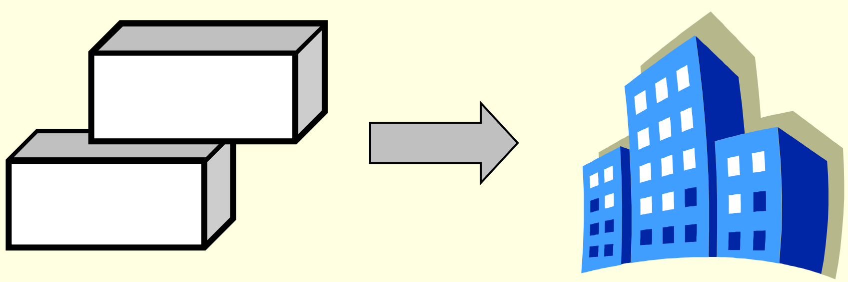
- The mathematical method is deductive, synthetic and formal.
- The synthetic nature of the mathematical method is manifested in the choice of axioms.
- The peculiarity of mathematics lies in the definitions introduced by it.
- The definition boils down to the fact that one new symbol is used instead of a certain combination of old symbols.
- This allows you to shorten the formulation of statements and theorems that would otherwise be difficult to review.

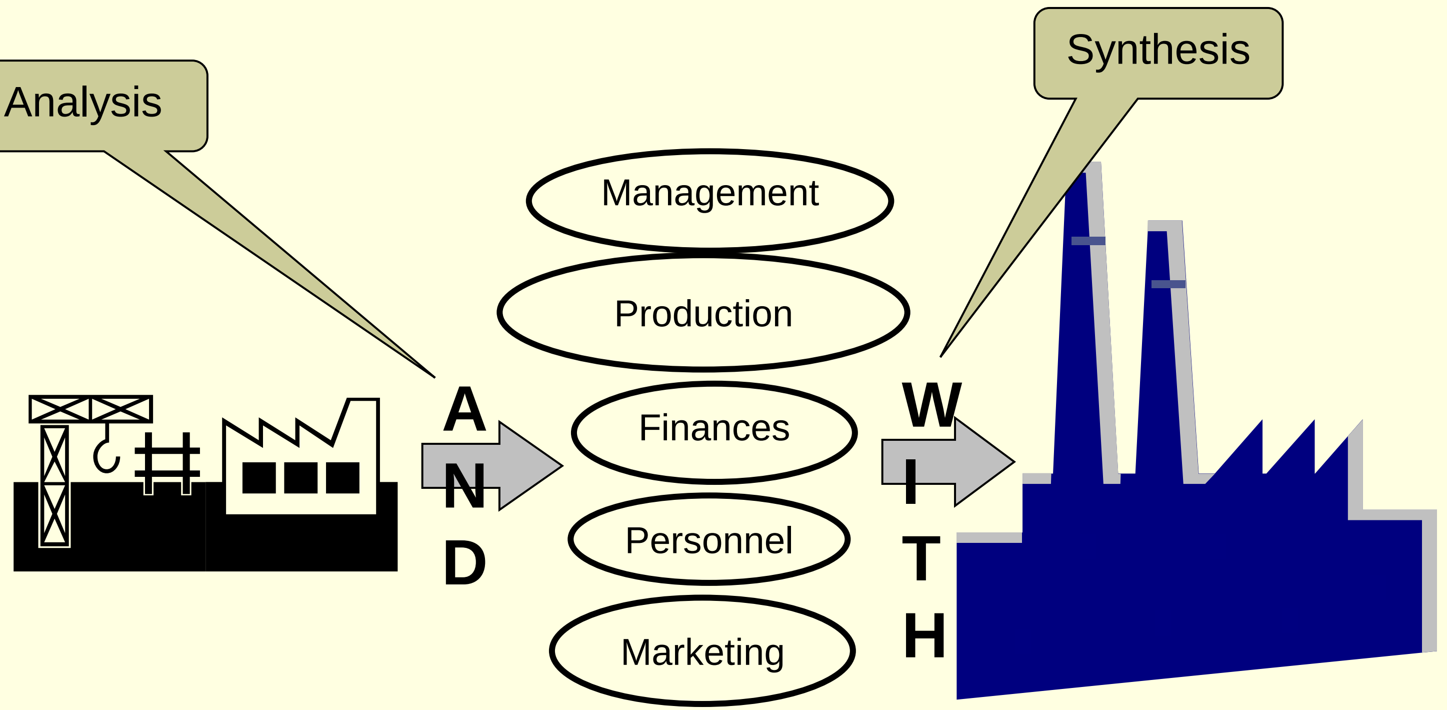
4.2.10. Analysis and synthesis

Analysis is a procedure of imaginary splitting elements into component parts.



Synthesis - the procedure of imaginary combination of interconnected elements into a single whole.




Analysis
Synthesis
Management
Production
Finances
Personnel
Marketing
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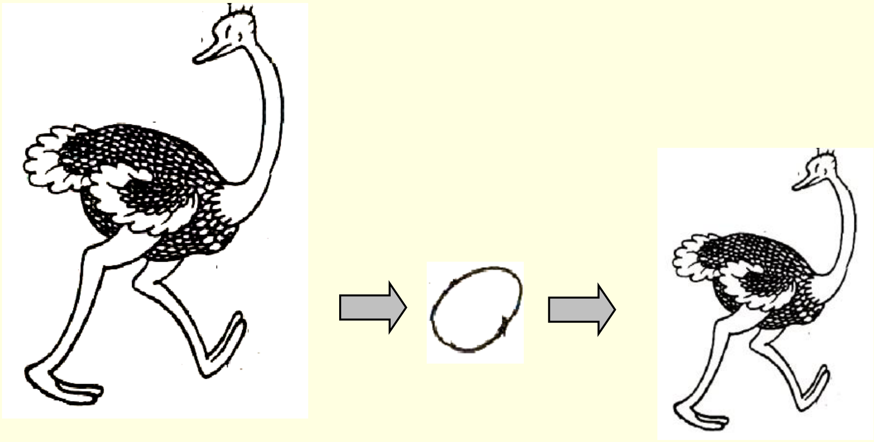
Different types of analysis in scientific research

- Empirical analysis: company revenues are divided by departments;
- elementary-theoretical analysis: in the results of the company's activity, expenses and output are distinguished (since income is formed in the form of the difference between revenue and expenses);
- structural and genetic analysis: in the results of the enterprise's activities, are allocated to taxes, wages and profit are, and in the profit - resources for development, as the basis of the future income of the enterprise, are included.

4.3 . Methods of the causal relationships installation

Reason X of the phenomenon **Y** is a necessary condition for the occurrence of the phenomenon YЮ



The cause will be a phenomenon that precedes the other phenomenon in time and is connected with it by an internal material link so that the presence of the first necessarily causes the appearance of the second phenomenon - a consequence, and the elimination of the first causes the elimination of the second phenomenon .

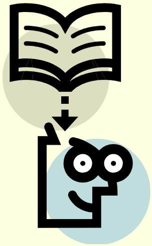
4.3.1. Classic of the causal relationships establishment

Methods of establishment of causal relationships :

- ✓ Similarities;
- ✓ Differences;
- ✓ similarities and differences (connected);
- ✓ accompanying changes;
- ✓ Remnants.

to establish causality, it is necessary:

- To distinguish the studied phenomenon from the set of others with which it is connected and exists at the same time,
- to focus attention on the facts and circumstances preceding this phenomenon,
- to investigate these circumstances, which preceded the phenomenon, and to identify among them the determining factors capable of causing such a phenomenon.



The similarity method:

1. Given ***ABC*** *phenomenon* ***x occures***
2. Under the ***ADE condition*** *phenomenon* ***x occures***
3. Under the ***AKL condition, phenomenon x occures***

⇓

AND **– reason for** *phenomenon* ***x occures***

.

The difference method is expressed by the scheme:

1. Under the ***ABC*** *condition* , a phenomenon ***x*** occurs *.*

2. Under the condition *of* ***VS****,* there is no phenomenon ***a.***

Therefore, ***A*** is the cause of phenomenon ***a.***

The method of similarities and differences (combined):

ABC causes *p.*

DEV causes *p.*

DVS causes *p.*

AC does not cause *p.*

DE does not cause *p.*

DS does not cause *p.*

Probably, *B* is the cause of *p.*

The method of accompanying changes is expressed by the scheme:

1. Under the condition *A BC,* phenomenon **a** occurs*.*
2. Under condition *A1BC,* phenomenon **a1** occurs*.*
3. Under condition *A2BC,* phenomenon **a2** occurs.

Therefore, *A* is in a causal relationship with the phenomenon *a.*

4.3.2. Other methods of causal relationships establishing

The exclusion method

The essence of the method: it is based on the gradual exclusion of a significant group of components on the basis of the law of exclusion of the third, the meaning of which is that the matter looks as described in the statement or as required by the objection, and no other is given.

Other methods of causal relationships establishing (continuation)

- ***The regularity method***. *<u>The essence of the method</u> :* it is a search for a stable and non-random characteristic or connection of phenomena.
- ***The balance method***. *<u>The essence of the method</u>:* selection of two sides of something that define the whole and balance each other.
- ***The ranking method***. *<u>The essence of the method</u>:* assignment of a set of objects to certain numerical values on the basis of intuition or according to the degree of expressiveness of a certain characteristic.

Other methods of causal relationships establishing (continuation)

- ***The test method***. *The essence of the method:* selection from a set of certain objects and their testing.
- ***The method of ambivalence of disagreement.*** *The essence of the method:* the search for any ambivalent concept to explain the phenomenon (fullness-hunger, large-small, etc.), search for discrepancies that determine the essence of the phenomenon.
- ***The method of systematization***. *The essence of the method:* bringing the available data into a certain system that allows you to explain them from the standpoint of a systemic approach.

Other methods of causal relationships establishing (continuation)

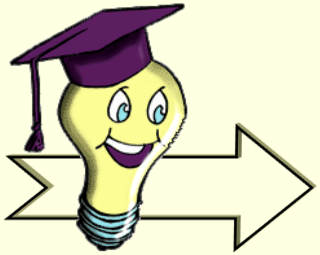
- ***Method of extrapolation*****.** *The essence of the method :* spreading the conclusions obtained by observing one part of the phenomenon to another part of it.

- ***Method of control questions*****.** *The essence of the method:* involves compiling a list of questions to which answers are prepared.

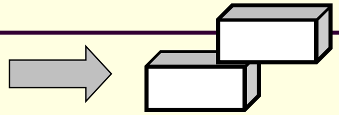
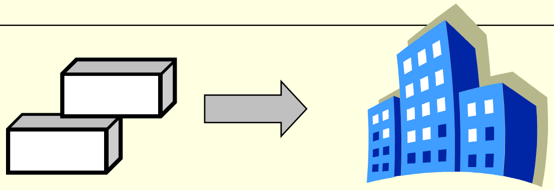
Other methods of causal relationships establishing (the end)

- ***The focusing method***. *<u>The essence of the method</u>:* aimed at bringing individual objects into the focus of attention, which allows you to get their original vision of them.

- ***The selection method*****.** *<u>The essence of the method</u>:* the study of not the entire set of phenomena, but only a certain part, selected according to certain rules.



Result

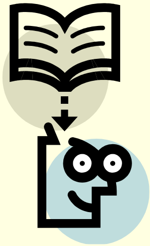
Analysis	
Synthesis	
Deduction	$\forall\, S_i \in S$ – є P S_1 – є P · S_2 - є P … S_n – є P
Induction	$\forall\, S_i \in S$ – є P S_1 – є P · S_2 - є P … S_n – є P
Analogy	**Business** ≈ 

4.4. Peculiarities of using theoretical methods in economics

4.4.1. Abstraction as a method of economic research

- ***the difference*** between essential and non-essential properties and relationships ***is relative*** and depends on the nature and objectives of the study.
- in real processes, ***properties are in unity***, and therefore non-essential properties cannot simply be dismissed as secondary and accidental.
- ***are temporarily abstracted*** from non-essential properties.

Abstraction is an element of economic research in which a complex economic process or system as a whole ***is split into constituent elements, parts*** or ***subsystems.***



- ***The stage of abstraction*** in economic research is called ***the analytical stage.***
- ***They analyze either individual properties, aspects, relationships, or parts and elements of the whole.***
- ***As a result, specific economic concepts and categories are created with the help of abstraction.***

- ***The synthetic stage*** of research is related to the unification, or synthesis, of individual abstractions, concepts, categories, and judgments into a single system of theoretical economic knowledge.
- As a result of the synthesis, the reproduction ***of concrete***, integral ***knowledge is achieved*** in a single system of abstract concepts and theories.

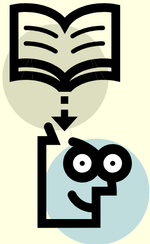
4.4.2. Economic facts (EF) and generalizations

- **EF are** facts that express certain **economic relationships of people**, their **interests, incentives and motivations** for work.
- **EF are connected** not so much with individual, subjective relations and motivations, but **with interpersonal,** collective relations.
- **EF allow measurement** with **the help of money** , which allows you to get more accurate knowledge about the economic situation.

4.4.3. Economic concepts and theories

The classic concept of economics (Smith, Ricardo , Mill):

- **is based on the basic law of value, according to which the value of goods is determined by the socially necessary labor spent on the production of goods.**
- **was called the labor theory of value.**



Economic concepts and theories
(continuation)

Keynes' economic concept:

- **universal self-regulation does not exist;**
- **full employment under capitalism is only rarely achieved;**
- **forced unemployment exists, always ;**
- **since the market cannot serve as a regulator of the economy in all cases, the state must play an active role in the implementation of these tasks;**
- **the intervention of the state in the regulation of the economy should consist in the implementation of such a fiscal and monetary policy that would mitigate periodically occurring sharp declines in production.**

Economic concepts and theories (continuation)

Monetarist concept (M. Friedman):

- **the state should not interfere in market regulation;**
- **the correct monetary policy, free from arbitrary exchange rate changes, is the most effective in the fight against inflation;**
- **monetary policy will be optimal on long-term time intervals if the growth of the money supply is 3-4 % increase in the real volume of production.**

Economic concepts and theories (the end)

- **Fundamental economic theories are research paradigms.**

- **Partial theories consider the problems of development from the fundamental sectors of the economy: production and exchange, consumption and distribution.**

- **These sectors have their own theories (for example, the theory of pricing in relation to factors of production in the framework of the theory of distribution or the theory of consumer demand in the framework of the theory of consumption).**

- **All theories are built according to the hierarchical principle – the basic concepts and laws of partial theories are the concretization of concepts and laws of more general theories.**

4.4.4. Methods and principles of decision-making in economics

Rational decision-making model:

- **the consequences of decisions taken** or their usefulness are taken into account;
- **the probability of their implementation** in specific conditions is determined;
- by comparing various alternatives according to the relevant parameters, **the optimal** or more priority solution is selected;
- it is assumed that **the subject who makes the decision** thinks and **acts reasonably;**
- (**DECISION MAKER),** as well as its consultants, are idealized, **rationally acting subjects;**
- it is assumed that both **the set goals and the rational choice** of decision throughout the process **remain unchanged;**
- the classic **choice model** is focused on achieving **the optimal solution.**

The principles of economic activity related to the limited resources of society, which determine the choice (decision-making) of people between different goods

1) *in order to receive some benefits, people have to* **give up other benefits;**

2) **the value of a good** *is determined by* **what can be obtained** *from it, while the cost -* **what should be given for it;**

3) *when making decisions, rationally acting, or intelligent, people always* **compare the marginal values of their benefits and costs.**

Methods and principles of decision-making in economics (continuation)

4) **people should care about the future;**

5) **caring about the future, people take into account its uncertainty;**

6) **people are responsible for the consequences of their decisions;**

7) **people respond to incentives that arise in connection with changing conditions and circumstances in the economy;**

8) **trade turns out to be mutually beneficial for its participants;**

9) **the market serves as the most important way of organizing economic activity.**

Methods and principles of decision-making in economics (continuation)

10) *under certain conditions*, **the state can intervene** *in market regulation and exert a positive influence on it;*

11) **the standard of living of the population** *directly depends on the country's ability to produce goods and services;*

12) **prices rise** *when the government prints too much money.*

Methods and principles of decision-making in economics (the end)

When solving complex problems of management in the economy and social life, nowadays people rely less and less on experience, intuition and common sense, and turn to accurate analysis of the problem, calculation and construction of mathematical models.

Control questions

1. Reveal the meaning of abstraction and idealization as the beginning of theoretical research.

2. List the principles of processing scientific facts and their generalization.

3. Describe the process of formulating, building and testing scientific hypotheses as a stage of theoretical research.

4. Define scientific laws, regularity and randomness.

5. Describe the methods of analysis, classification and construction of theories.

6. Under what conditions are deduction and induction methods used?

7. Give examples of the use of the method of analogy in economic research.

8. Reveal the essence of methods of idealization, abstraction, ranking.

9. What is the purpose of using the aggregation method?

10. Define and characterize the formalization method, axiomatic method, mathematical methods.

11. What are the peculiarities of economic research methodology?

12. How do economic concepts and theories develop?

Control questions (the end)

13. What methods and principles underlie decision-making processes in the economy?

14. Reveal the essence of the hypothetical-deductive method.

15. What is the essence of the inductive model of substantiation of science.

16. Why can the method of mathematical hypothesis be considered as a kind of hypothetical-deductive system?

17. Describe the hypothetico-deductive model of science.

18. Describe the types and methods of scientific explanation.

19. What is the peculiarity of causal explanations?

20. List the main features of the methods of establishing causal relationships: (similarities, differences, similarities and differences (combined), concomitant changes, residuals).

The practical component

Example. Description of the use of research methods in the dissertation.

To achieve the goal and solve the tasks, the following research methods were used:

- **morphological analysis** - to generalize theoretical approaches to determining the essence and content of the conceptual-categorical apparatus of the subject area of management of integrated development of enterprises;
- **dialectical method of cognition and comparative analysis** - to determine and systematize the factors of formation of the complex, identify opportunities and limitations for enterprises in their integration to create a tourist product with defined parameters;
- ***sy*stemic and programmatic approaches, as well as the laws of organizational theory, synergy and benchmarking methods** - when systematizing the composition and substantive characteristics of nature management imperatives and building a consolidated structural model for sustainable recreational and tourist development;
- **general scientific methods of abstraction, analysis and synthesis** - to establish the structure and typology of the tourist market, as well as to determine the economic nature and components of the multifunctional structure of tourism;
- **functional and logical analysis** - when determining the patterns of formation and displaying the subordination of the components of institutional support for the integration of the national tourist market into the world system of tourist flows;

The practical component (the end)

- **formalization** – for the development of a methodical approach to the assessment of the tourist attractiveness of territories and objects of the natural and recreational sphere;
- **the method of expert evaluations** - to determine the priorities of managing the development of the complex;
- **prognostic methods** - for forecasting the likely consequences of deepening the level of economic integration of the national economy into the globalized market environment;
- **classification** - to systematize types of competitive advantages of tourist enterprises;
- **factor analysis** - for a comprehensive assessment of the quality of tourist services;
- **general equilibrium computing models (Computable General Equilibrium)** – for modeling the choice of the form of integration interaction of enterprises;
- **rating and reflexive management** - for selection of network participants;
- **organizational and architectural standardization** – to create a formalized description of product creation processes and subordination relationships that arise between representatives of the complex;
- **Petri nets** – for dynamic display of provisions of the proposed concept of enterprise development;
- **matrix methods** - for structuring the formed mechanism according to the levels of hierarchical representation of the cluster and formalizing the strategic guidelines for the development of the complex;
- *the method of main components - for evaluating the cluster structuring of enterprises of the complex.*

Task 4.1

1. Based on the studied material, **build a map of key concepts and issues** of the topic;

2. **Solve the problem** . **Conduct an analytical study** of the state and development prospects of one of the following phenomena and processes in the subject area of the dissertation research:

The content of an analytical study on a chosen (or self-formulated) topic should include:

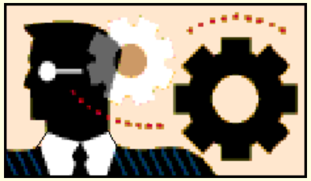
- setting the main tasks to be solved as a result of the research (for example, analysis of the state of the research object, trends and directions of its distribution in the industry, conditions necessary for its implementation and advantages that occur as a result of this, etc.);
- collection and analysis of secondary information for solving tasks from local to global networks;
- collection and analysis of primary information to solve the tasks by observing real processes and phenomena in the industry;
- synthesis and comparison of information obtained for solving the tasks in different ways.
- formulation of the main critical conclusions based on the results of solving the set research problems.

" When man divided the world into parts, he stopped understanding the effect of not only God's laws, but also human laws."
Lao Tzu

"The serious problems we face cannot be solved at the same level of thinking at which they arose."
Albert Einstein

5. The systematic research method. Complex system of research methodology

System elements of the topic



Control questions

Practical component

5.3. Methodology of research of complex systems

5.2.1. Principles of system thinking

5.2.2. Techniques and methods of system analysis

5.2. The system approach and system analysis

5.1. System method. System

5.1. System method. System

A system is a set of interconnected elements that form a certain integrity.

The system is characterized by the presence of:
a) **connections** between elements;
b) **properties** different from the properties of individual elements/

The property of emergency is the occurrence of an interaction effect that is not additive in relation to local effects.
(*English: emergent* is one that arises unexpectedly)

Basic definitions

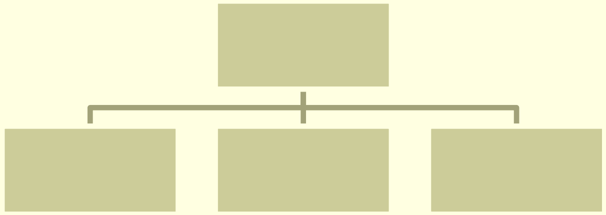
- **A system element** is a part of the system that is considered as a whole without further division.
- **Connection** is what connects objects and properties in the system process, ensures the emergence and preservation of the structure and integral properties of the system.
- **Structure** is a concept that reflects the most significant relationships between elements and their groups (subsystems), which change little with changes in the system and ensure the existence of the system and its properties.

Basic definitions (the end)

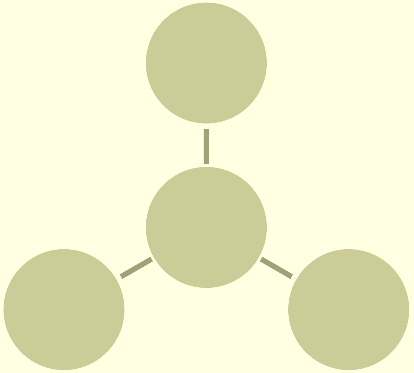
- **A subsystem** is a component larger than the elements, and at the same time more detailed than the system as a whole.
- **Relationships** between objects exist if they **impose mutual constraints** on each other's behavior. Connections characterize both the construction (statics) and the functioning (dynamics) of the system.
- **Connections** between objects (elements) can be **rigid and flexible**, which change during the functioning of the system.

Examples of the representation of organizational structures

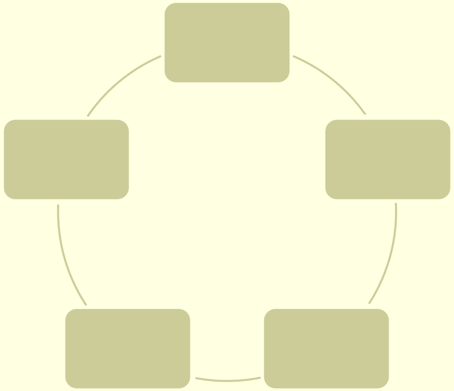
Hierarchical



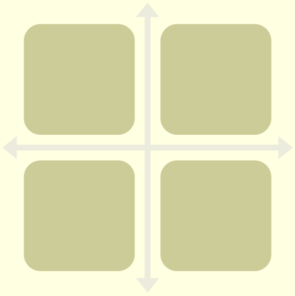
Radial



Ring



Matrix

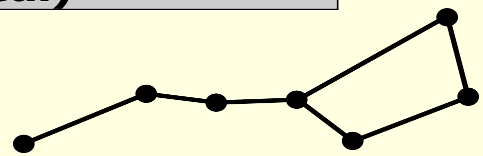


Characteristics of system functioning

- **The state** is the value of a set of essential parameters of the system fixed at a certain moment in time.
- **Behavior** is the system's ability to transition from one state to another (S1 S2 S3).
- **Equilibrium** is the ability of a system, in the absence of external disturbing influences, to maintain its state for as long as desired.
- **Stability** is the ability of the system to return to a state of equilibrium after it was removed from this state under the influence of external actions.
- **Development** is the system's ability to change its composition and structure.

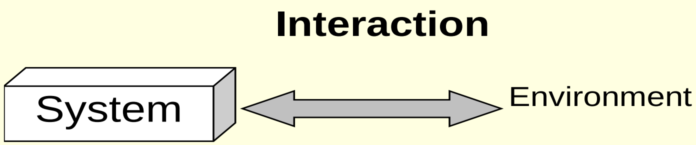
Classification of systems

Objective (real)



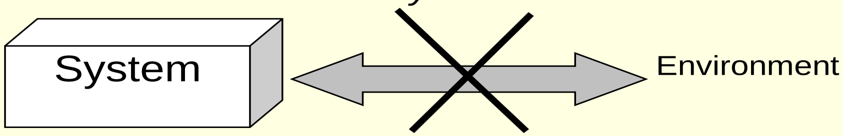
Ideal

Open



Close

Not exist in reality



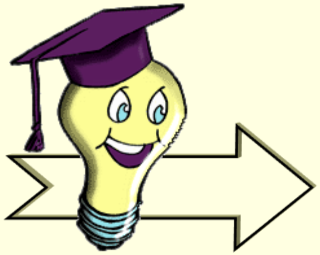
Determine

P=1

Stochastic

0< P< 1 1

Random process and phenomenons



Classification of systems

(continuation)

1. According to the objectivity of existence:

real - abstract (symbolic).

2. By origin:

natural ; ***- artificial*** ; ***- mixed*** .

3. According to the nature of the relationship between system parameters and the environment:

closed ; ***- open*** ; ***- combined*** .

4. According to the nature of the connections between the elements:

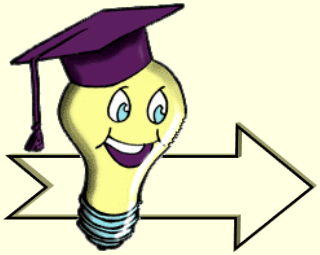
deterministic .

5. According to the management structure:

centralized ; ***decentralized.***

6. By nature of functions:

-specialized ; ***-multifunctional (universal)***.



Classification of systems
(the end)

7. By complexity of behavior:

automatic ; ***decision-makers*** ; ***self-organizing ones*** ; ***those that provide*** ; ***such that transform***.

8. By nature of development:

stable ; ***those that are developing.***

9. By degree of organization:

well organized ; ***poorly organized (diffuse).***

10. By size:

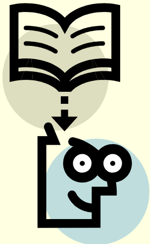
one-dimensional ; ***multidimensional*** .

11. On the ability to set a goal:

causal ; ***purposeful*** .

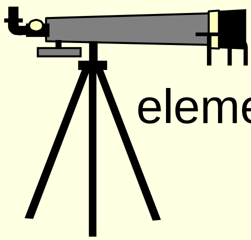
12. According to the homogeneity and diversity of structural elements:

homogeneous, or homogeneous, **heterogeneous** , or heterogeneous, **mixed type.**

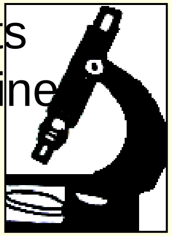


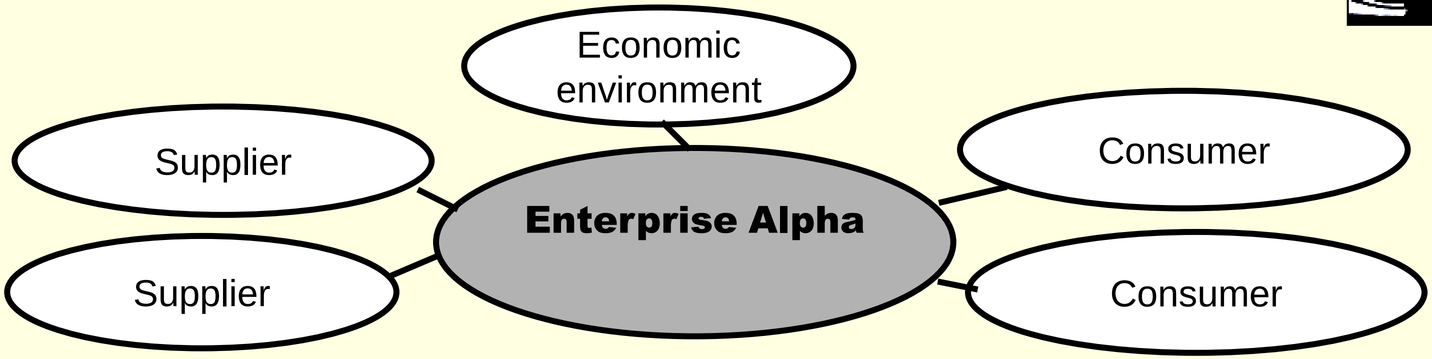
! ! !

To know a part without knowledge of the general whole is as impossible as to know the whole without knowledge of its parts.



The system is not uniquely determined by the propertie of its elements. On the contrary, the elements themselves – are defined by the whole .

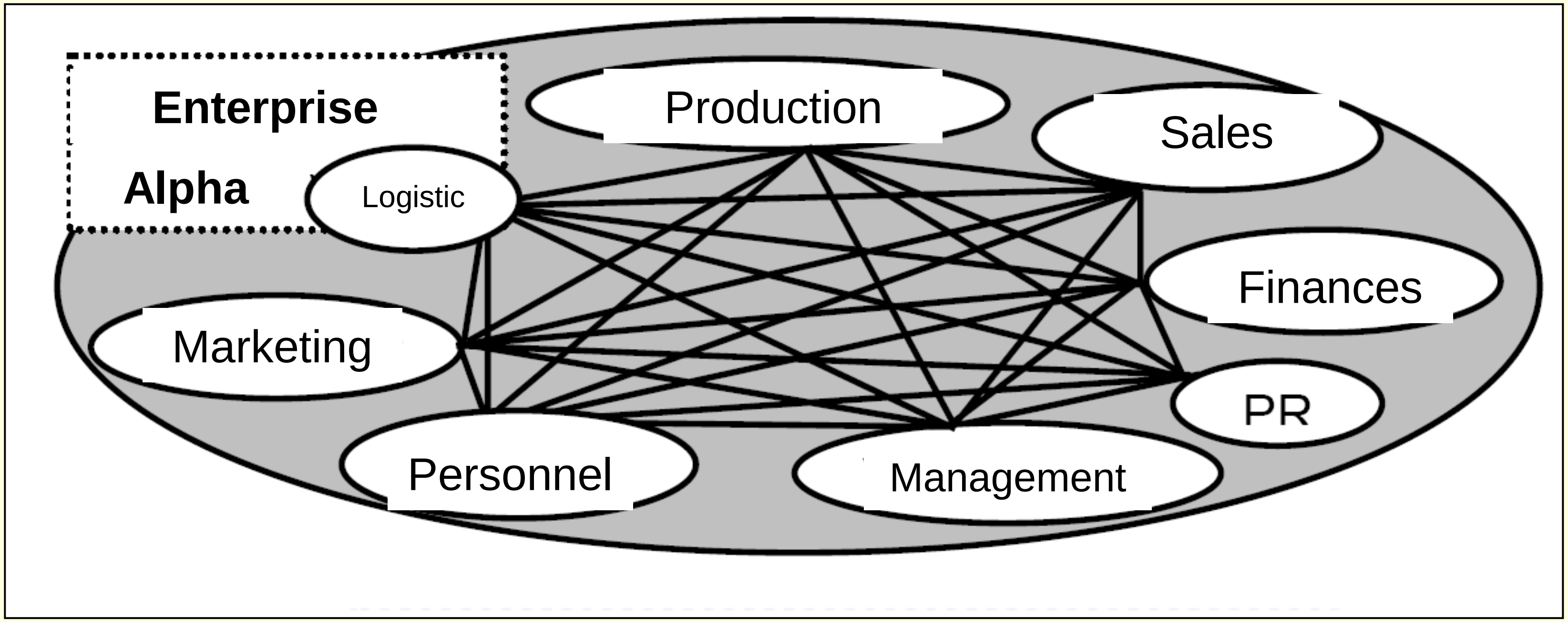


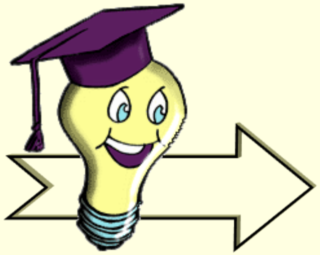


Techno complex

5.2. The system approach and system analysis

The system approach is a study and construction of the object as a system - as integrity in the unity of internal and external connections.





Prerequisites for the emergence of system approach

- attenuation relationships between scientific disciplines

- increasing complexity of tasks;
- growing interdependence of decisions
- appearance of super-complex objects;
- growing number of factors and criteria;
- growing importance of consequences;
- increasing responsibility.

?

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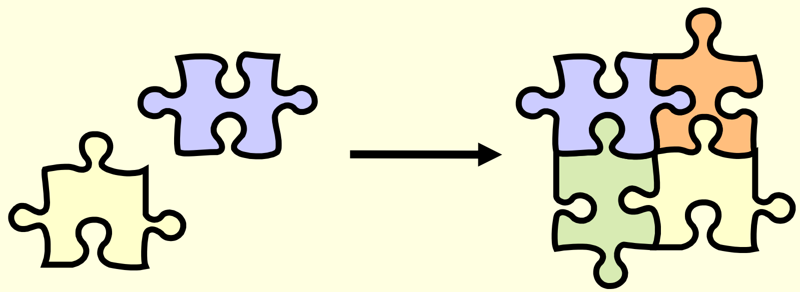
Development civilization

middle
20th century

Stages of implementation of the system approach

1. Analysis of the system structure.
2. Analysis of the functions of the elements.
3. Synthesis.



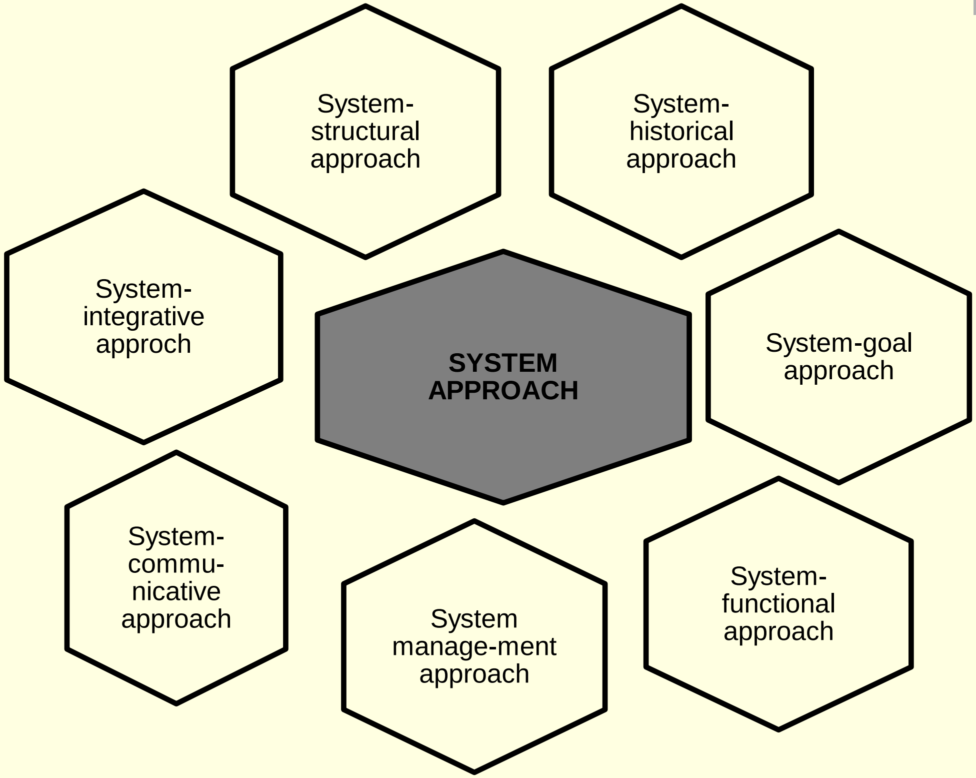
Principles of the system approach

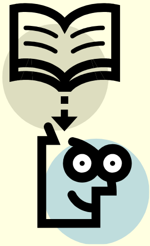
- Patterns of formation and development of systems
- Principles of research, creation of systems

Aspects of the systems approach in scientific research:

- system-historical;
- system-targeted;
- systemic and structural;
- system-functional;
- system and communication;
- system management;
- systemic and integrative.

Main aspects of system approach





The content of the main aspects of the system approach in scientific research:

- **system-historical**, considers the causes of the system's emergence, the stages of its development;
- **system-target** determines the purpose of the system, its elements by building a tree of goals (decomposition method);
- **systemic-structural,** describes both the internal structures of the system and the place of the system in the external environment as an element of a lower level;
- **system-integrative,** reveals the factors of ensuring the integrity of the system, the mechanisms of its development and improvement;
- **system-functional,** describes the functions that the system can implement;
- **system and communication,** deals with the description of both internal and external flows between system elements;
- **systemic-management,** describes the principles of strategic and tactical management, which are based on the accounting of internal changes and external actions that affect the effective achievement of the set goal.

Principles of the systems approach

(postulates of systems thinking which are correct for all systems in general)

1. **The principle of coherence and common goals** – the own goals of system elements must be consistent with each other, as well as with the global goals and tasks of the system.

2. **The principle of a single basis** – interaction, mutual transfer of ideas and other information between elements of the system should be carried out on a single basis – a set of concepts and definitions that have the same definition within the system as a whole and its individual elements.

3. **The principle of incomplete determinism** – received and transmitted messages (as an element of communication) should be considered with a certain degree of reliability.

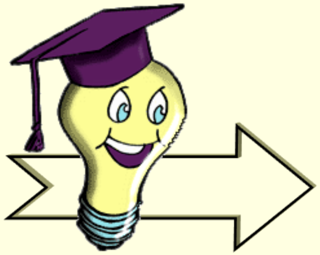
4. **The principle of continuity of the process of adjusting system goals** – it is necessary to continuously monitor the achievement of the set goal of the system and ensure the need for its adjustment .

Principles of the system approach
(the end)

5. **The principle of satisfaction** – any actions, changes in the system must be aimed at satisfying the needs of its elements.

6. **The principle of a comprehensive approach** – any issue (problem) must be considered and resolved taking into account the history of its occurrence, near and far consequences .

7. **The principle of complete system** – the level of detail of the considered questions (problems) should be such as to achieve the set goal (and, as a rule, no more).



The general theory of systems

General theory of systems (GTS) is a scientific direction related to the development of problems of analysis and synthesis of complex systems of an arbitrary nature.

! ! !

The basis of gts is an analogy of processes that flow in different types of systems

Two directions of GTS

Philosophical concept

Mathematical apparatus

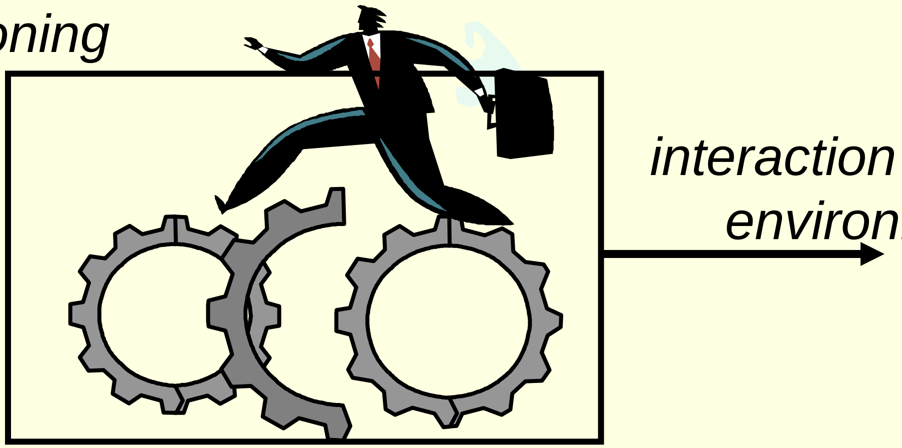
The general theory of systems (the end)

Postulate

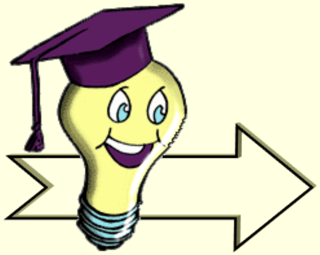
• the organization of the system can be determined by observing its interaction with the environment;

• the organization of the system determines its functioning and interaction with the environment.

System functioning



interaction with the environment



System analysis

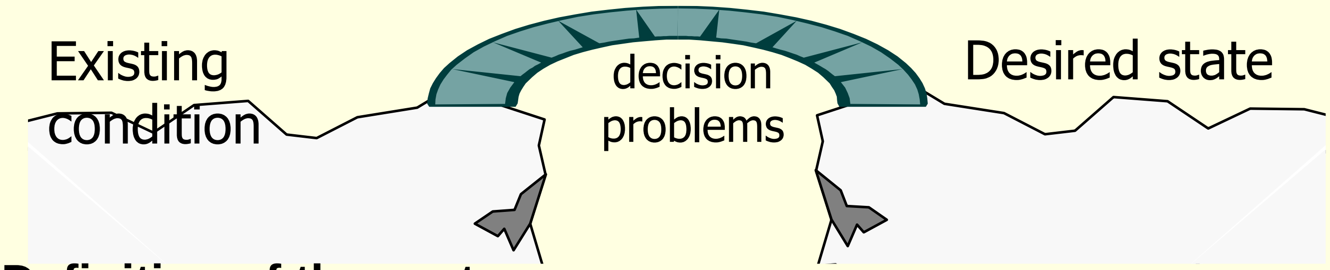
System analysis is a set of scientific methods for solving problems in various spheres of human activity based on a systemic approach.

Stages of system analysis

I. Analysis of the problem.
II. The definition of the system.
III. Analysis of the system structure.
IV. Formulation of the general goal and criterion of the system.
V. Decomposition of the goal, identification of the need for resources and processes.
VI. Identification of resources and processes, composition of goals.
VII. Forecast and analysis of future condition.
VIII. Evaluation of goals and means.
IX. Selection of options.
X. Diagnosis of the existing system.
XI. Building a comprehensive development program.
XII. Designing an organization to achieve goals.

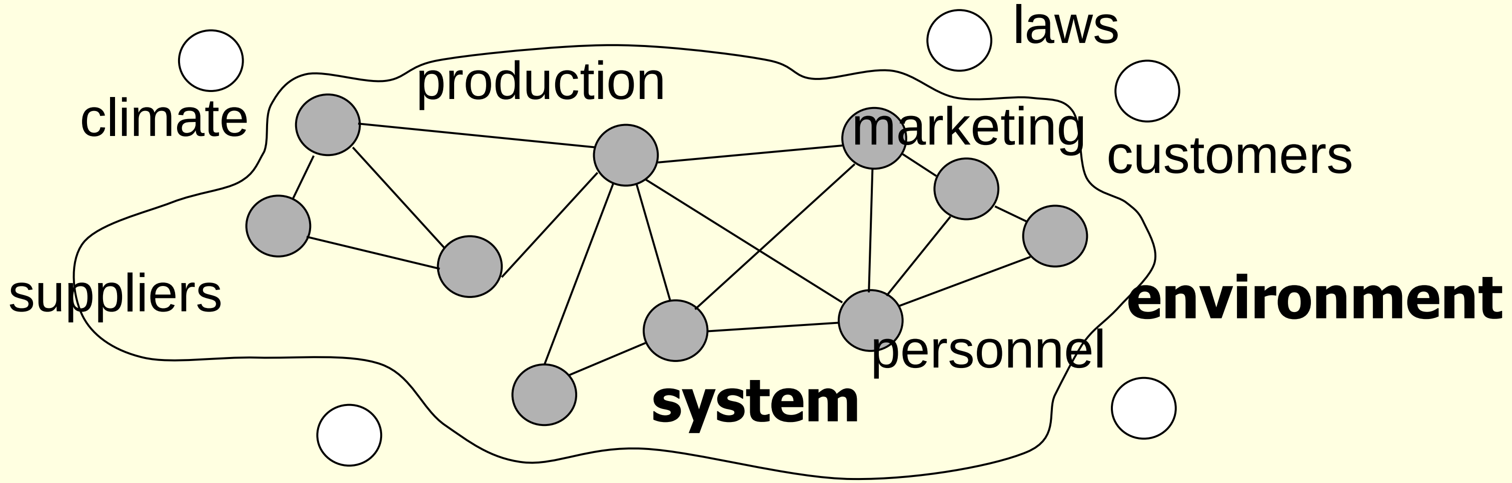
A problem is a situation in which there are two states: existing and desired. In each of these states there is a set of objects, properties and connections that are combined into a process. To move from the existing state to the desired one, it is necessary to change the existing set of objects, properties and relationships in some way.

1. Problem analysis



2. Definition of the system

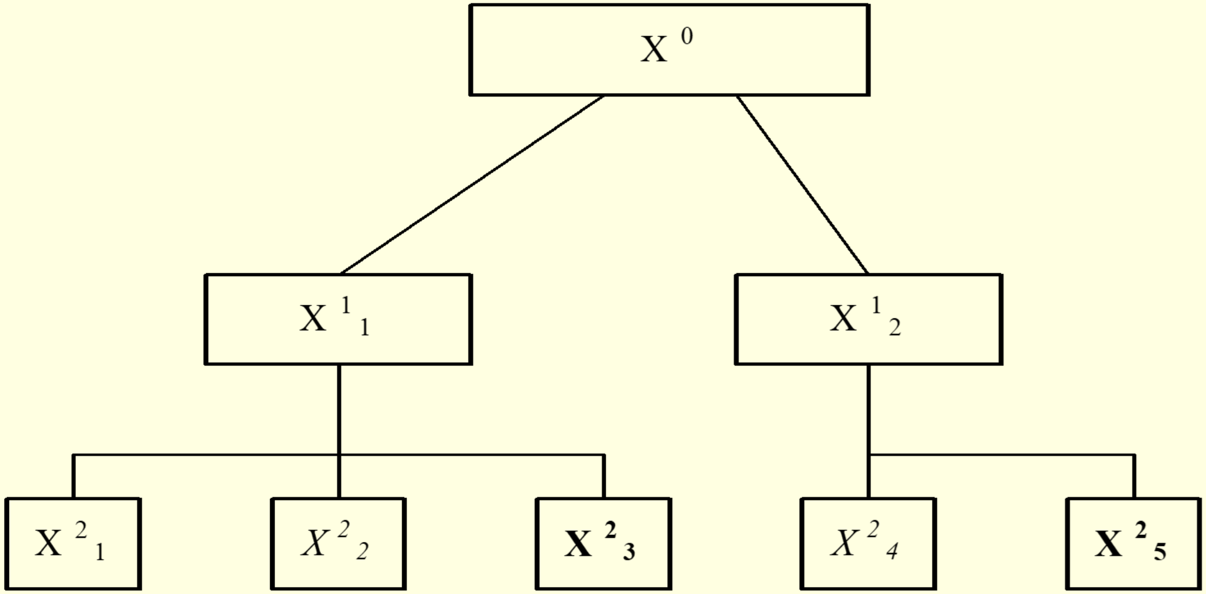
3. Analysis of the system structure



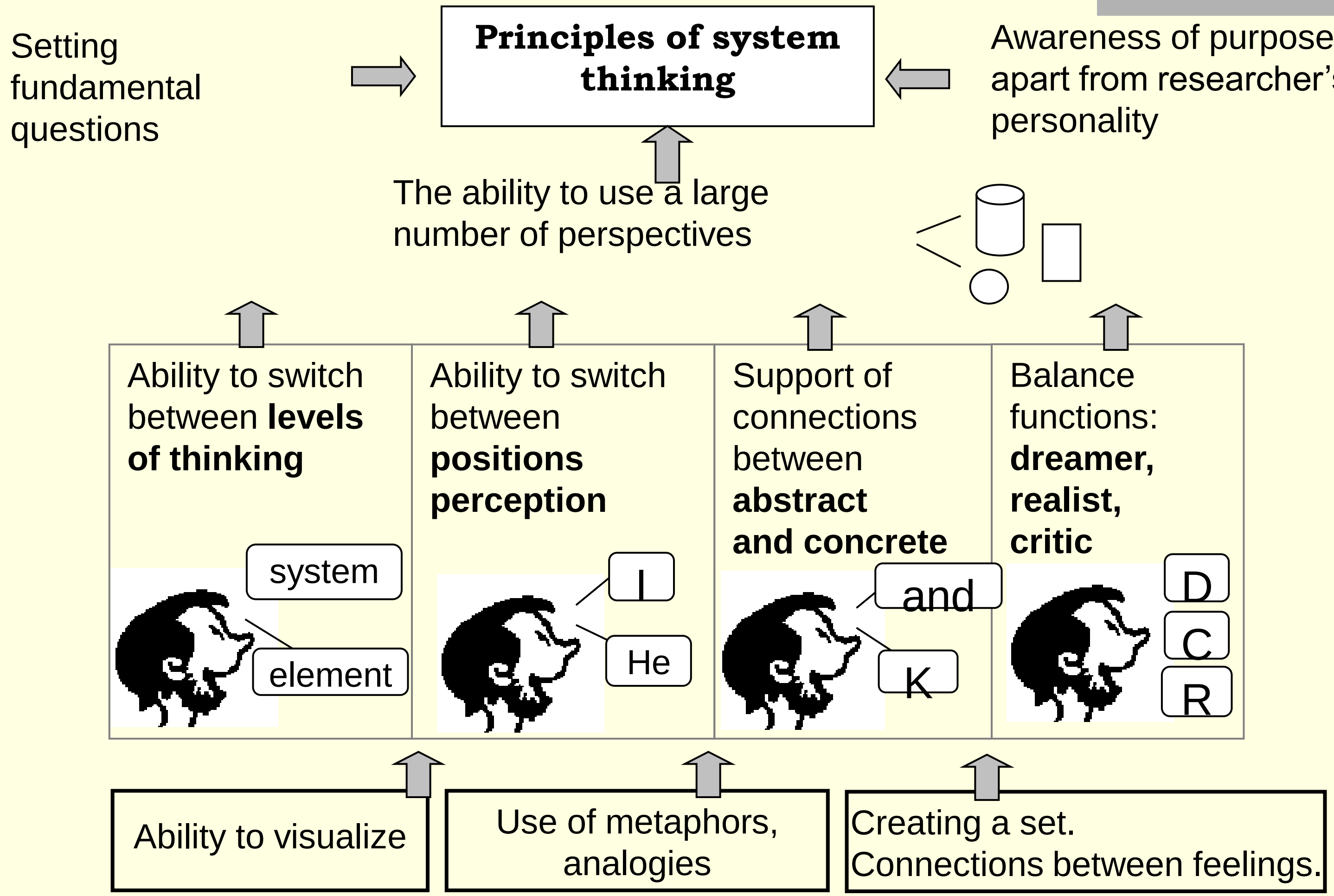
4. **Formulation of the entire system.**

5. **Decomposition of the goal.**

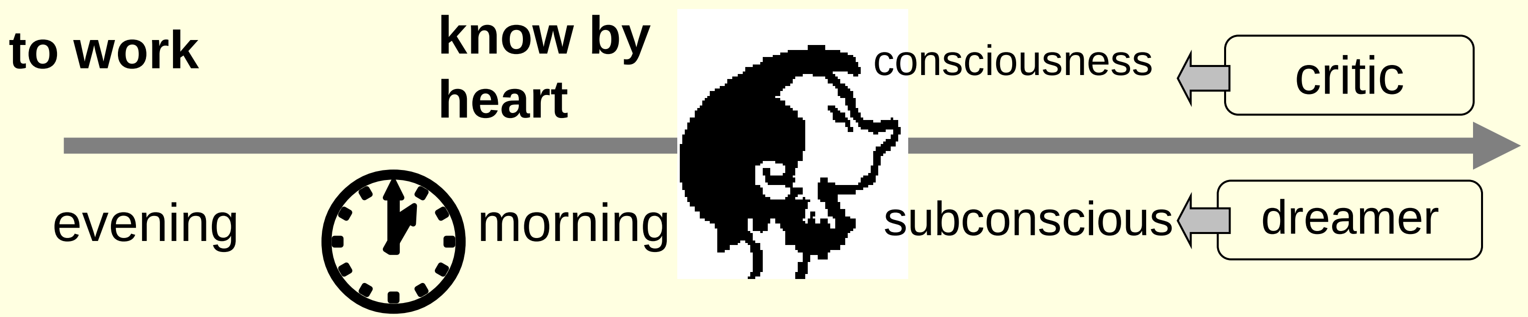
6. **Composition of goals.**



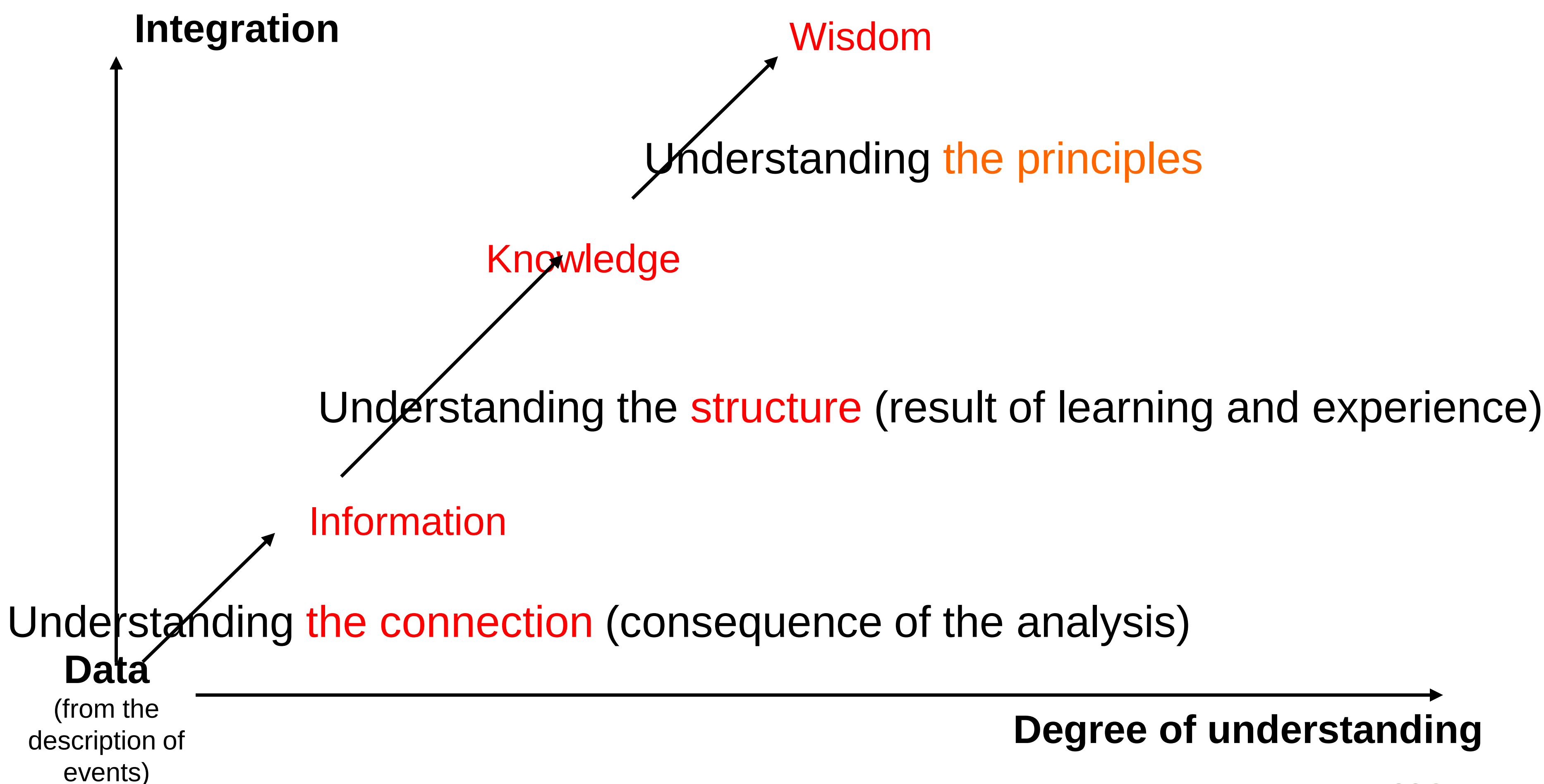
5.2.1. System thinking principles



Techniques for effective thinking

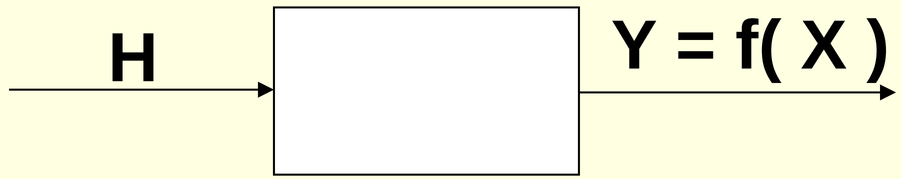


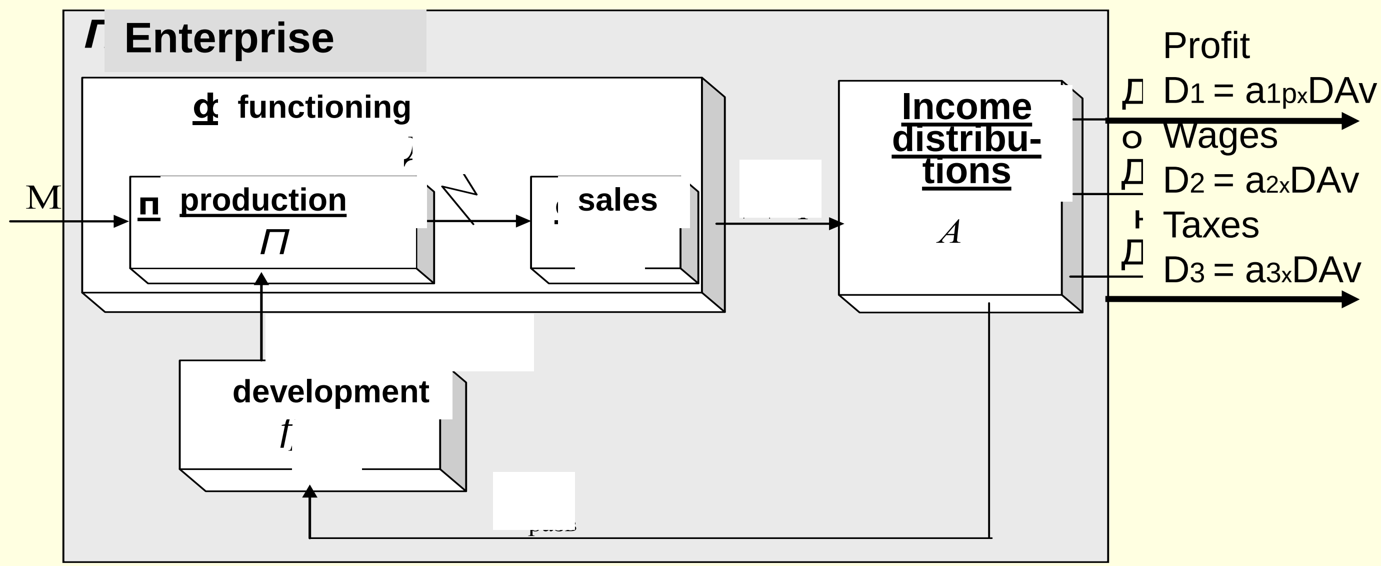
Relationship of some concepts of system thinking



5.2.2. Techniques and methods of system analysis

The main reception: **PRESENTATION OF THE OBJECT PRESENTED IN THE FORM OF SYSTEMS**





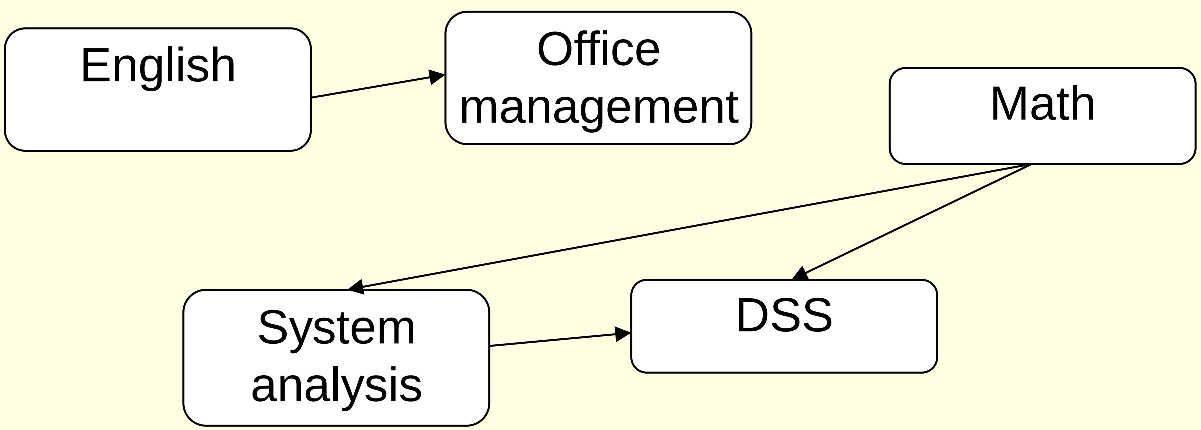
Matrix methods

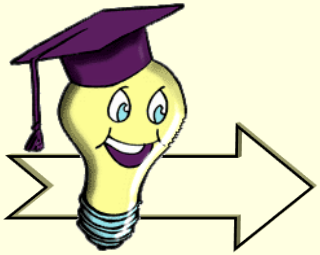
Building matrices interactions

	Mathematics	English	System analysis	Office management	DSS
Mathematics		0	+1	0	+1
English	0		0		
System analysis	-1	0		0	+2
Office management	0	-1	0		0
Decision Support System (DSS)	-2	0	-2	0	

Method of aggregate models

	Mathematics	English	System analysis	Office management	DSS
Mathematics		0	+1	0	+1
English	0		0		
System analysis	-1	0		0	+2
Office management	0	-1	0		0
Decision Support System (DSS)	-2	0	-2	0	





Morphological analysis

Morphological box

System parameners	Probable value of parameters	Number of variants
P_1	A_{11} A_{12} . . . A_{1k1}	K_1
. . .	. . .	. . .
P_i	A_{i1} A_{i2} . . . A_{ikj}	K_i
. . .	. . .	. . .
P_n	A_{n1} A_{n2} . . . A_{nkj}	K_n

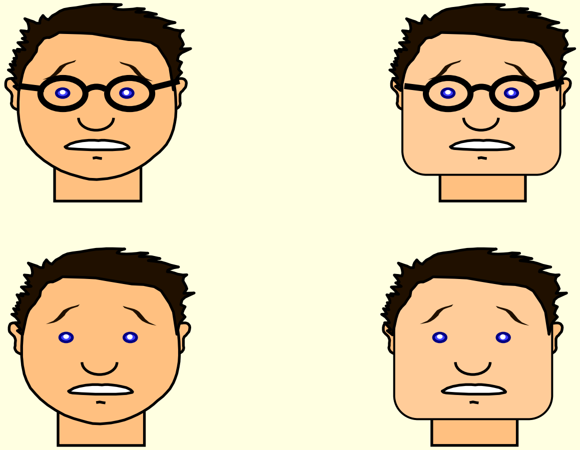
Total number of options

$$M=\bigcap_{i=1}^{n} k_i ,$$

Morphological analysis. Example 5.1.

Morphological table of alternative versions of the photo robot

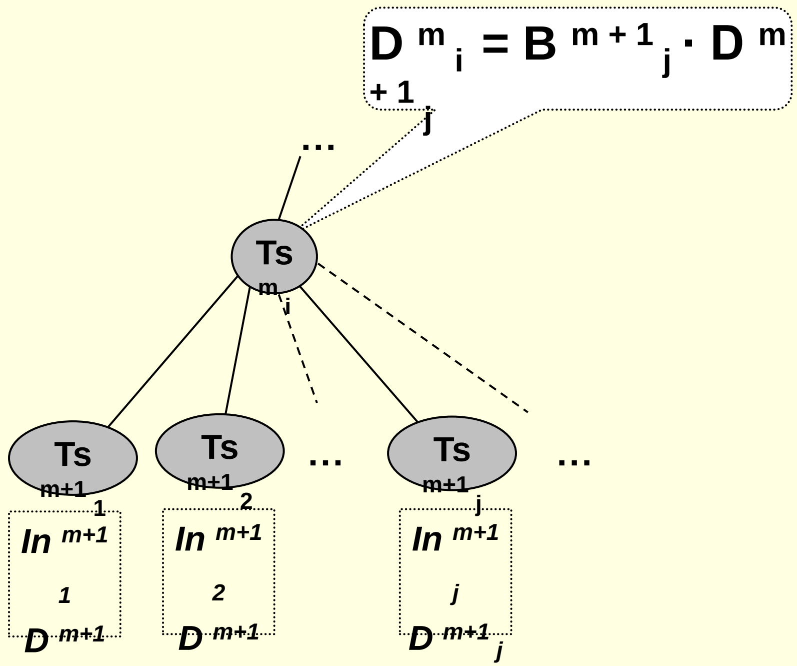
Parameters	**Value of parameters**	**Number of values**
Face shape	Oval Square	2
Glasses	Yes No	2



The total number of photo robot options is ***2 × 2 = 4***

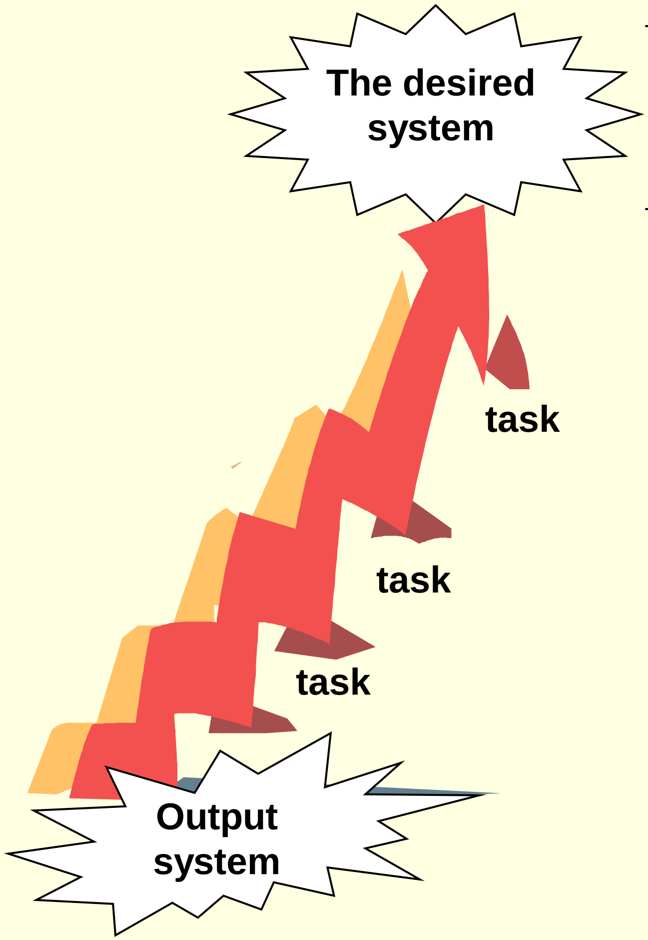
The goals tree

Quantitative analysis of the goal tree



Dmi - assessment of the degree of achievement of the goal **Ts** $^m{}_i$
Jmi - the set of numbers j of sub-goals of the goal **J** $^m{}_i$
Дm+1j - assessment of the degree of achievement of the sub-goal **Ts** $^{m+1}{}_j$
Bm+1j - coefficient of relative importance of the subgoal **Ts** $^{m+1}{}_j$

Application of the system methods of analysis to solve problems



Methods of the morphological analysis

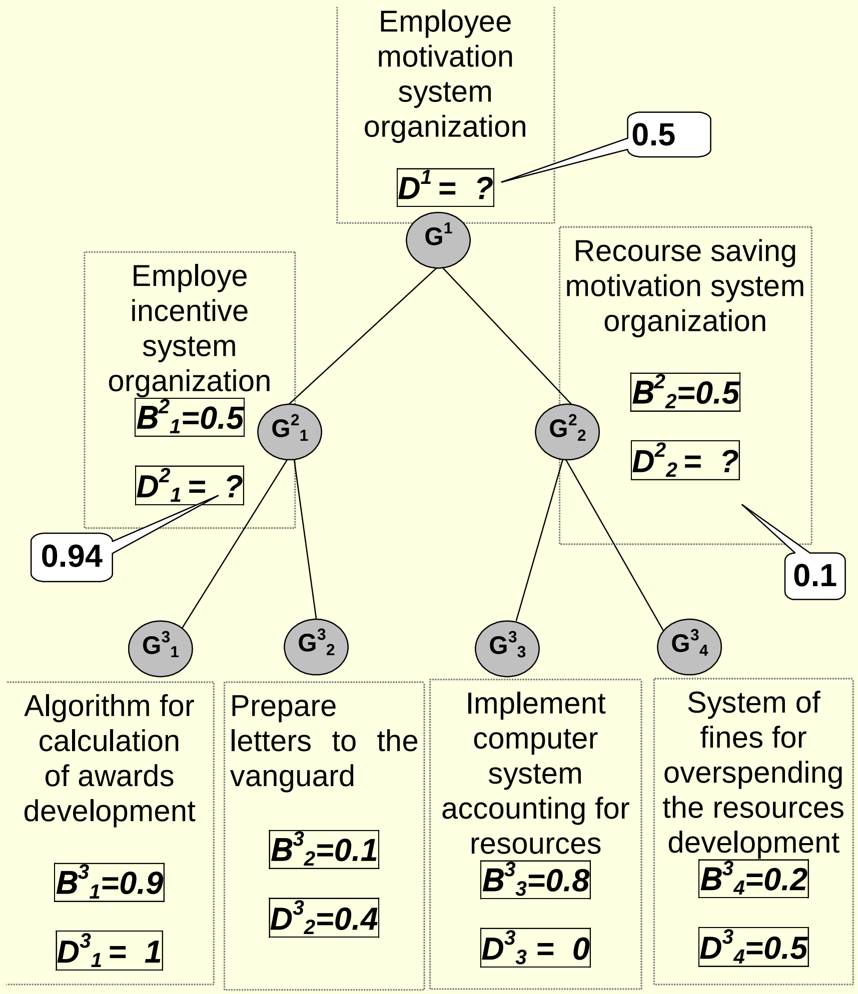
Method of the goal trees

Morphological analysis. Example 5.2.

Variants of the personnel motivation system

Indicators of the system	Passible parameters value	Number of variants
Encouraging the best employees	1) payment for holiday trip; 2) salary allowance; 3) certificate	3
Premium	Depends on the results of work 1) employee 2) employee and department 3) employee, department, company	3
Punishment for the breach of discipline	1) non-material 2) material	2
Incentives for saving resources	1) money 2) certificate 3) no incentives	3

The goal tree. Example 5.3

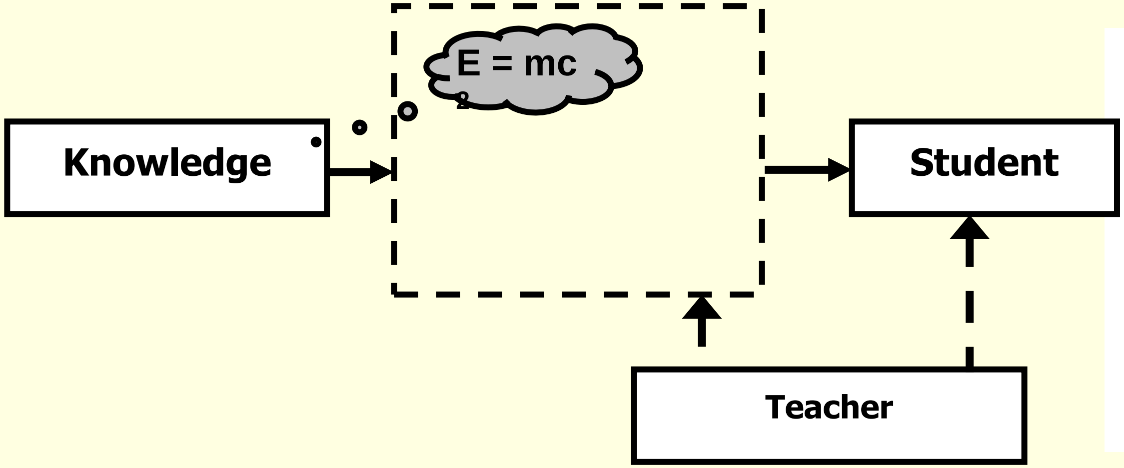


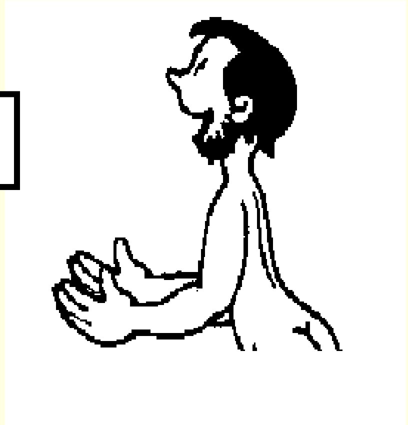
Example 5.4. The education system

The old version of the system

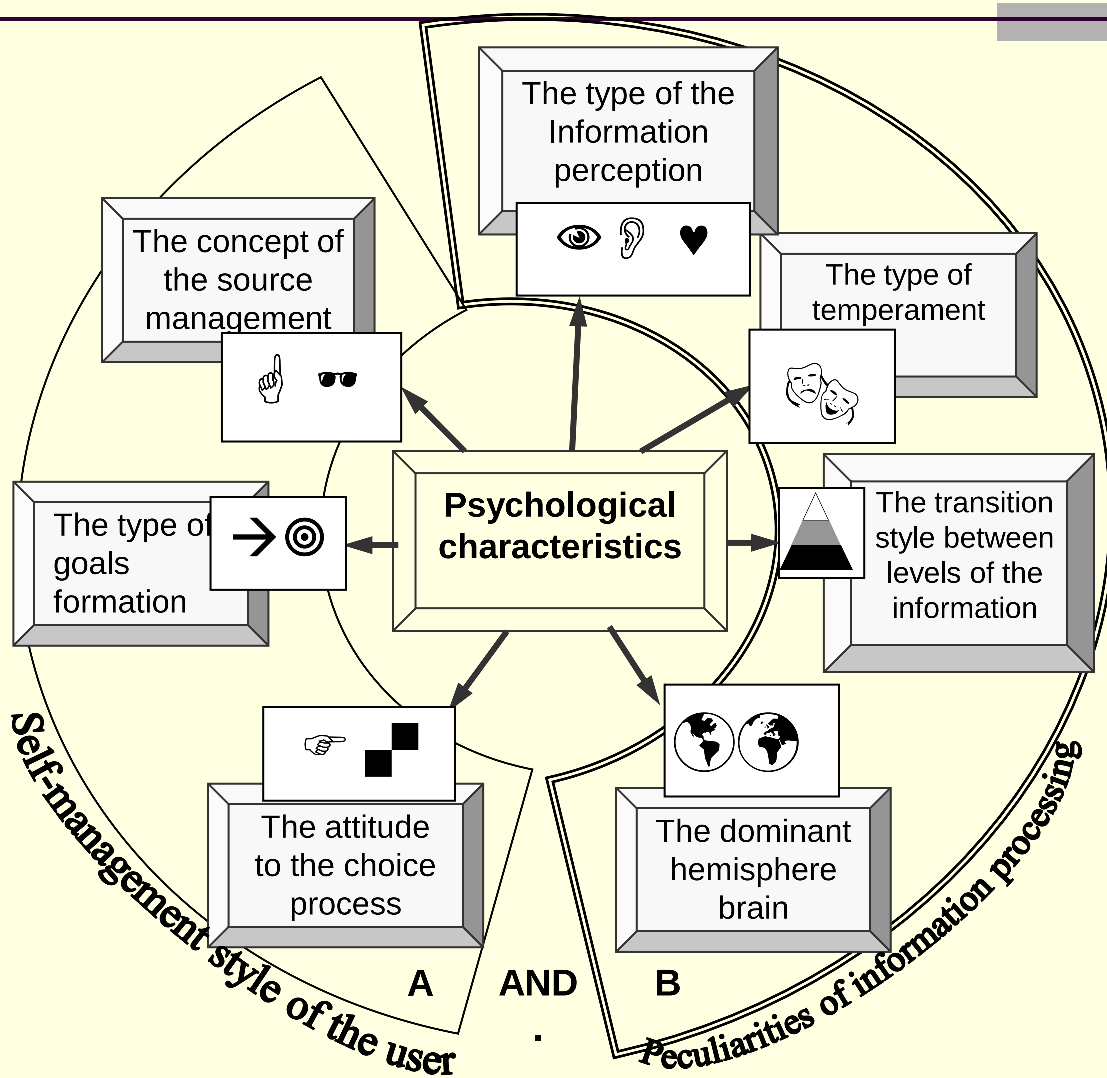
Knowledge → **Teacher** → **Student**

The new version of the system ***(E-learning)***





Example 5.4 (continuation)



Example 5.4 (continuation)

Types of users

Types of users

- Ideas about the source of control
  - Internal strategy.
  - External strategy.
- The type of information's perception
  - Auditory.
  - Visual.
  - Kinesthetic.
- The type of temperament
  - Phlegmatic.
  - Choleric.
  - Sanguine.
  - Melancholic.
- The type of goals' formation
  - " From "
  - Type "To"
- The style of transition between the levels of information
  - Abstract
  - Specific
- Relation to the selection process
  - A person of choice.
  - Man of procedure.
- The dominant hemisphere of the brain
  - *Analytical thinking.*
  - *Heuristic thinking.*

Example 5.4 (the end)

Parameters of the education system,
which are customized to the personality of the user

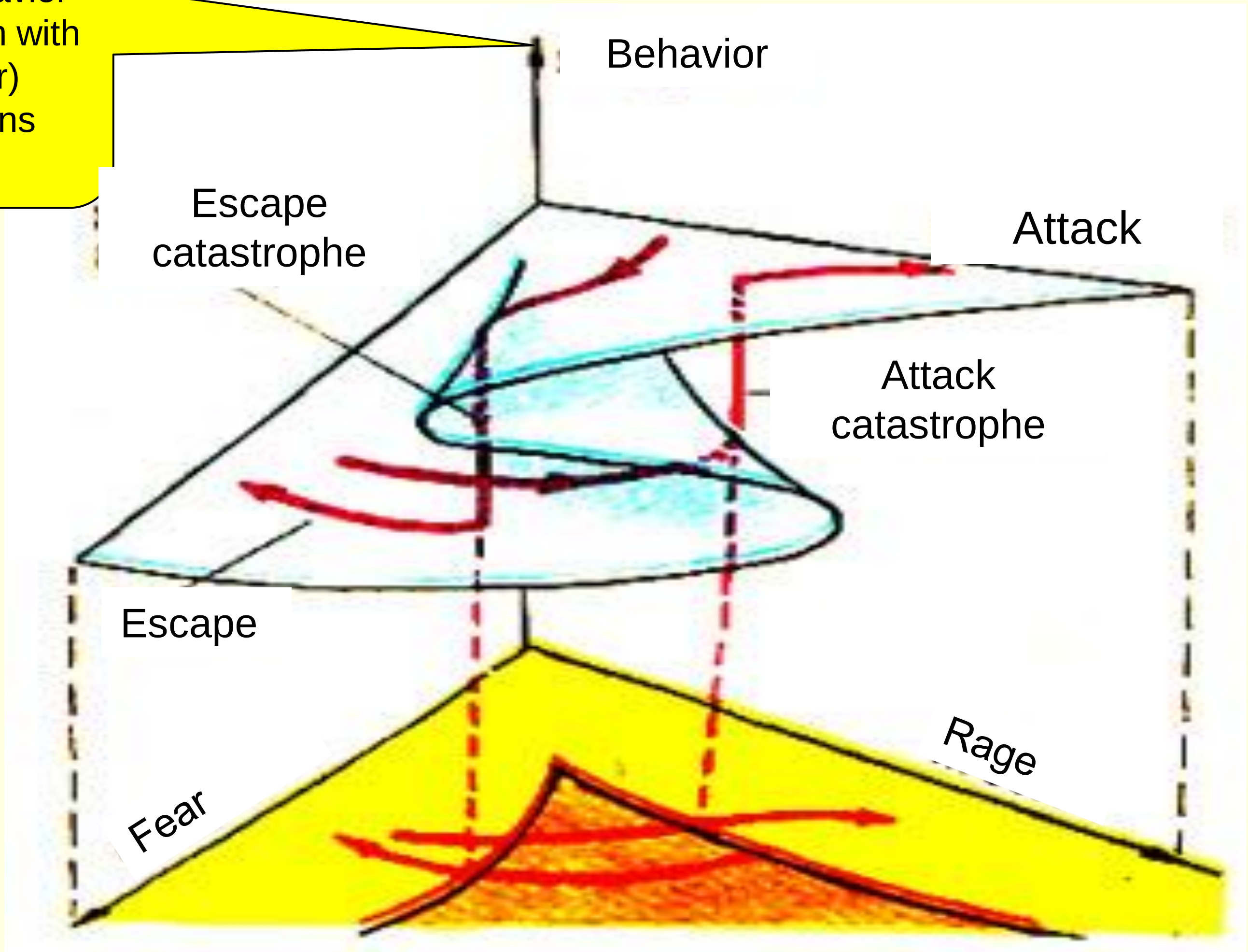
Education process management parameters of the:

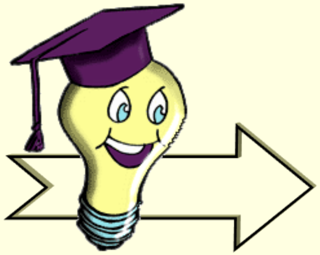
- the ratio of the number of selection elements and the procedure;
- a set of selection points that allow the user to control learning;
- a set of toolbar buttons that allow the user to control the learning process;
- style of setting learning goals.

…

5.3. Methodology of research of complex systems

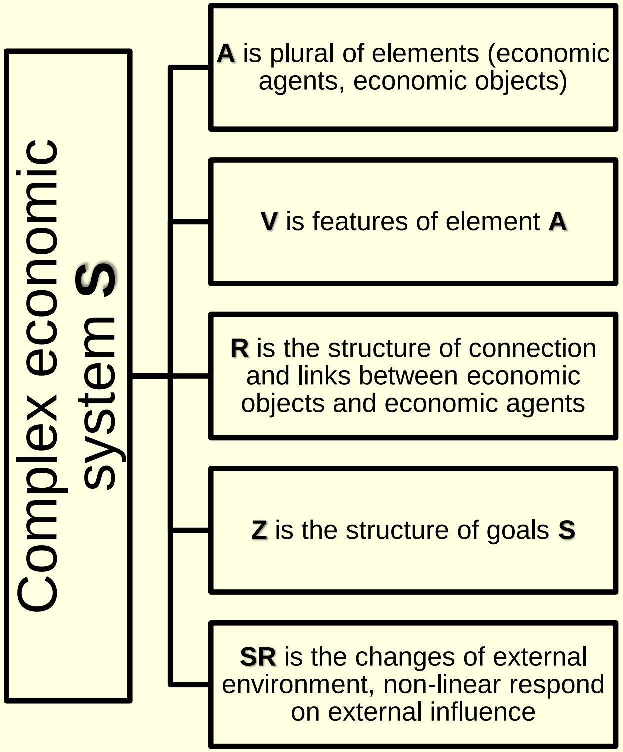
A model of the behavior of a complex system with jump-like (trigger) behavior transitions





Research problem complex systems

The increase in complexity and potential diversity in the manifestation of systems leads to the fact that the existing research apparatus (methodology, modeling tools) is not able to absorb the complexity of the studied systems

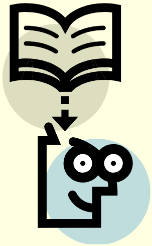


Anomalous events – Black Swans (according to Nassim Taleb)

The Black Swan is an event that has the following three characteristics:

- it is anomalous because nothing in the past foretold it;
- it has enormous power of influence;
- human nature forces us to invent explanations for what happened after it happened, making an event that was initially perceived as a surprise understandable and predictable.

It happens that the “Black Swan" does not come alone (Photo by the author. France, 2017)



Classical science is based on two bases of knowledge:

- **empirical knowledge of the world**, given to a person through his feelings
- **rational thinking** based on common sense and conventional logic defines cognition based on abstract thinking.

The third aspect – **intuitive knowledge** – should complement the empirical and abstract aspects and allow the researcher to really penetrate into the essence of the objects and phenomena under study and see them "from the inside".

Examples from various fields of science

A new metaphor for an organization.

An old metaphor for a company is a railway with rigid plans, fixed rails and stations, an established traffic schedule.

A new metaphor is a taxi that travels the streets on call, with short-term, frequent plans, that performs tasks that arise as they are received. The driver makes a decision at the moment of the action, fulfilling the wishes of the passenger.

Taking into account the new metaphor of the organization, it is necessary to:

1. **Embrace uncertainty and chaos in your life** and learn to thrive in those conditions.

2. The organization must find ways to bring the future closer to the present, **relying on parallel perceptions of the past, present and future**, and learn to think backwards.

3. **Decision-making should be polarized within the organization** following the "taxi driver" all the way.

4. Learning will be central if the organization is to continue the process of adaptation and remain **able to accept the unplanned and unforeseen** , that will arise in the future.

5. The central role of leadership in the new organization will shift from technical to adaptive and creative problem solving .

6. The organization will need such **a leader who can work on the edge of chaos**, refusing power and management.

Complexity is the basis of thinking

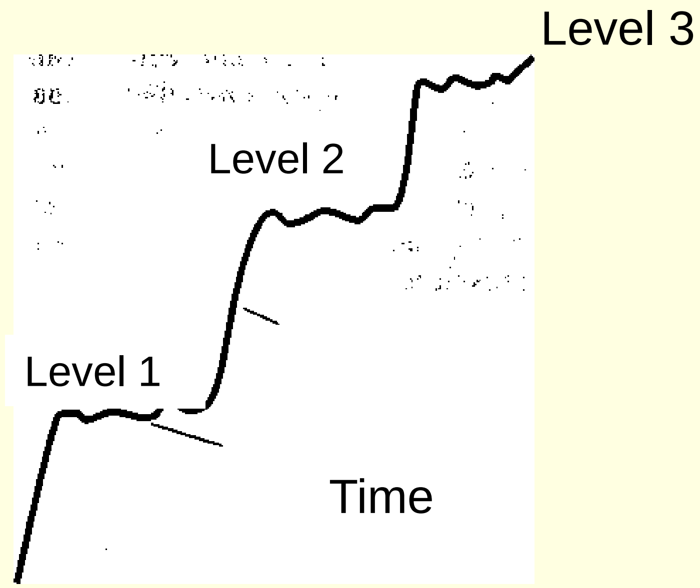
- **Model of the solar system by Kepler** (1571 – 1630) is based on three laws.
- **Isaac Newton** proposed **the concept of the gravitational field** – it incorporated and explained Kepler's laws .
- Newton's model revolutionized thinking and remained **the leading scientific hypothesis** for 200 years. This **model has become a metaphor** in disciplines and areas far from mechanics and gravity.
- The philosopher **Immanuel Kant** (1724 – 1804) used **the Newtonian model** of the interaction of masses in a gravitational field as **a metaphor for the search for the laws of human behavior.**

- Kant's categorical imperative made it possible to formulate a criterion for people's behavior, which can be compared to an orbital attractor in the gravitational field, that is, to the behavior of planets in orbit: "Become as you would like to be treated."

- **The order** evident in the Newtonian model has become **a model for organizations.** The orderly, mechanism-like model of the organization was preserved for a long time.

- **The uncertainty principle** set a limit to what we can observe and predict. **Newton's model was supplemented by Einstein's theory of relativity.**

- The time has come for a new metaphor for organizations, **the intellectual organization .** This metaphor says to how complex systems theory can be used to **transform an organization into an organism.**

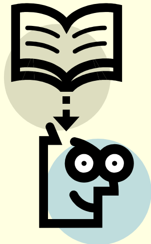


The revolution is spontaneous.

Evolution is slow.

Two stages – revolution and evolution.

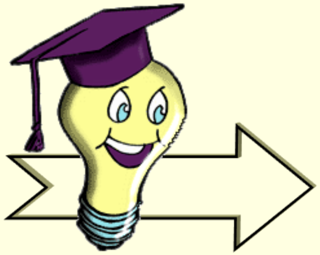
Between extreme **states of chaos and order, the system can self-organize into groups that** follow both internal and external rules of behavior, themselves, influencing and being influenced by neighboring groups.



Complex systems **adapt best where the system is in a state of order on the verge of chaos** (on the edge of chaos), in which a measure of stable constancy is inextricably linked to flexible adaptability - that is, where an evolutionary, planned, slow process is such that it changes in an orderly manner within a state of order, rooted in ordinary thinking, reinforced by revolutionary, rapid innovations, great achievements.

Computers and humans are also now **undergoing co-evolution.**

The most profound changes **are computers and telecommunications influenced our connections**, which we can establish with **sources of information and with other people.**



Causal analysis

Cause-and-effect analysis is based on rational thinking and does not allow thinking to grasp and explain the contradictions and antinomies that actually exist in the world.

Categories of reason (Aristotle):

- causa efficiens (causes of driving force):
- causa materialis (reasons connected with materiality):
- causa formalis (formative reasons):
- causa finalis (causes of purpose).

Causal analysis (continuation)

An example.

To create an information system as a commercial product, it is necessary:

1. **To have the intention** to do it (causa finalis).

2. **To have a driving force**, i.e. resources - investments and specialists in the field of IT (causa efficientis).

3. **The necessary development project** (causa formalis).

4. **Necessary materials** – computers, components for creating networks, consumables, etc. (causa materialis).

If there is not at least one of these reasons, it is impossible to create an information system.

Causal analysis (continuation)

Fundamentally different worldview systems (different "main" reasons).

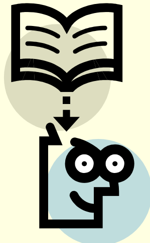
Objective perception of cause-and-effect relationships became the basis of **spiritual sciences**.

natural Sciences chose the main cause of energy (**cause of the driving force**).

The natural-scientific perception of the cause drives it into the past, while the target model correlates it with the future.

Many energy reasons belong to the past ("The program stopped working because it was hit by a virus").

Many of the goals' reasons are future oriented ("We must develop this program today because our competitors may develop it tomorrow").



Causal analysis (the end)

- the energy option makes it possible to detect **a mechanical connection** and correlates **with the material leve** ,
- target causality deals with **motives and intentions** that correlate with **the psyche**.

This is a specific form of the following polarities:

Sausa efficiens – sausa finals.

The past is the future.

Matter is spirit.

The body is the psyche.

- **Time is a phenomenon of our consciousness**, which we project outward, beginning to believe that it moves in one direction - from the past to the future.
- We do not take into account that **at the point we call real, there is neither past nor future.**

Wherever we deal with relatively small segments of the world and are able to see an object or event as a whole, the use of time, linearity and causality helps to create adequate representations of them.

Finding reasons is a way of thinking characteristic of **the left hemisphere**.

The right hemisphere thinks at the level of **analogies**.

Analogies are the second **way of looking at the world, which is opposite to the search for reasons.**

Only **the unity of causality and analogies is capable** of creating **a coordinate system** in which the world can be meaningfully interpreted:

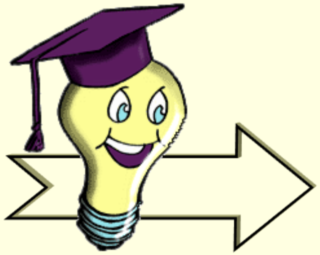
- Causality allows you to see **horizontal relationships.**
- Analogy permeates all levels of its manifestation **with the principle of verticality**.
- **Analogy** does not require a relationship, it is focused **on the identity of the content expressed in different forms**, and exists due to synchronicity, which is expressed by the relationship "always – if – then".
- **Causality** leads to increased **differentiation.**
- **Analogy** reduces all **the diversity of phenomena to some integral samples.**

Example. Science, every time, **re-examines the principle of polarity** for different forms of manifestation: electricity, atom, acid-alkaline balance, hemispheres of the brain and thousands of other cases.

Analogy, on the other hand, **shifts the angle of perception by 90 °** reveals in all these forms the manifestation of the same principle.

that is, the left hemisphere, the positive electric pole, the Sun, fire, and the Chinese yang **reveal something in common** , although there is no causal relationship between them.

Analogy derives for all the listed forms a common initial sample of a masculine, **active beginning.**



Modern methods of mathematical description of complex systems (phase space, chaos theory, attractors, fractals)

New math:

- mathematics of complex systems,
- theory of dynamical systems,
- system dynamics,
- complex or nonlinear dynamics.

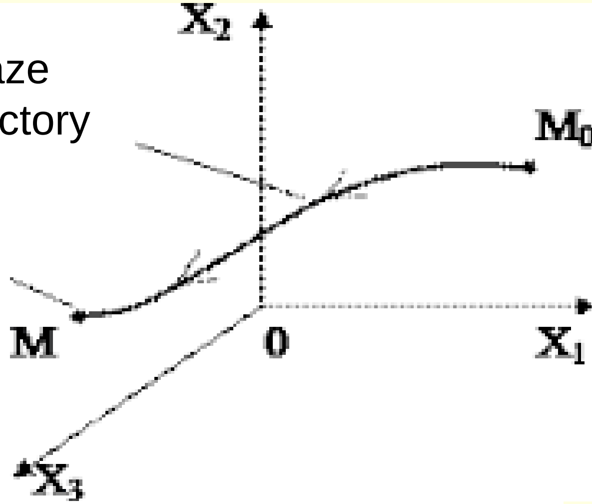
Phase space technique

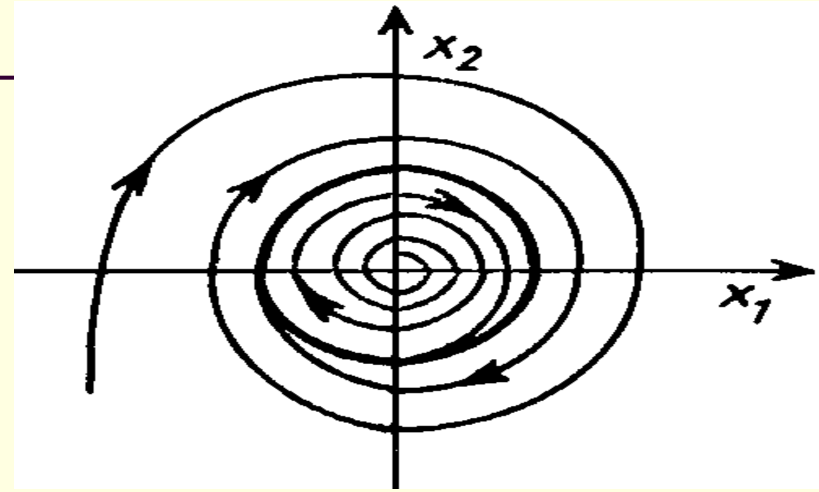
- Each variable in the system is matched with one of the coordinates of the abstract space (phase space).
- One point in the phase space describes the entire system.
- The system changes its state – the point traces out a trajectory in the phase space.
- If there are N variables in the system, an N-dimensional space is used. One point in this space will completely describe the state of the entire system.

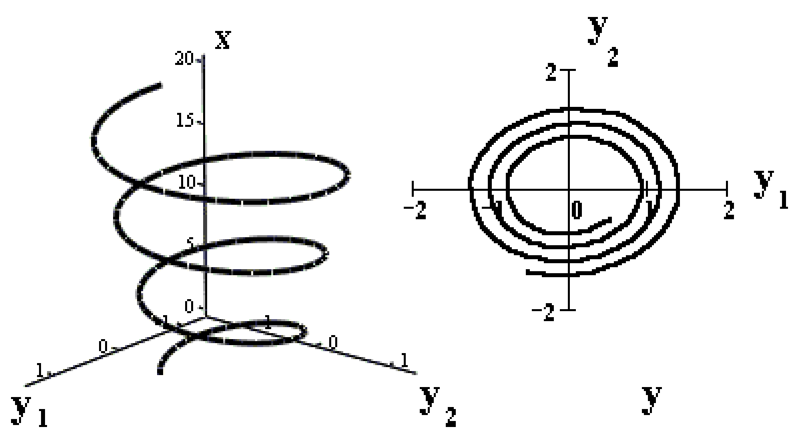
Examples of system models in phase space

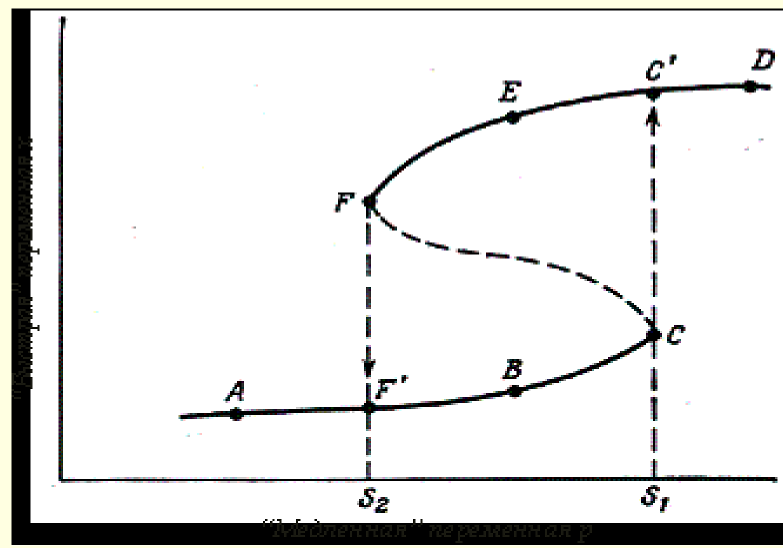
Faze trajectory

The dot which presented bifurcation

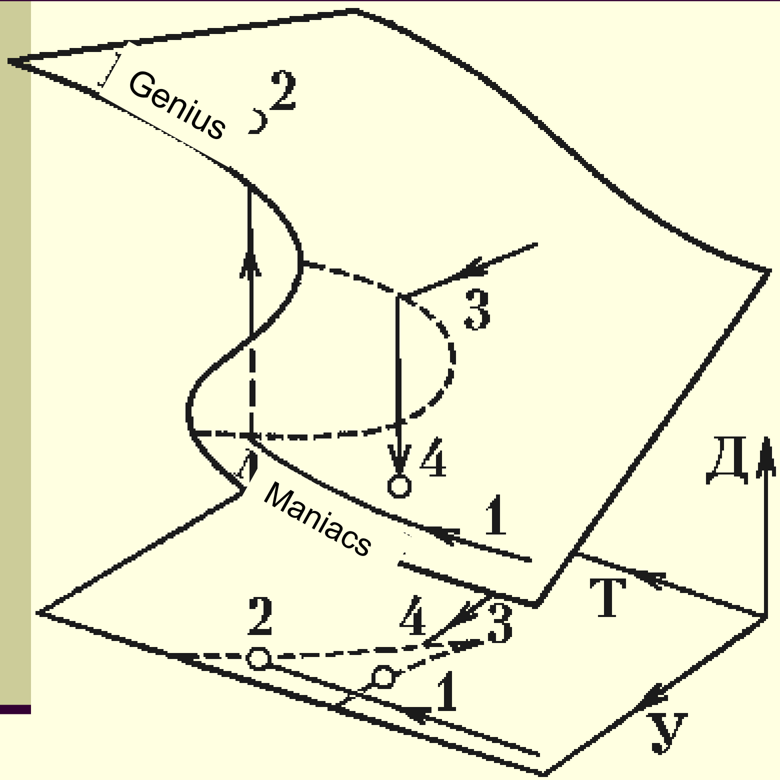




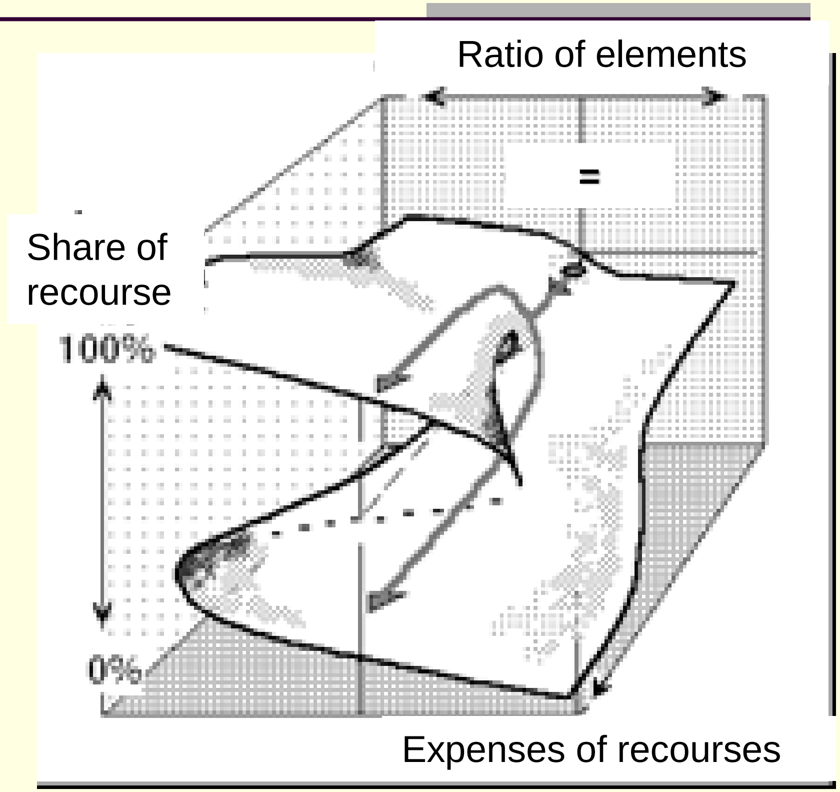




Catastrophe models in phase space



A geometric description of the scientist's creativity in the coordinates of his achievements (D), passion (Y) and mastery of research techniques (T).



Disaster: the object consists of parts that consume the same resource, and the efficiency of the system depends on those resources that have arrived or on external conditions in a non-linear way.

Example 5.5.

In the two-dimensional phase space, the motion of a real pendulum is represented by a curve spiraling toward the center. Such a trajectory is called ***an attractor*** (in a metaphorical sense, a fixed point in the center of the coordinate system attracts this trajectory.

Three main types of attractors:

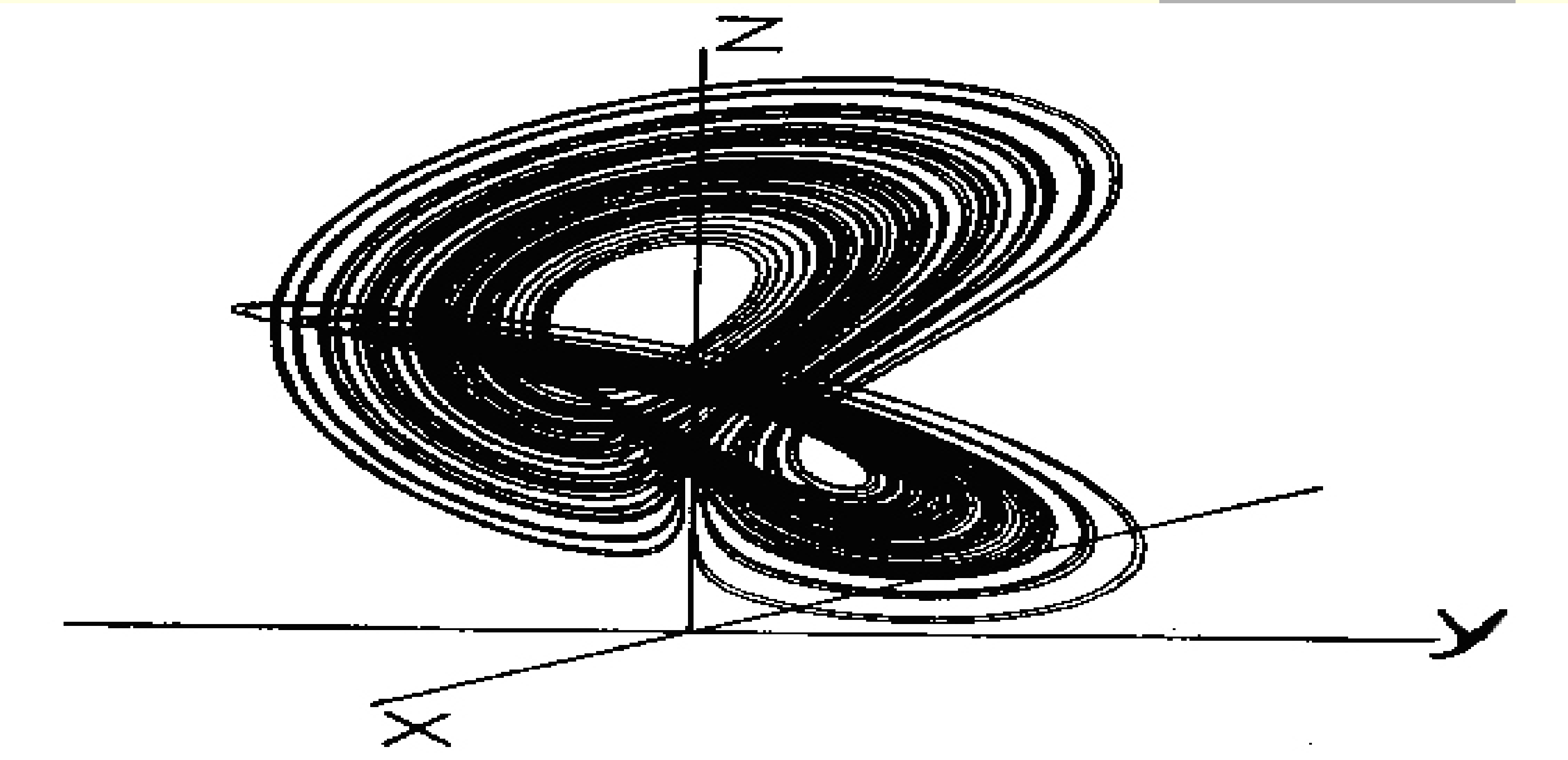
- **point**, which correspond to systems that reach stable equilibrium;
- **periodic**, corresponding to periodic fluctuations;
- **strange attractors**, corresponding to chaotic systems.

A complex highly organized pattern - a strange attractor Ueda

Ueda's attractor

https://www.bing.com/ck/a?!&&p=5d8b5b8add286675JmltdHM9MTcwNzY5NjAwMCZpZ3VpZD0zNTdlMjdjMS02YjNiLTYyYzMtMzVhZC0yYTNhNmEwZTYzYmImaW5zaWQ9NTE5Nw&ptn=3&ver=2&hsh=3&fclid=357e27c1-6b3b-62c3-35ad-2a3a6a0e63bb&psq=ueda+attractor&u=a1aHR0cHM6Ly9vYnNlcnZhYmxlaHEuY29tL0BycmV1c3Nlci91ZWRhLWF0dHJhY3Rvcg&ntb=1

"Butterfly effect" – the smallest changes in the initial state of the system lead to large-scale consequences over time (early 1960s meteorologist Edward Lorenz).



Lorenz's attractor

The new mathematics **represents a shift from quantity to quality.**

The analysis of a dynamic system is reduced to the definition of attractors of the system, their spheres of attraction, and their classification.

The result is a dynamic picture of the system (a **phase portrait**).

The system is "structurally stable“ if with a slow change in the parameters of the equations, the phase portrait - that is, the shape of its attractors and sphere of attraction, undergoes corresponding smooth changes.

The system is structurally unstable if small changes in certain parameters can lead to serious changes in the main characteristics of the phase portrait:

- attractors may disappear;
- attractors can transform from one to another;
- attractors may suddenly appear .

Critical points of instability are called **bifurcation points** ("branching").

In the evolution of the system, a "fork" suddenly appears in these places, and the system deviates in one or another new direction.

In a mathematical sense, bifurcation points mark sudden changes in the phase portrait of the system.

In the physical sense, they correspond to points of instability, in which the system changes dramatically, and new forms of order suddenly appear.

*Instead of the term **"bifurcation"** can use the term **"catastrophe"** (Rene Thom)*

Fractal geometry

Fractal geometry is *"the language in which you can talk about clouds"* to describe and analyze the complexity of irregular forms in the surrounding natural world.

Mandelbrot: implemented the simplest nonlinear algorithm on the complex plane in the form:

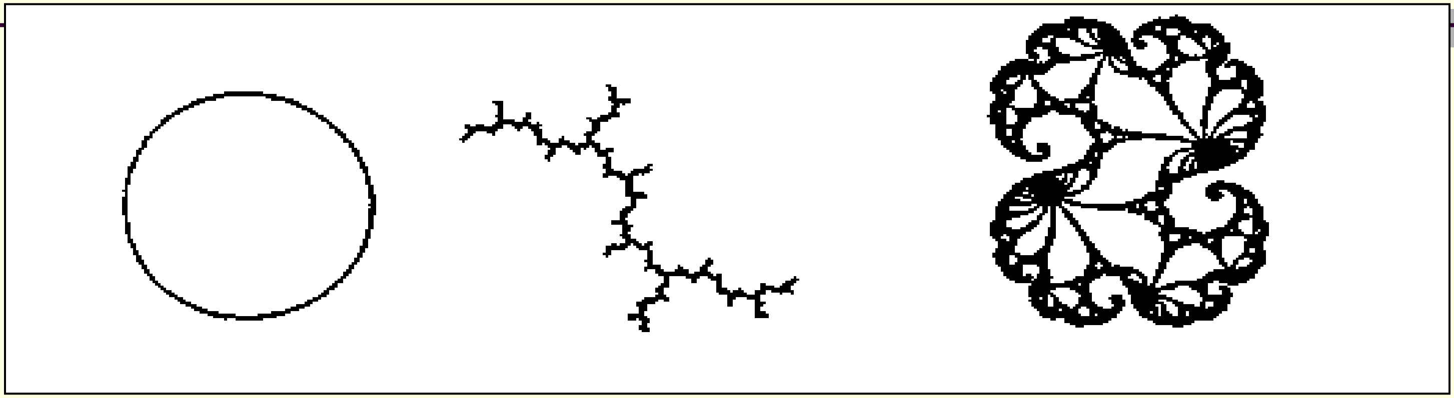
$$\mathbf{Z_{p+1} \rightarrow Z^2_n + C \ (1)}.$$

For comparison:

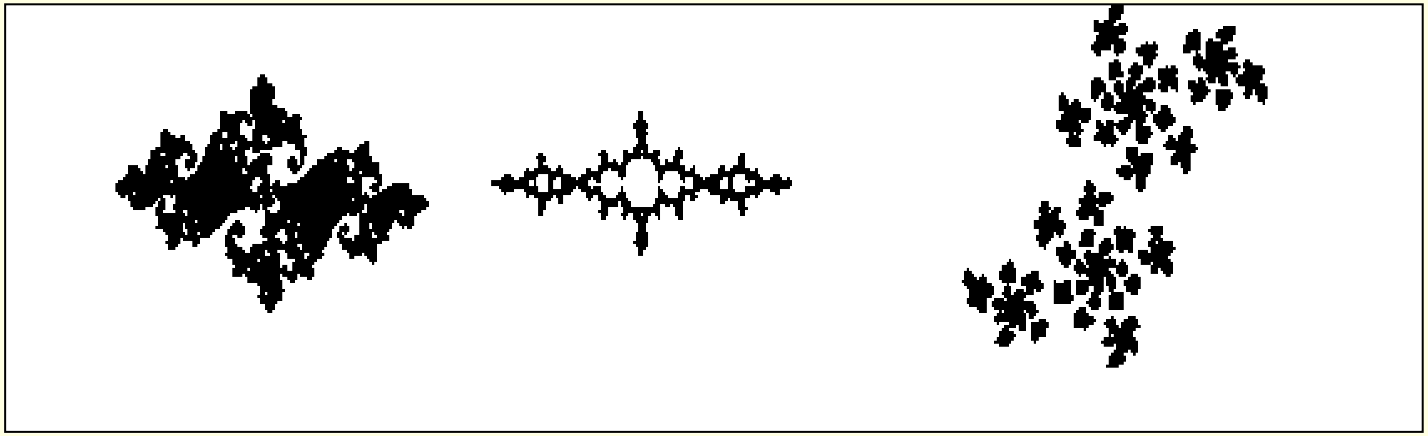
Pythagorean theorem $\mathbf{a^2 + b^2 = c^2}$;

Einstein's unique formula $\mathbf{E = ms^2}$.

Six examples of Julia's set

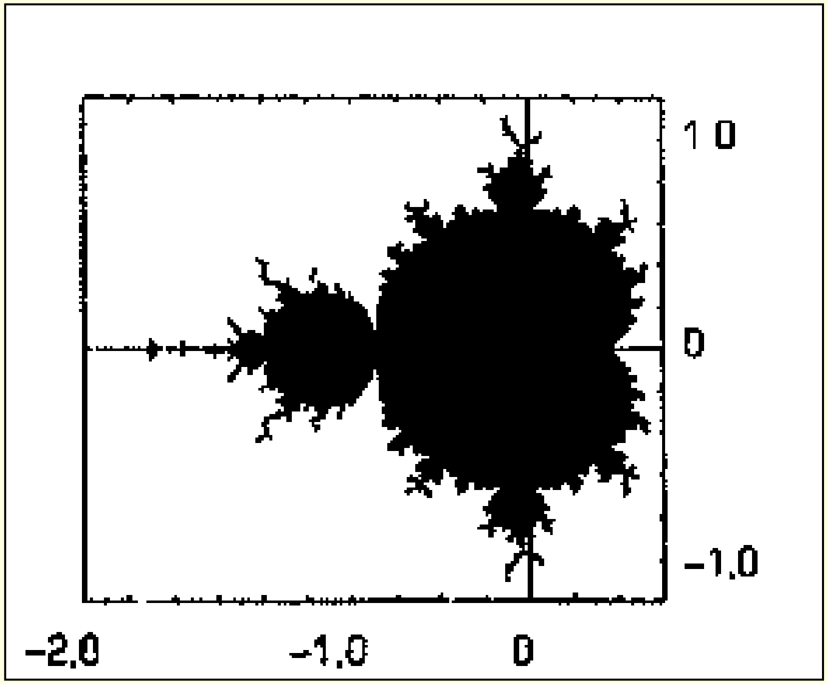


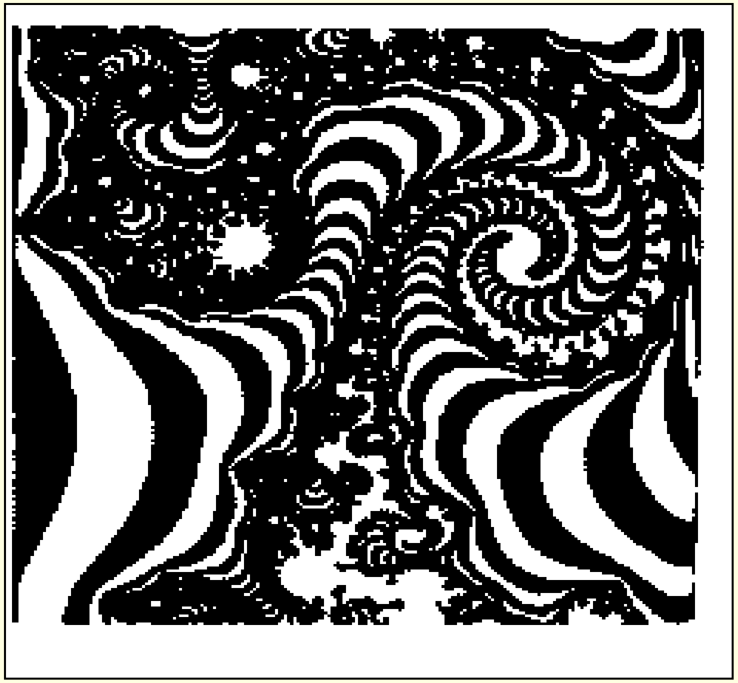
C = 0, C = i C = 0.27334 + 0.00742i



0 = 0.74543 + 0.11301i C = - 0.125 C = 0.11301 - 0.67037i

The Mandelbrot set (M) – a catalog to the infinite variety of forms of the Julia set.





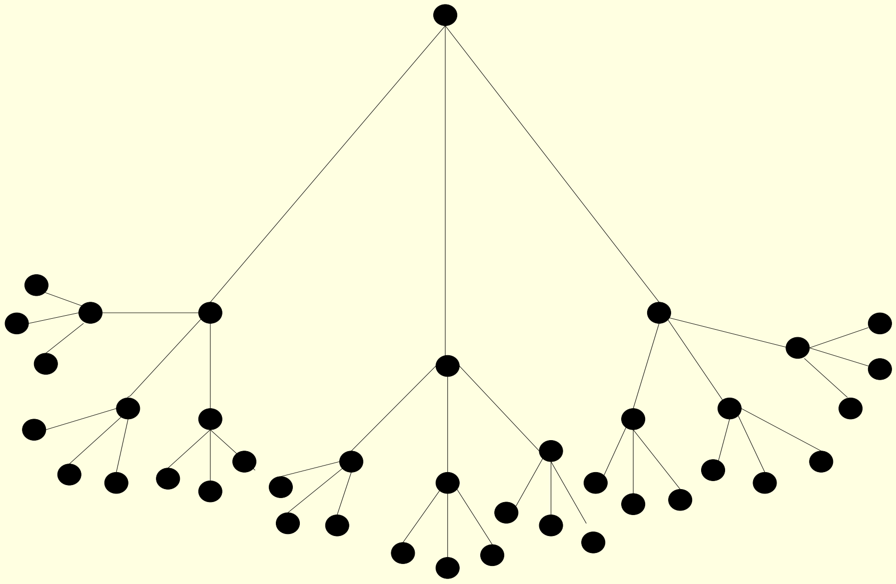
Mandelbrot's fractal

Example.

Modeling of bank activity.

Product life cycle modeling.

Modeling of the regional development goals system.



Control questions

1. What processes determined the formation of a system method of research?
2. Specificity of the system method and classification of systems.
3. What is the specificity of the system approach in scientific research?
4. Name the main stages of system analysis .
5. Describe the most used aspects of the system approach in the analysis of systems.
6. Formulate the principles of system thinking.
7. How is the degree of understanding of the system related to the integration of the received data about it. Describe the stages that the researcher goes through.
8. How is the method of morphological analysis used in applied research?
9. In what cases is it advisable to use the goal tree method?
10. What techniques of effective thinking are used in system analysis?
11. What is self-organization of systems?

12 Describe the synergistic analysis of complex organized systems.

13. What is the place of the system method in the modern scientific outlook?
14. What are the main functions of forecasting as a special type of prediction?

Control questions (the end)

15. What methods of forecasting depending on the reliability and the available source information do you know? Describe them.

16. What is the essence of the problem of researching complex systems?

17. Describe the methods of qualitative research of complex systems.

18. Name the methods of causal analysis.

19. Describe modern methods of mathematical description of complex systems (phase space, chaos theory, attractors, fractals).

The practical component

Objectives of the task:

- to get to know the role of system analysis methods in scientific research;
- to acquire skills in the application of the method of morphological analysis in the framework of research work;
- to learn how to conduct qualitative and quantitative analysis of a goals tree.

Tasks.

1. Using the method of morphological analysis, form alternative versions of any economic system on the topic of your research work. Choose one of the alternative system options as the best.

2. Build a goals tree for the creation of the economic system designed as a result of task #1. Perform a quantitative analysis of the goal tree.

3. Decompose the purpose of your research paper. Carry out a quantitative analysis of the obtained goal tree and determine the degree of achievement of the research goal at the current moment.

Example 5.5. The problem of goal coordination in a complex system

- An indicator of the completeness of the achievement of the system's goal is usually a value indicator. The choice of an indicator – a criterion of system efficiency – is the final stage of formulating the goals and objectives of the system.
- Let's assume that there is an enterprise, and its subsystems (departments) are selected, the functions of each subsystem and each element in them are defined, the connections within the system and in relation to the external environment are described. The first approach that can be taken – let each element function optimally – does its job most effectively.
- The company produces certain types of products and, naturally, strives to get the maximum profit from the sales. In the management system, the question is solved - how many finished products should be stored in the company's warehouse and how many varieties should be produced?
- So, each of the departments is interested in achieving the global goal – the maximum profit of the company. But the analysis of special (local) interests of different departments of the company demonstrates their divergence and multidirectionality.

Example 5.5 (the end)

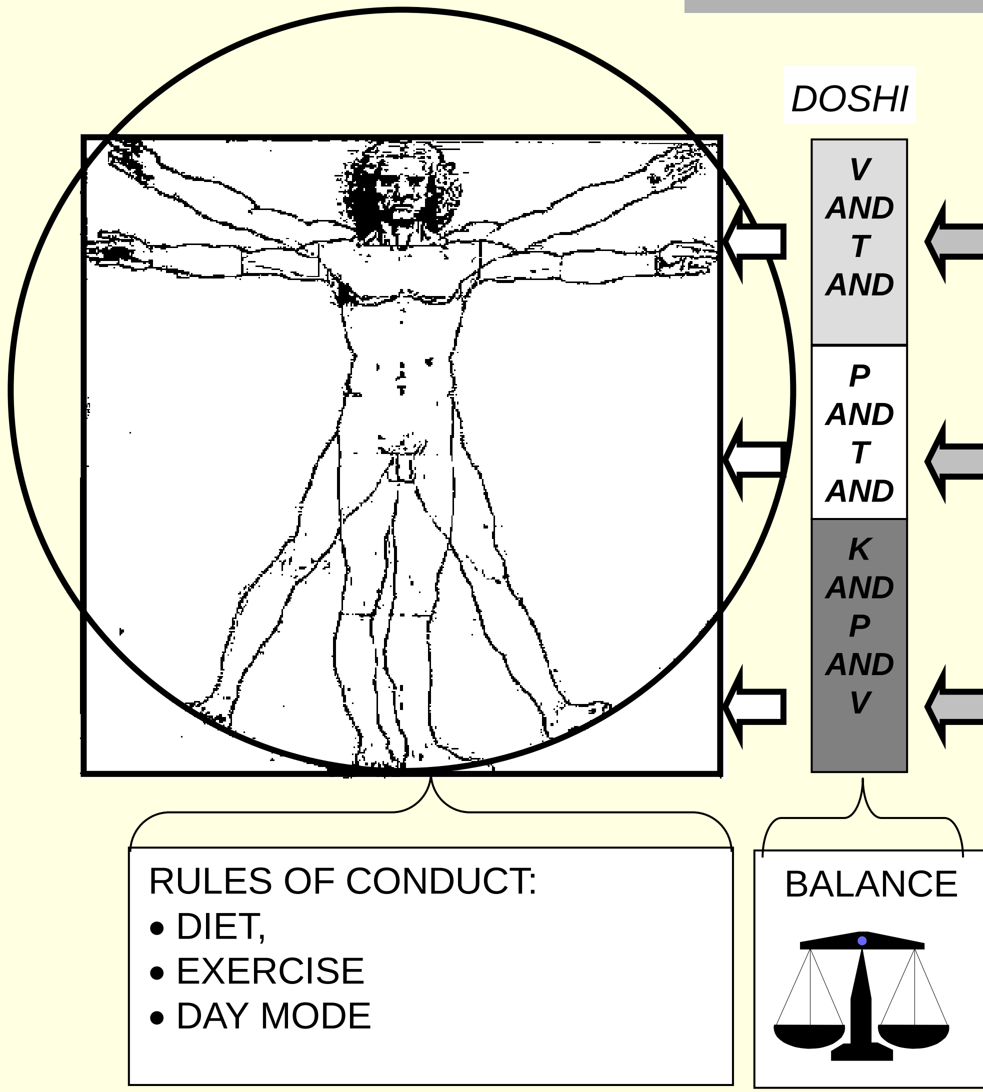
- The production department will be interested in long-term and continuous production of the same type of products. In this case, the costs for setting up the equipment will be the lowest.
- The sales department, on the contrary, will defend the idea of producing the maximum number of types of products and large stocks in warehouses.
- The financial department will insist on a minimum amount of stock – what is in the warehouse cannot bring profit.
- The personnel department will have its own local target function – to produce products at all times (even during periods of business decline) and in the same assortment, as in this case there will be no problems with personnel turnover.

The task of managing such a large system with the achievement of the global goal of maximum profit is complicated by the task of coordinating the goals of individual subsystems, and the efficiency of some subsystems has to be measured not in monetary terms, but with the help of other, non-numerical, indicators.

Example 5.6. System approach in Ayurveda

(the system was created about 5 thousand years ago)

"Ayus" means life,
"Veda " means knowledge.
Three substances (three doshas, types of energy (VE), entities): **Vata**, **Pitta**, **Kapha**.



The main ideas of Ayurveda

1 . At birth, a person is given a certain defined combination of types of energy (VE).

2. A person's comfortable, joyful existence is ensured by maintaining the balance of VE in the proportion that was given to him at birth.

3. The entire environment is also a manifestation of these three BEs - in nature (locality, seasons), in food products.

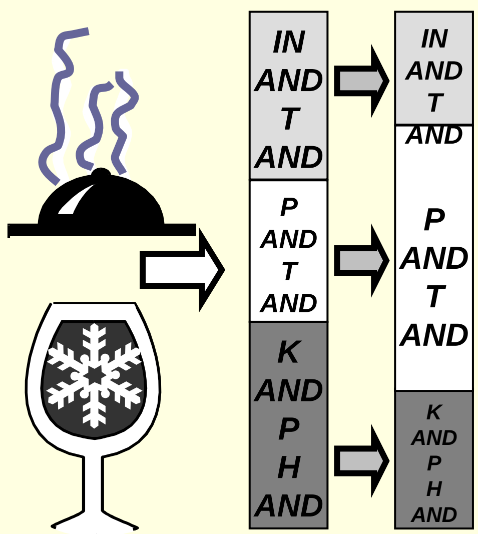
4. Ayurveda formulates the rules of human behavior in relation to its interaction with the environment.

Ayurveda is a system model of a person

Man (and all nature and its phenomena) is a collection of three substances characterized by qualitative characteristics

Vata	Pitta	Kapha
1. Dry	1. Hot	1. Heavy
2. Mobile	2. Acute	2. Cold
3. Cold	3. Lung	3. Oily
4. Lung	4. Moisture	4. Licorice
5. Changeable	5. Slightly oily	5. Permanent
6. Thin	6. Liquid	6. Slow
7. Rude	7. With a sour smell	**7. Soft**
8. Fast		8.Sticky

Interaction between internal and external environment based on features of substances



Stages of diseases:

accumulation;
burden distribution;
localization;
manifestation;
destruction.

A practical component of the Ayurvedic model

Ayurveda considers six stages of the disease:

1. **Accumulation** – the process begins with the growth of one or more VE .

2. **Burden** – the excess of a certain VE is such that it begins to spread beyond the norm.

3. **Spread** – VE begins to spread throughout the body.

4. **Localization** – a traveling VE settles in a place that is not typical for it.

5. **Manifestations** – in the place of localization of this VE physical symptoms appear.

6. **Destruction** – the disease flares up with all its might.

Some examples of how deviations of basic substances from the "norm" in the Ayurveda system are manifested:

- If Vata is unbalanced, pains, spasms, convulsions, colds, tremors appear .
- If Pitta is unbalanced, inflammation, fever, excessive hunger or thirst, heartburn appear.
- If Kapha is unbalanced, various stagnations, inflammation of the mucous membranes, edema, depression and drowsiness appear.
- The first three stages (Accumulation, burden, distribution) Western medicine cannot fix and respond to them.

Example. Balances of Vata:

sweet, sour, salty, heavy, oily, hot

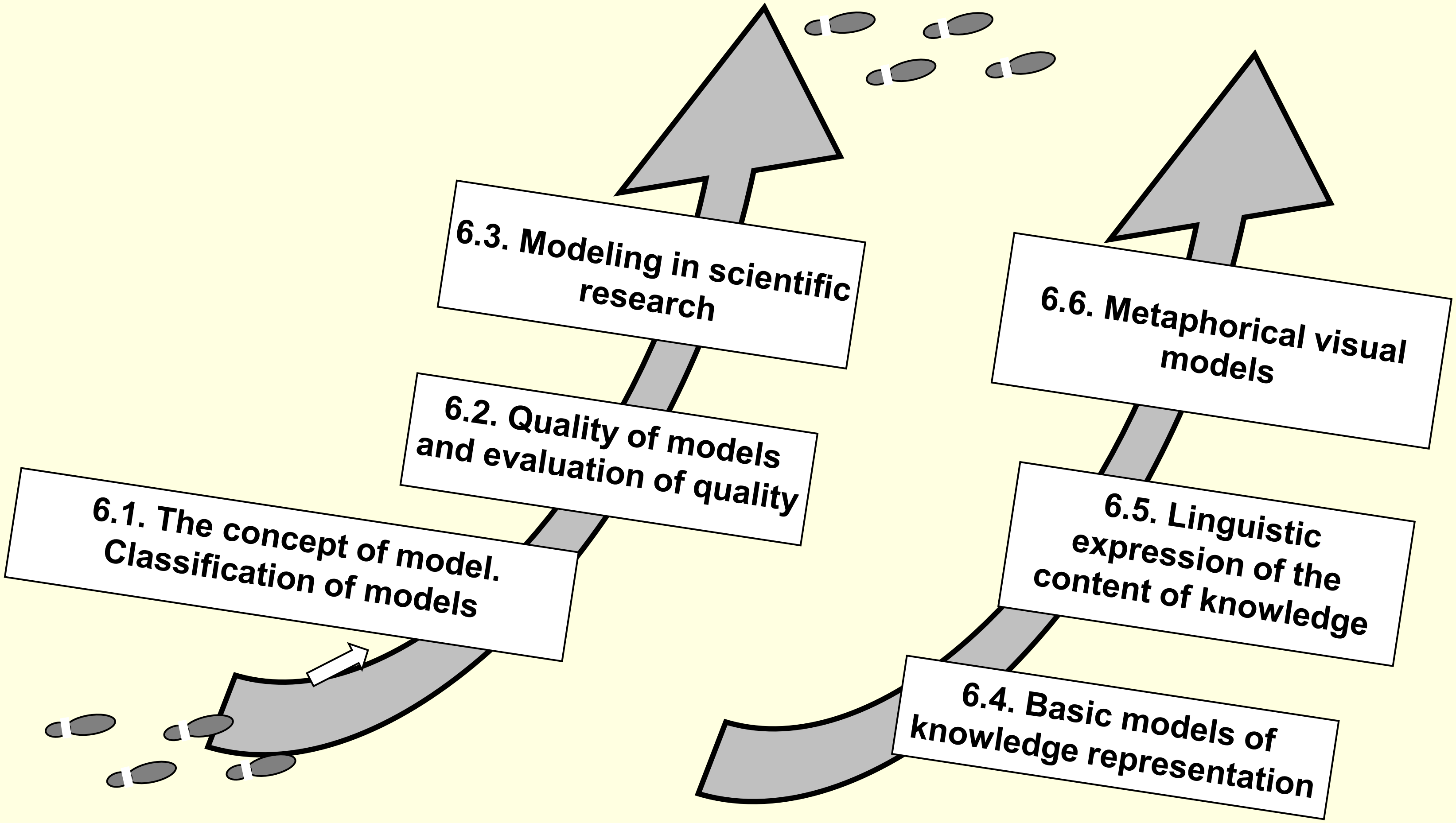
- **increases Vata**

pungent, bitter, astringent, light, dry, cold.

- **The principle "Like attracts like"**
- **Example:** Wheat is heavy, barley is light, honey is hot and dry, milk is cold.

6. Models
and modeling methods in scientific research

System elements of the topic



6.1. The concept of model. Classification of models

Definition 1. A model is an artificially created object (real or ideal), which, being similar to the researched object, reflects and reproduces in a simpler form the structure and connections between the elements of the researched object. The model is created for objects, the direct study of which is associated with any difficulties.

Definition *2.* A model is a simplified, ("packaged") knowledge that carries quite certain and limited information about a particular subject, a phenomenon that reflects certain of its individual properties.

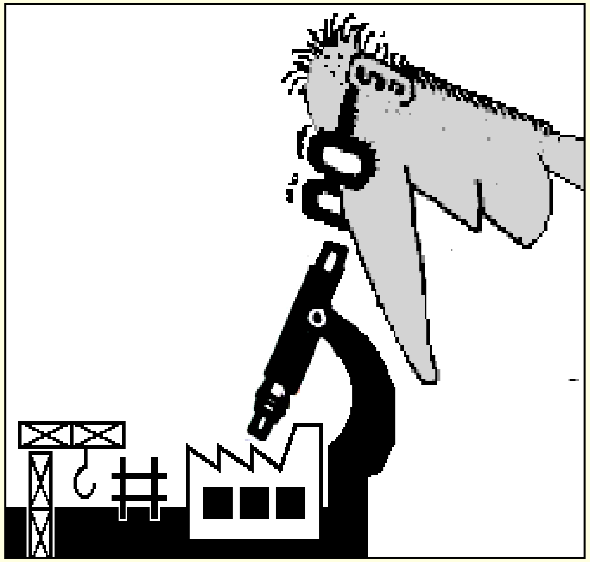
The concept of model. Classification of models (continuation)

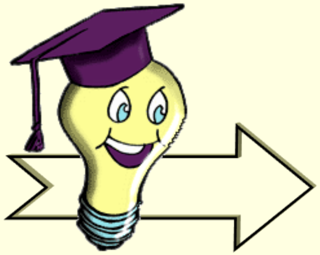
An ECONOMIC-MATHEMATICAL MODEL is description of an economic object by symbolic mathematical means in the form of a system of equations, inequalities, logical relationships.

A model is a reflection of a certain aspect of the research object, which is created:

- For whom?
- Why?
- To illustrate what ?
- In what environment?
- In what way?
- By what means?
- With what quality?

A scientist should ask these questions when starting to create models





Classification of models

Cognitive and pragmatic models → **division of goals into theoretical and practical** .

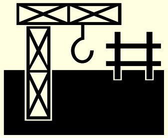
Cognitive models are a form of organization and presentation of knowledge, a means of connecting new knowledge with existing knowledgeю
Pragmatic models are a means of management, a means of organizing practical actions, a way of presenting exemplary correct actions or their results, that is, they are a working representation of goals.

Examples of pragmatic models: action plans and programs, organization charters, codes of laws, algorithms, working drawingsю

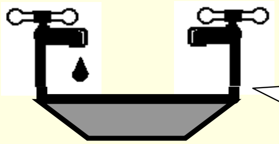
Classification of models (the end)

Material

Choice of the place of production



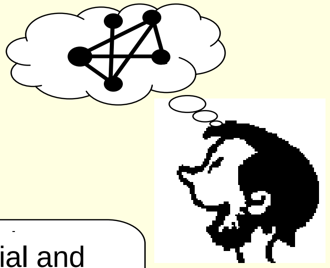
Direct similarity



Indirect similarity

Material and financial flows = water flows

Ideal



Cognitive

Goal – subject area research
Model – "as is"

Pragmatically

Goal – subject area formation
Model – "as should be"

Static

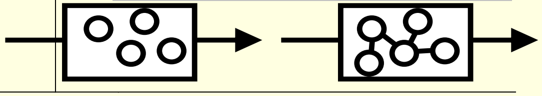
$Y = F(X)$

Dynamic

$Y = F(X, t)$

Black box

Compositions model
Structural model



Static and dynamic models

A model of a specific state of an object, a "snapshot" of an object is called **static**.

Example: structural models of systems.

Models reflecting the state change process are called **dynamic.**

Example: functional models of systems.

Materials for building models:

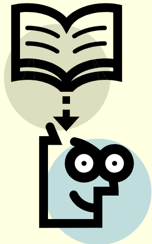
- means of consciousness itself – abstract (ideal) models;
- means of the surrounding material world – material (real, material) models.

Ways of establishing similarity, similarity

Direct similarity is established as a result of physical interaction in the process of creating a model (photos, models of ships, planes, models of buildings, patterns).

Indirect similarity is objectively exists in nature, manifests itself in the form of coincidence or proximity of abstract models.

Examples: electromechanical analogy. The regularities of electrical and mechanical processes are described by the same equations.
A clock is an analogue of time.

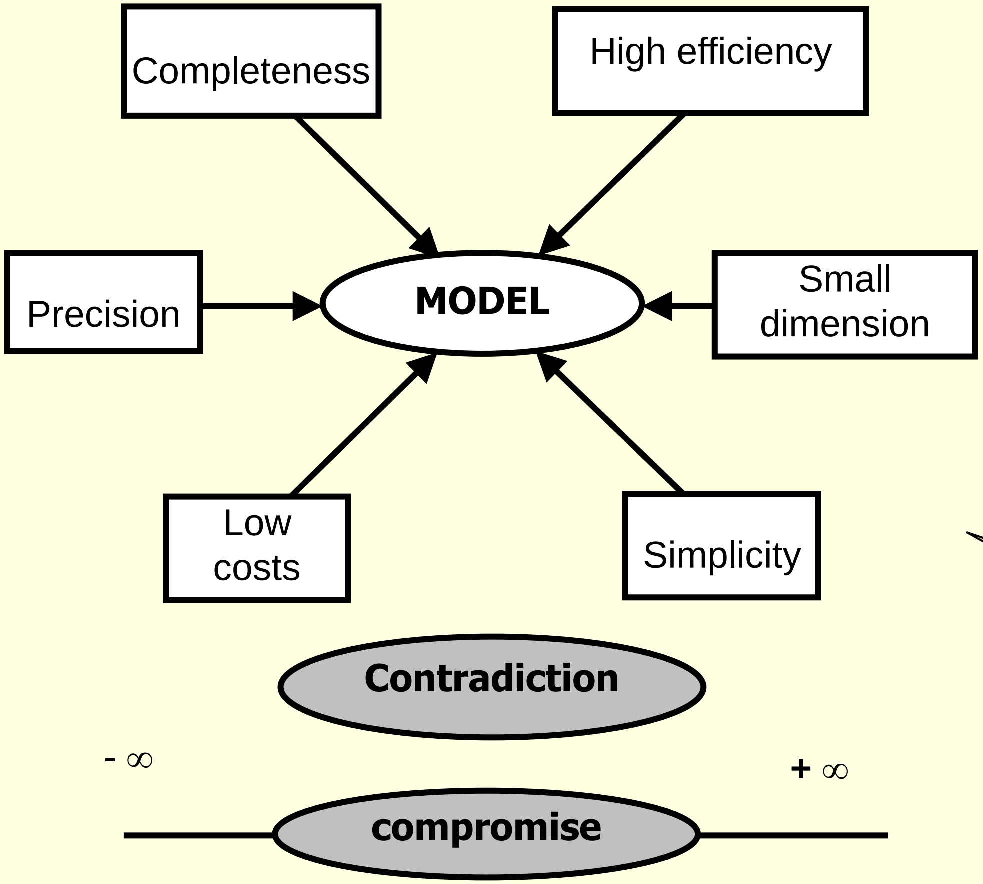


Conditional similarity is the similarity of real models of the original that is established as a result of the agreement.

Example. Money (a value model), **ID** (an owner model), **maps** (a terrain models).

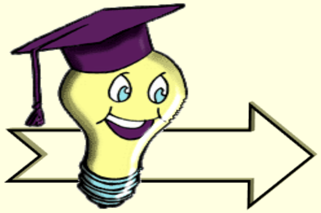
For example, communication theory, information theory, radio engineering, control theory – deal with specific models of conditional similarity that are used in technical devices without human participation, they are called **signals**.

6.2. Quality of models and assessment of the quality



There is no single, clearly defined algorithm for working with models from the point of view of quality assurance and assessment

The main indicators for evaluating the quality of the model



Abstract models and the role of languages. Adequacy and truth of models

Contradiction: **it is necessary to know the infinite world by finite means.**

Factors that allow finite models to reflect infinite reality:

The 1st factor is the simplicity of the models.

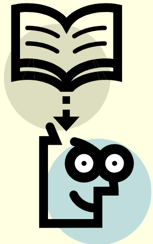
Of the two models that describe the phenomenon well, the one that is simpler turns out to be closer to the true nature of the reflected phenomenon.

The 2nd factor is **the closeness of the reflection of reality with the help of models.**

A model with the help of which a set goal is successfully achieved is called **adequate** *to this goal. Adequacy means that the requirements of completeness, accuracy and correctness (truth) are fulfilled not at all (immeasurably), but only to the extent that is sufficient to achieve the goal.*

The existence of two contradictory, but "equally" real models of the same object is possible.

An example. Wave (electromagnetic waves) and corpuscular (flow of photons) models of light – they are different, opposite and true, each in its own conditions.



<u>The aspect of explicit reflection of the level of truth:</u>

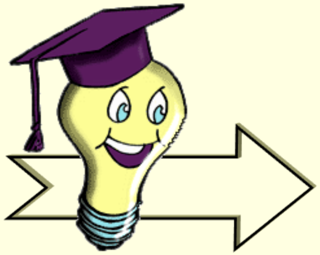
- what is known precisely, reliably;
- what is known with the estimated degree of uncertainty;
- what is known with uncertainty that cannot be estimated;
- which can be considered valid only if certain conditions are met;
- what is known about what is unknown.

The problem of economic and mathematical modeling (EMM).

The helplessness of axiomatic methods was manifested when using mathematical methods to analyze social phenomena were used.

Exit from the crisis

- **on the path of synthesis of heuristic thinking and new mathematics**;
- **on the way to a deeper understanding of the processes of thinking and cognition**.



Establishing similarities between the model and the original

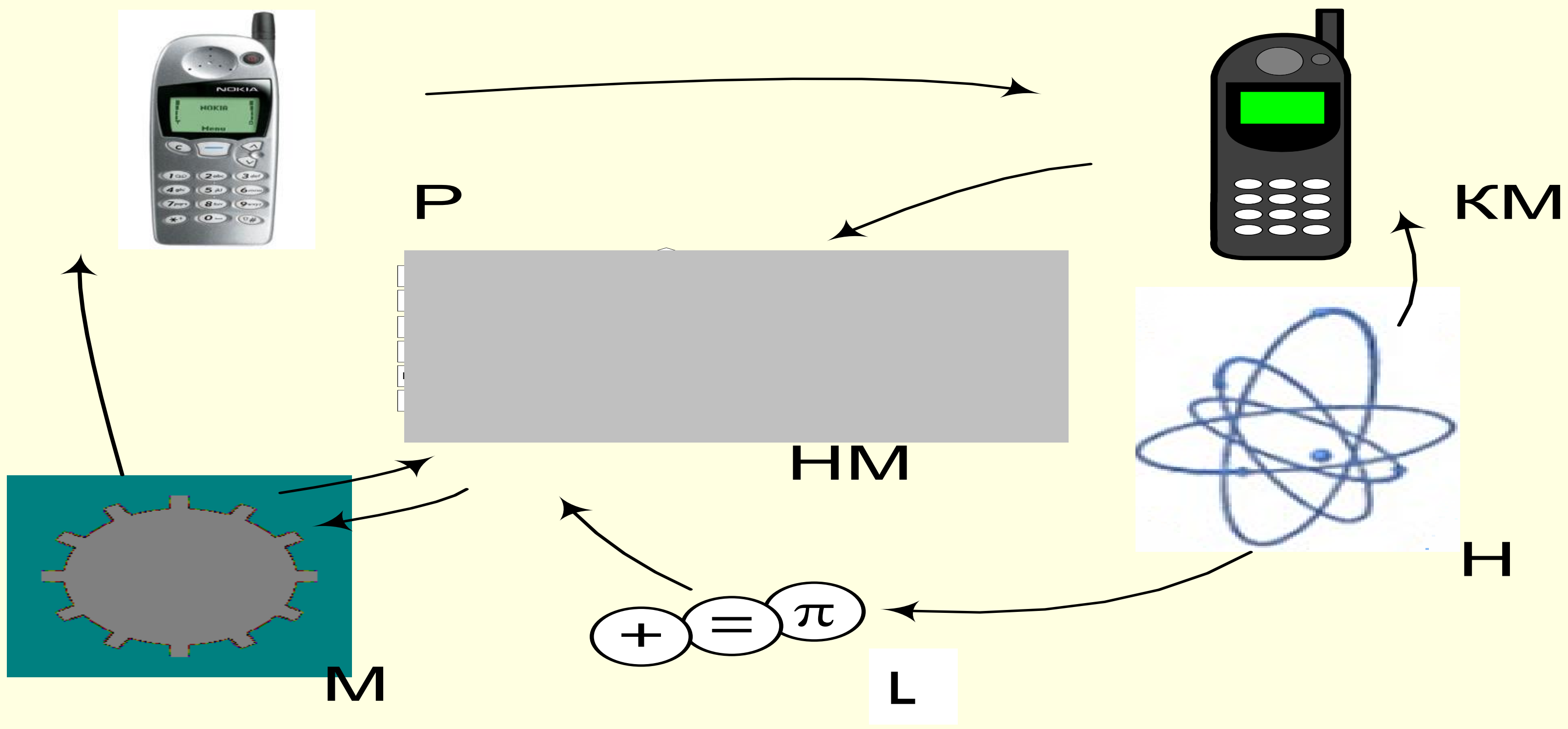
An isomorphic model can be displayed in any subject, if there is a complete element-by-element correspondence between the model elements

A mapping involving **a many-to-one transformation is called a homomorphic mapping.**

Example 6.1. If the Manager knows that company **A** generally produces more products than enterprise **B,** and in month **N** the opposite picture is observed, then he must conduct an investigation into the causes of the situation.
The results of such an investigation can be considered as an assessment made by the Manager when working with the use of a **conceptual model obtained on the basis of knowledge of similar situations observed in the past and from the acquired experience.**

The logic of the relationship between the real object, science and the models and methods they create and use

A scientific analogy, like a conceptual model, must fit the situation



Explanation of the scheme:

The logic of the relationship between the real object, science and the models and methods they create and use

Science N

- contributes to the development of **a conceptual model of KM;**
- creates **L languages**, which, together with this model, make it possible to build **a scientific model of the HM of the real system** P.

With the help of a scientific model, **formal methods M are created**, the use of which allows you to manipulate the real situation, as well as the scientific model itself.

A mathematical model

A mathematical model is an objective schematization of the solved problem or its description in mathematical terms. The mathematical model describes the studied system and allows to express its efficiency in the form of **an objective function**

$$W = f(X, Y),$$

where $X = (x_1, \ldots, x_n)$ are controlled variables,

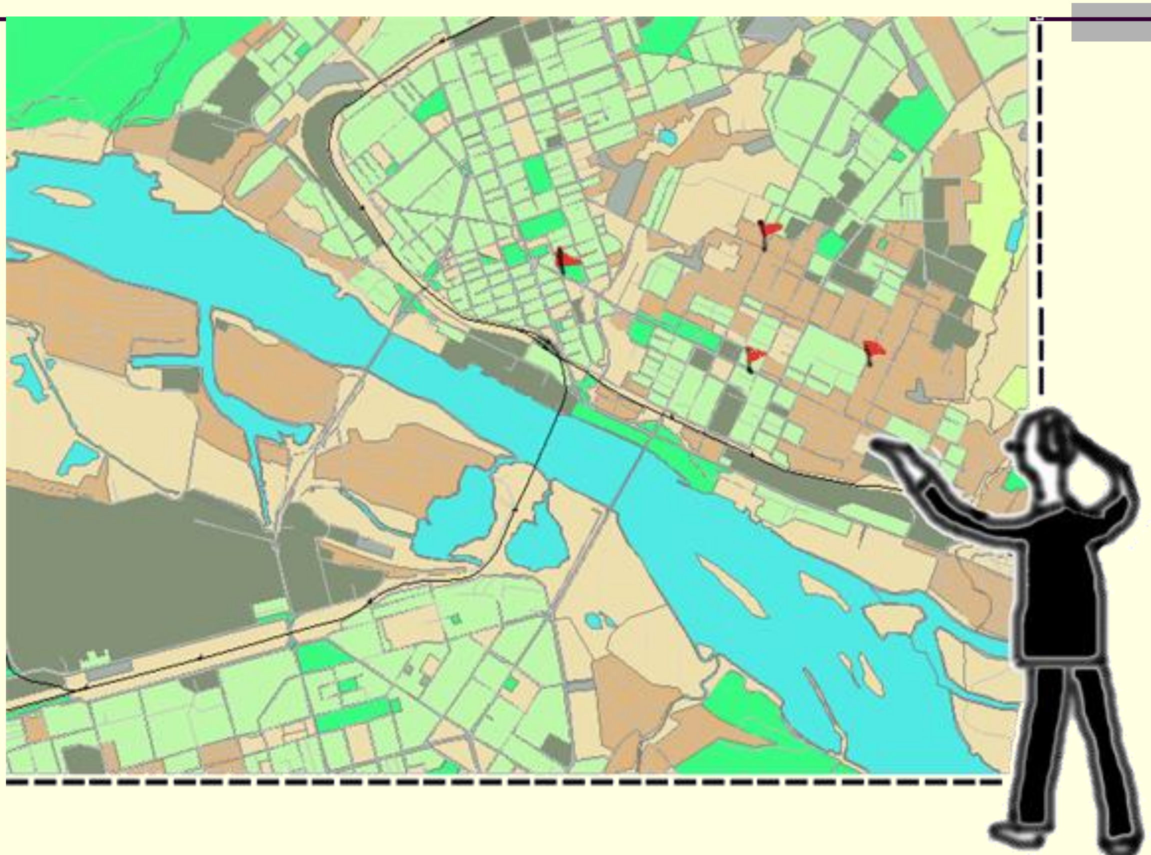
$Y = (y_1, \ldots, y_m)$ are uncontrolled variables (output data).

The relationship between variables $\boldsymbol{X}$ and outputs $\boldsymbol{Y}$ is expressed with the use of constraints

$$\varphi(X, Y) \le 0.$$

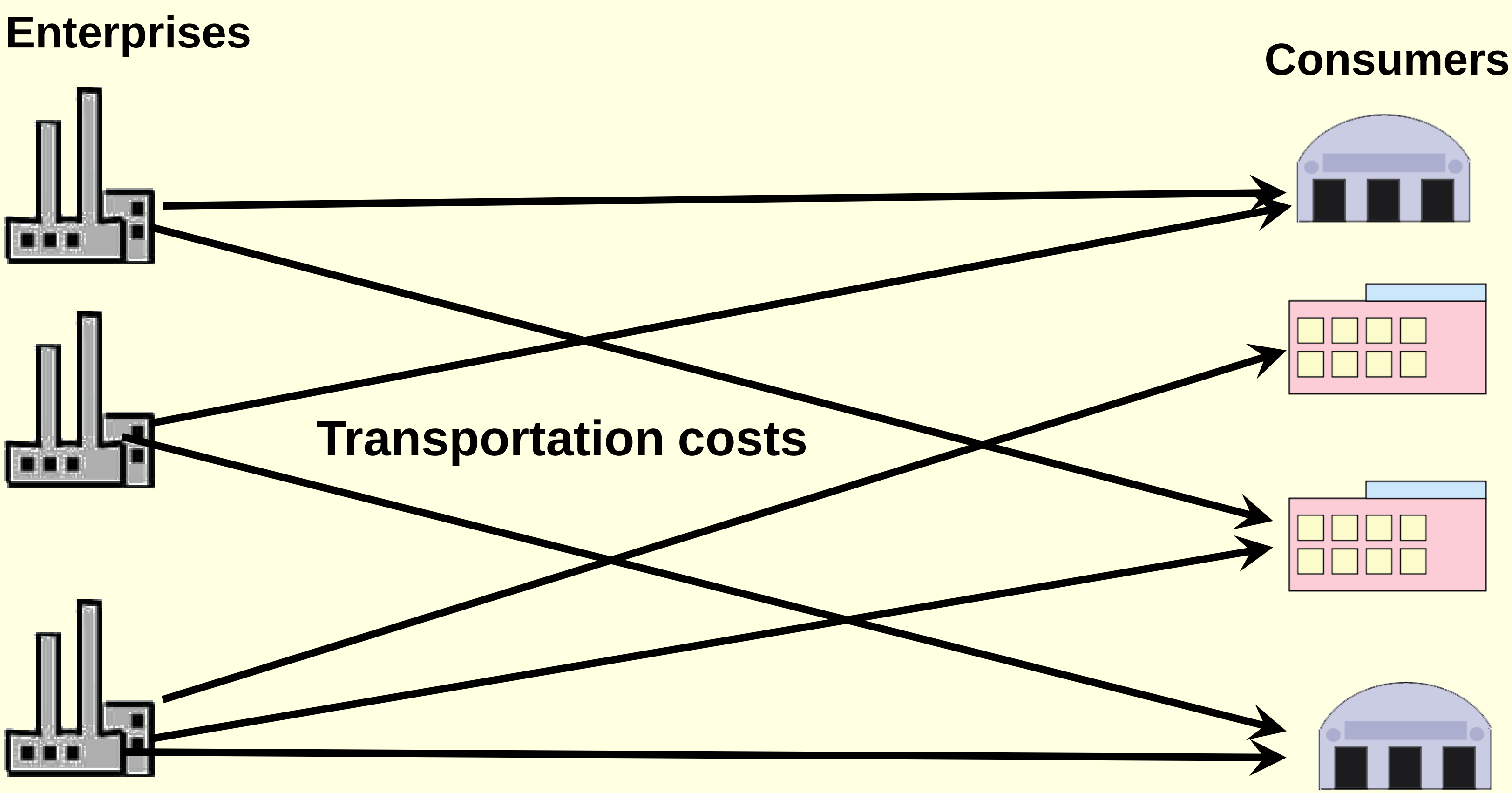
Example 6.2.
Use of
mathematical
models

Placement tasks



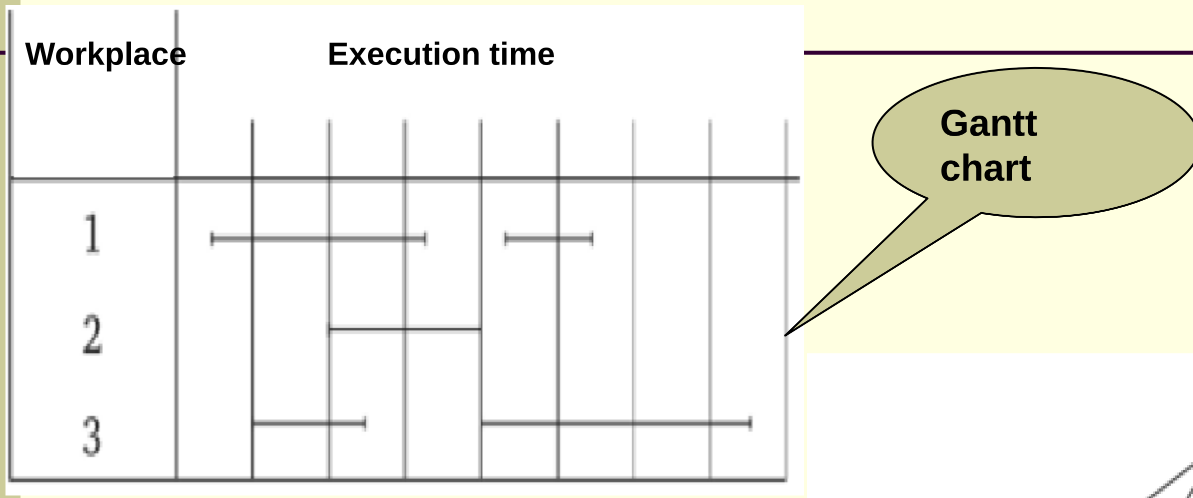
Where to place mobile communication systems, bank branches, service centers, etc.?

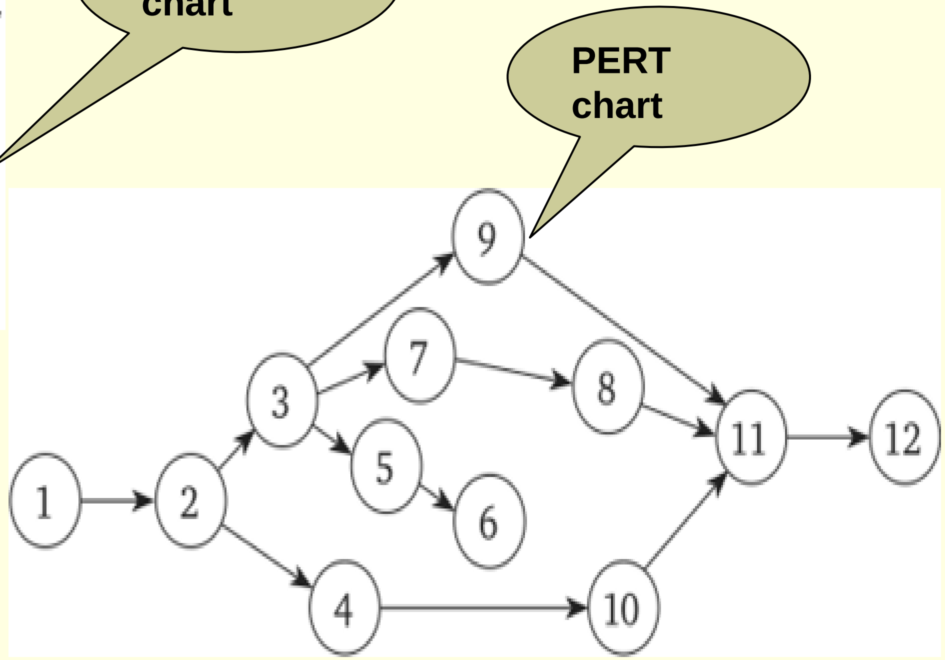
Transport problems



Minimize product transportation costs

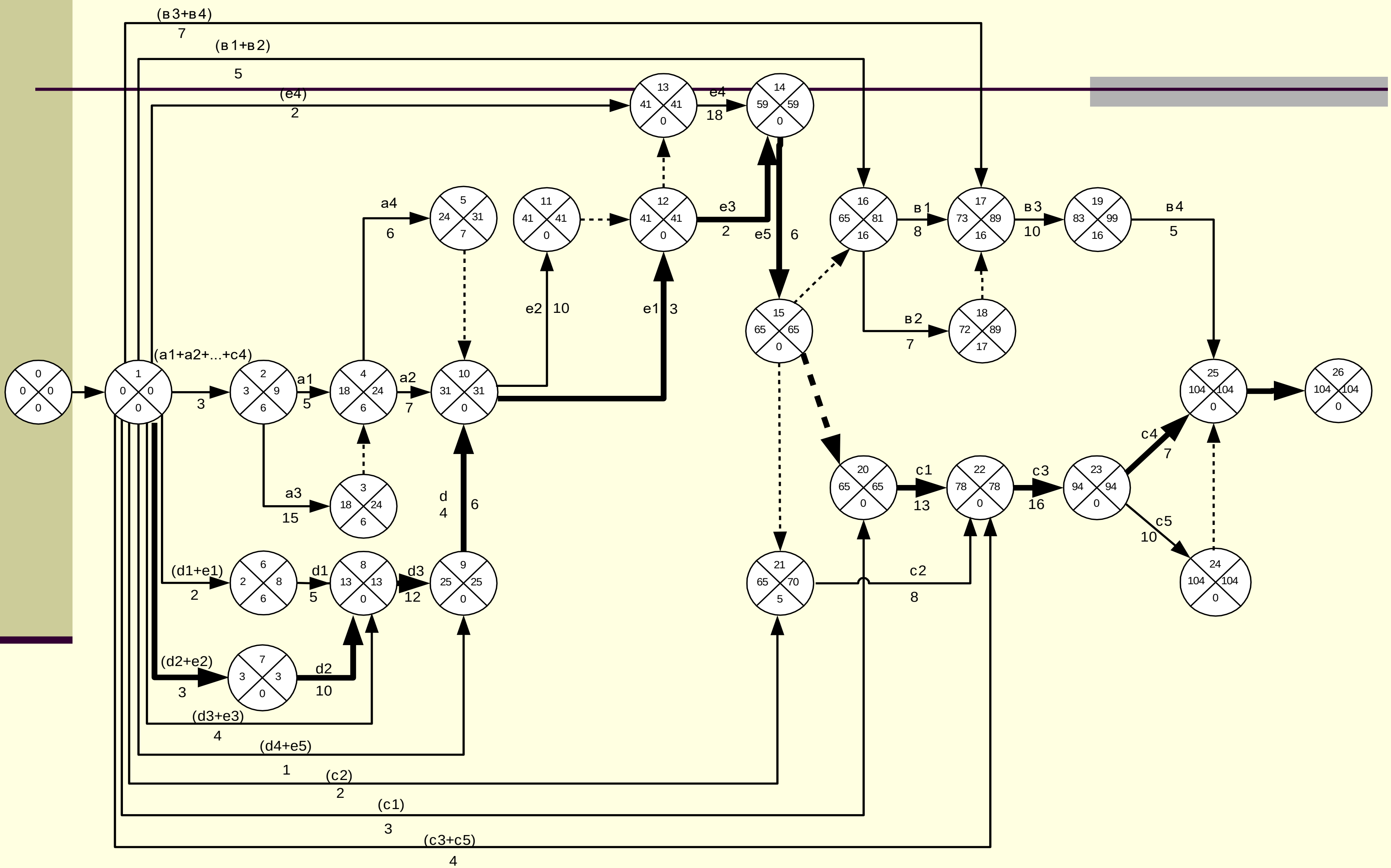
The theory of schedules



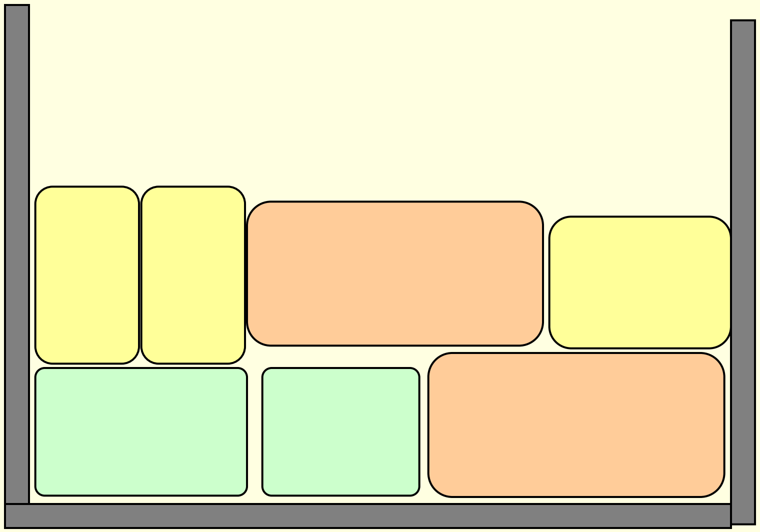


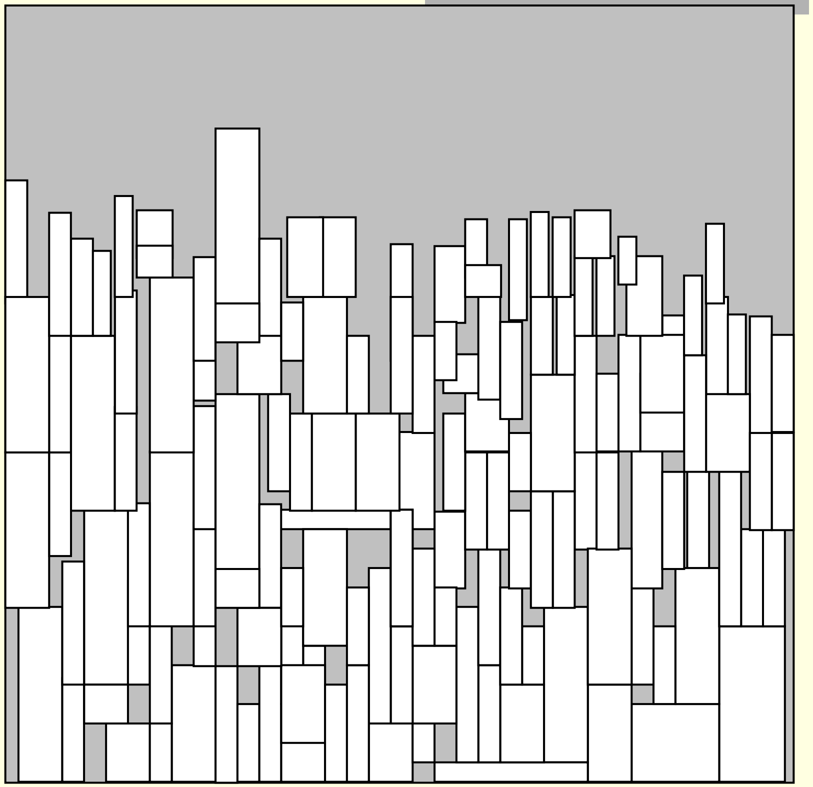
Implementation of complex projects, class schedules in offices, train schedules, activities of work crews.

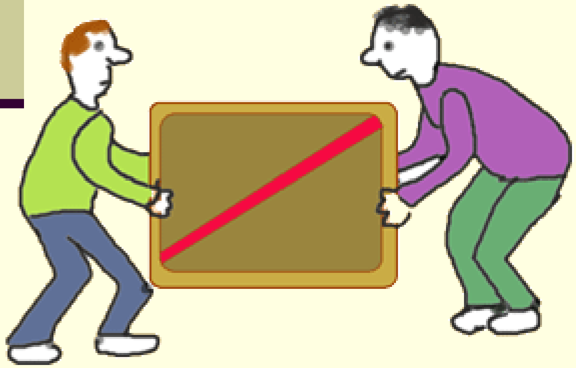
A detailed model of the PERT chart



Tasks of cutting and packaging

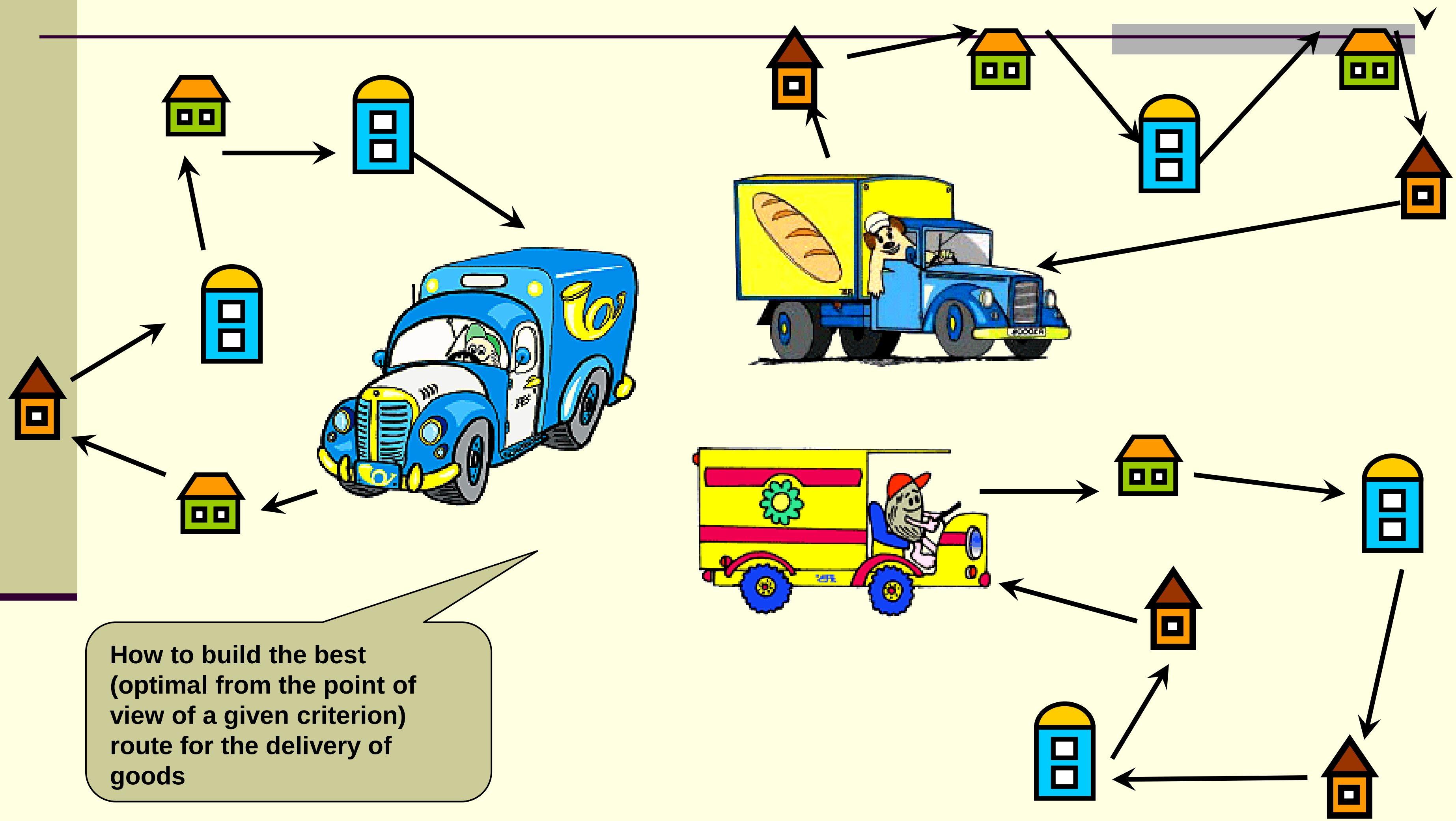






Sawing of lumber, sheet iron, programming of CNC machines.

Routing tasks



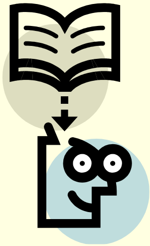
How to build the best (optimal from the point of view of a given criterion) route for the delivery of goods

6.3. Modeling in scientific research

Method – a set of mental and practical operations aimed at solving a specific type of task.

Definition 1 *. Modeling is an activity that includes the following stages:*
- **construction of a model** based on a preliminary study of an economic or technical object and selection of its essential characteristics;
- experimental and theoretical **analysis of the model**;
- **comparison of** results with **research tasks;**
- **comparison** of results with the **object data** ;
- model .

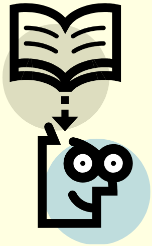
Example 6.3.
1. Every work process (technological process) is an activity aimed at achieving a certain goal. **The goal is an image of the desired future, that is, a model of the future state.**
2. Any activity (process) is carried out according to a certain plan or algorithm. **An algorithm is an image of future activity or its model.**

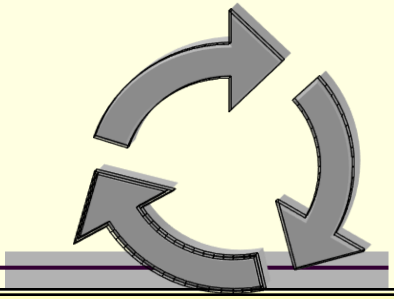


One of the most important tasks of science is the creation of methods of theoretical analysis, the identification of new information that is potentially contained in models and allows the discovery of new knowledge.

"Participants" of the simulation:

- the **"subject"** – the initiator of modeling and/or the user of its results;
- the **"original object"** – the object of modeling;
- the "**model** " – display of the object;
- the **"culture"** is the environment in which all other "participants" of the modeling process are located and interact with.





Definition 2. Modeling is a method of studying an object, process, or phenomenon based on their models.

During modeling, knowledge of the properties of one object (model) is transferred to another object (original).

Based on **the ownership of the model S of the properties abcd and the ownership of the original S1 of the properties abc** it is **concluded that the property d found in model S also belongs to the original S1**.

The correspondence between the model and the original may lie

• eather in **the similarity of the physical or economic characteristics** of the model and the original,

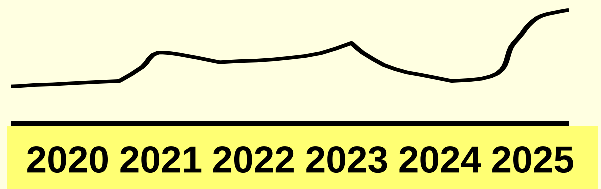
• or in **the similarity of the functions** performed by the model and the original,

• or in **the identity of the mathematical description of** the "behavior" of the original and its model.

Example 6.4. Economic and mathematical modeling

Model – source of new knowledge about the object

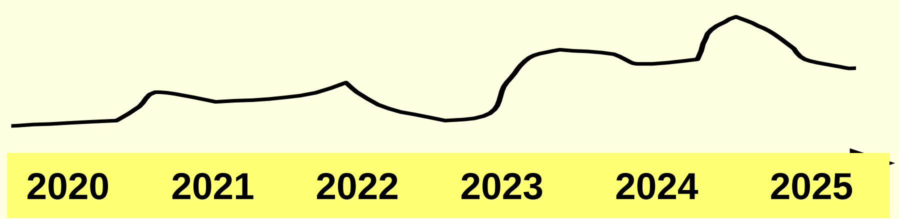
The source knowledge about the object

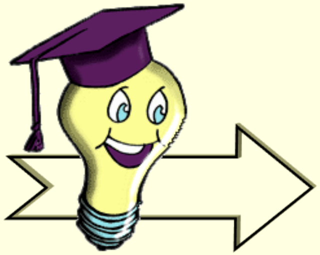


Model

$Y = f(x_1, x_2 \ldots x_n)$

New knowledge about the object





Dynamics of models

Models go through their life cycle:
• **occurrence;**
• **development;**
• **cooperation or competition with other models, giving way to more advanced ones**.

Reasons and regularities of the dynamics of models – the modeling **process is structured**, **organized**, consists of **a sequence of stages**. Stages differ in quality and specific goals.

Example 6.4. *When designing a new technical system, its model develops from the embodiment in the form of the results of previous research work at the stages of the technical task, technical project, working project, prototype, small series to the model intended for industrial production.*

Example 6.5. *Sequence of stages of simulation modeling: formation of modeling goals – construction of an abstract model – creation of a simulated real model – its research – processing and interpretation of results.*

Complexities of modeling algorithmization

1. **The model** functions **in cultural environment**.
2. **The requirements** for the model **are contradictory**: the completeness of the model contradicts its simplicity, the accuracy of the model - its dimensionality.
3. At the beginning, **it is impossible to predict** all the details of what will happen in the future with the model.

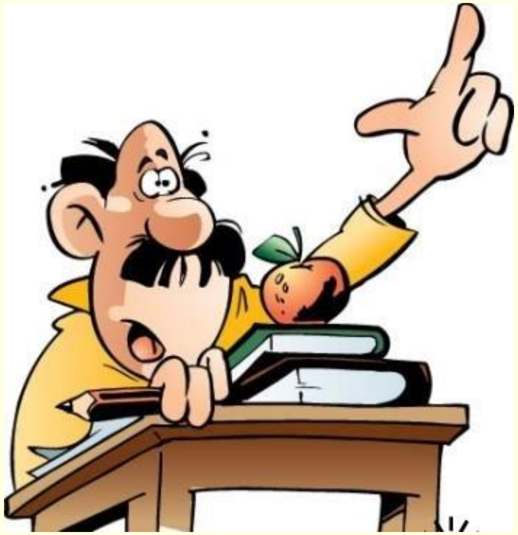
Example 6.6.

*1. **According to the results of the tests** of the experimental sample, it is often necessary **to make changes** to the technical task and return to the stage of designing the sample.*

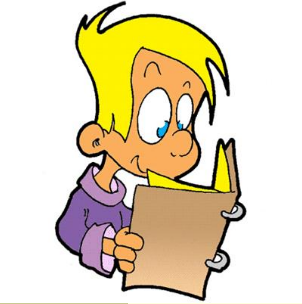
*2. **After interpreting the** simulation results, the goals are refined, **changes are made to the model** and the simulation is repeated.*

Natural evolution of models.

- **A feature of the scientific model:** it has a systemic non-mathematical character.
- **The essence of the scientific model in economic research is to ensure the evaluation of the management system, the decisions made,** and not to depict it with the help of mathematical symbols.



6.4. Basic knowledge of models presentation



The problem of finding and applying effective means of accumulation, organization and transfer of knowledge

As knowledge accumulates in various subject areas, there is a need to use effective means of their accumulation, organization and transfer of knowledge.

Basic models of knowledge presentation are a universal means of structuring knowledge for use in various fields of human activity, accumulation, organization and transfer of knowledge.

A metaphor

Like water that can be poured into different containers, knowledge can also be represented in different forms depending on the model used.

Basic models of knowledge presentation

- **Basic models of knowledge presentation** are certain templates that a scientist fills with information about the object or phenomenon being studied and which are then transformed into a model of the corresponding theory that describes this object or phenomenon.
- **Basic models of knowledge presentation are** the basis for formulating hypotheses regarding the construction of adequate models of the studied phenomena and for further formalization of knowledge.

Formalization of knowledge

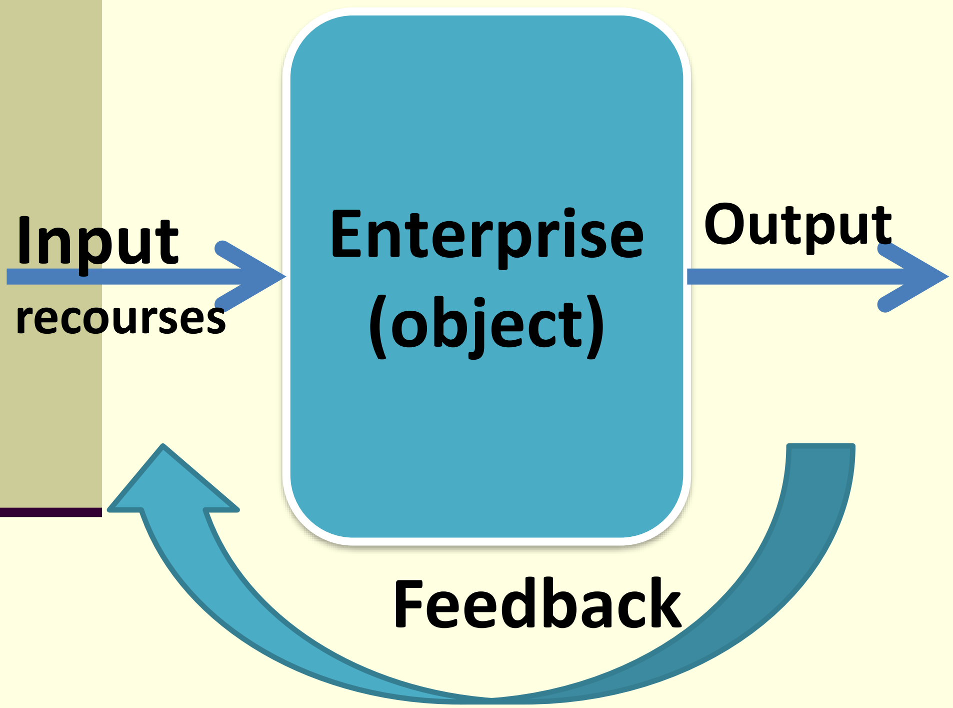
Necessary conditions for the formalization of knowledge are:

- the presence of a specific carrier of knowledge – a subject;
- the subject has the necessary knowledge;
- the existence of some predetermined model of knowledge representation;
- the presence of a knowledge carrier with a toolkit with the help of which knowledge is presented using the selected model.

The choice of the type of model depends on:

- nature of knowledge;
- purposes of submission;
- receiver;
- available tools.

Types of basic knowledge representation models



- A target model.
- A black box model.
- A dynamic black box model.
- System models.
- Technological models.
- A life cycle model.
- Activity models.
- Process models (IDEF diagram type).
- Non-linear process models.
- The goal.

System models

- Composition of elements (anything we study).
- System structure.
- System subsystems.
- System functions.
- System status.
- System parameters.
- A vector of parameters.
- A set of parameters.
- The criterion.

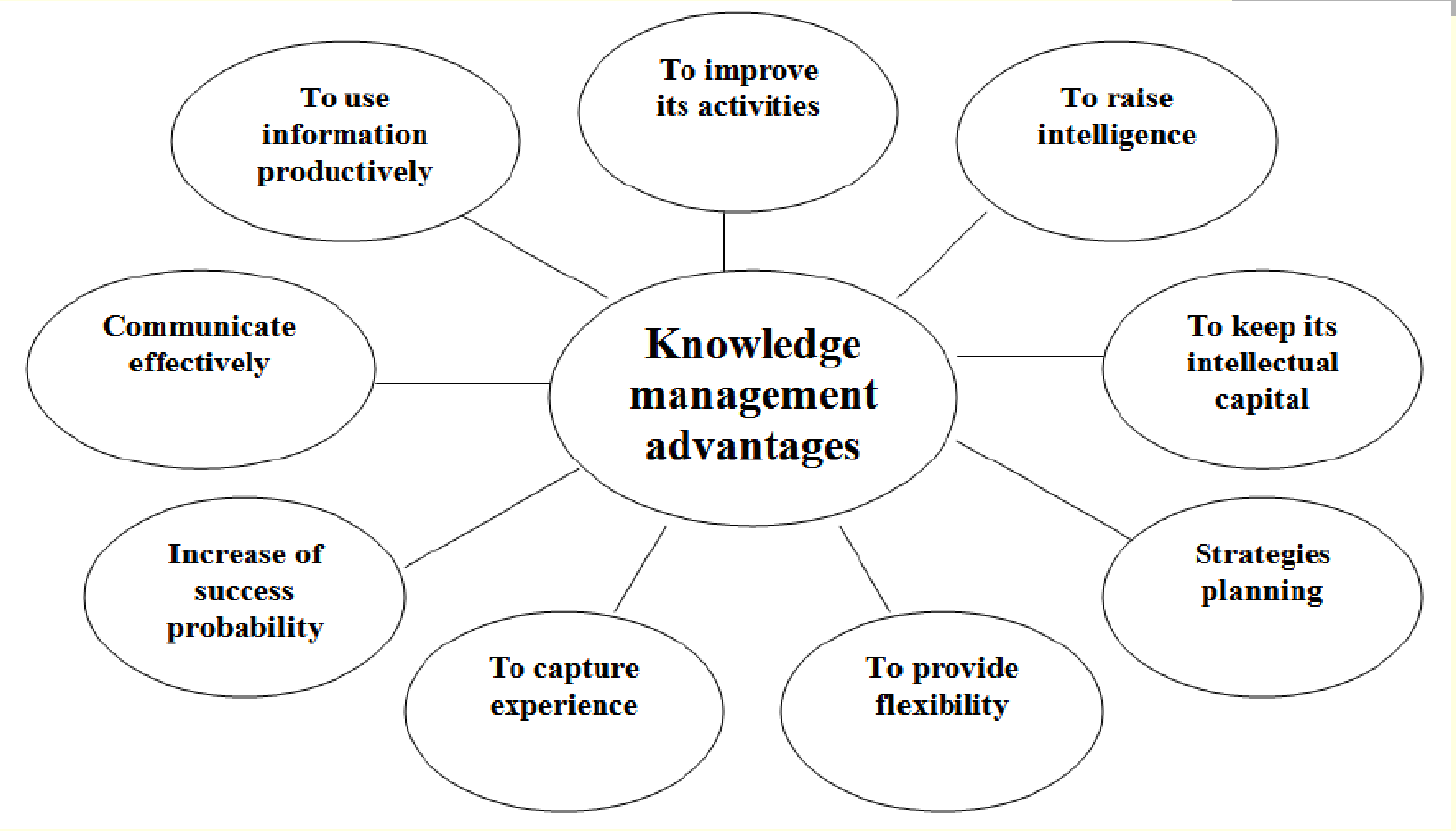
An example of a model of intelligence: seven types of intelligence according to Howard Gardner

The structure of the mind: the theory of multiple intelligences

https://www.verywellmind.com/gardners-theory-of-multiple-intelligences-2795161

- Visual-spatial.
- Linguistic-verbal.
- Logical-mathematical.
- Body-kinesthetic.
- Musical.
- Interpersonal.
- Intrapersonal.
- Naturalistic.

The structure of the management system

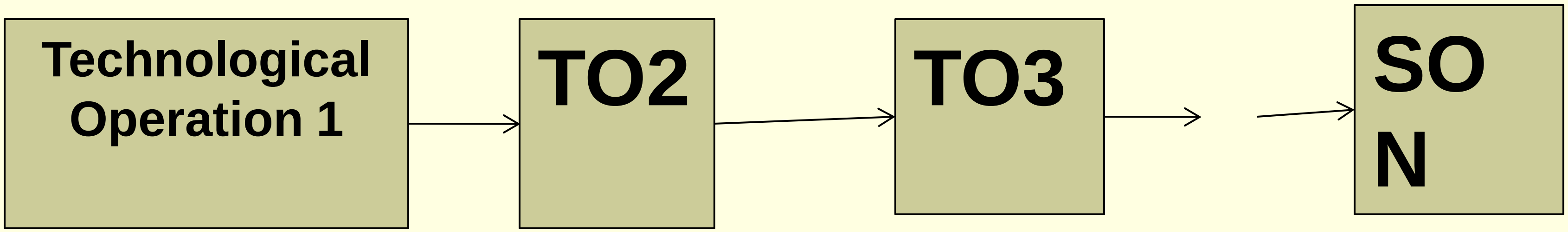


http://scholararticles.net/structure-of-knowledge-management/

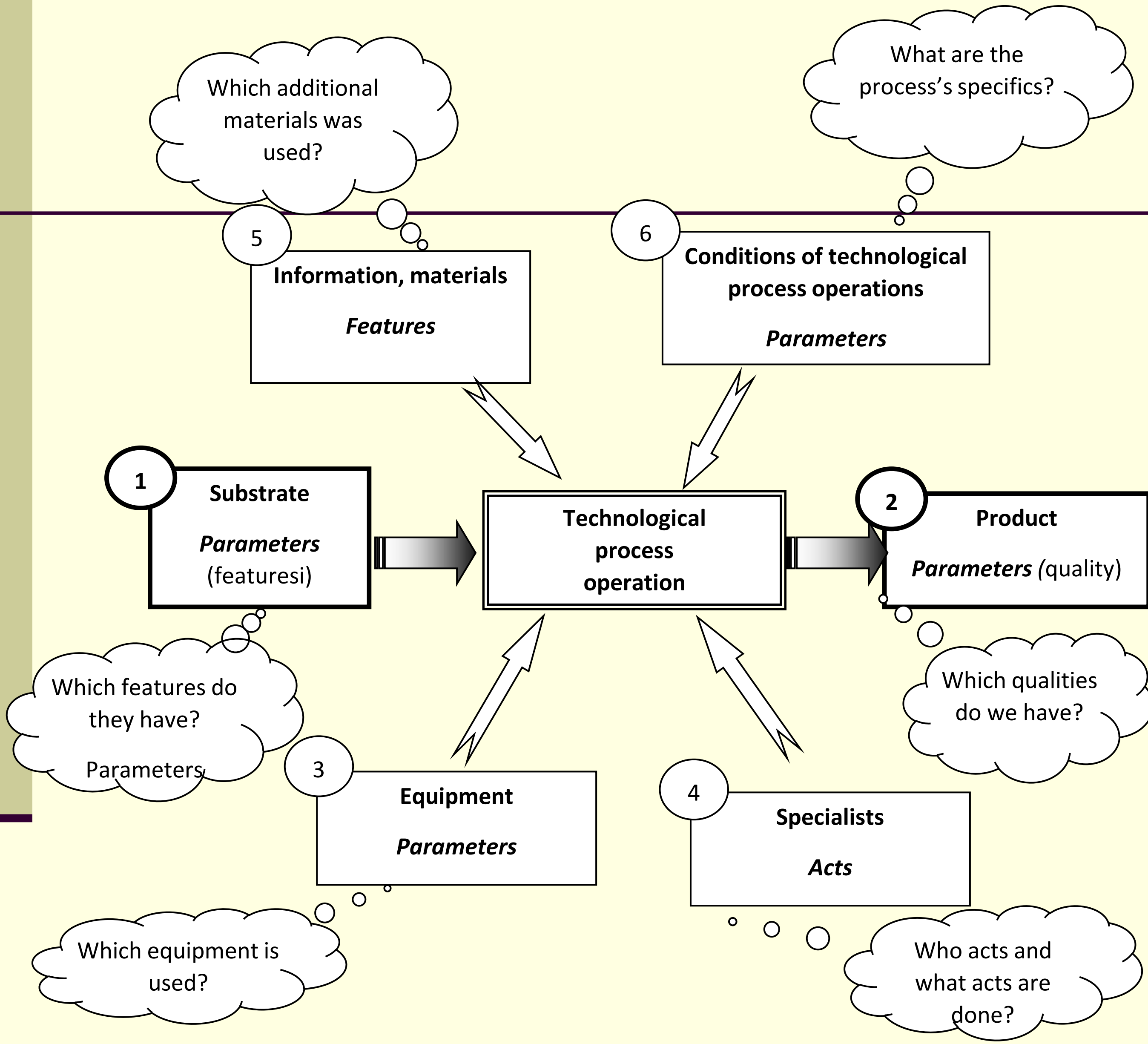
Technological models

- A model of technological operation.
- A model of technological process.

A model of technological process

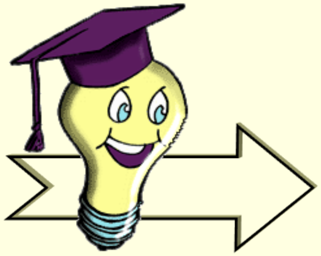


A model of technological operation



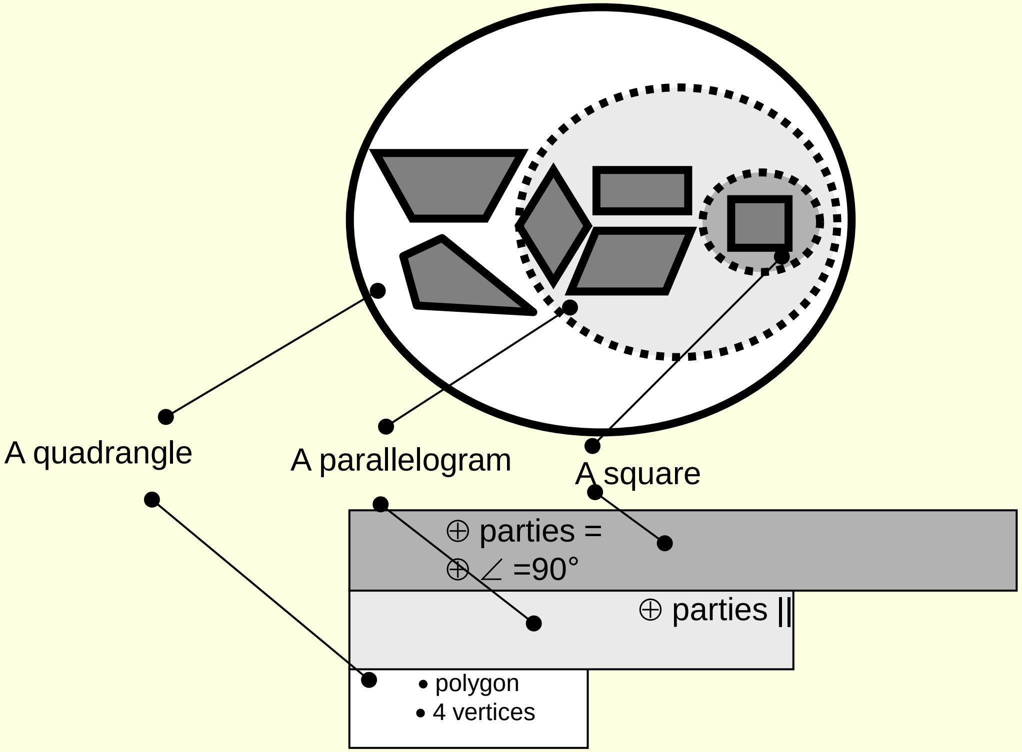
Models of human activity (mind work)

- Analysis.
- Synthesis → Art. → Designing.
- Rating.
- Memorization.
- Understanding.



A concept as a basic model

A concept is an opinion that reflects the general and essential properties of objects and phenomena.



Definition as a base model

Definition is a logical operation that reveals the meaning of a concept.

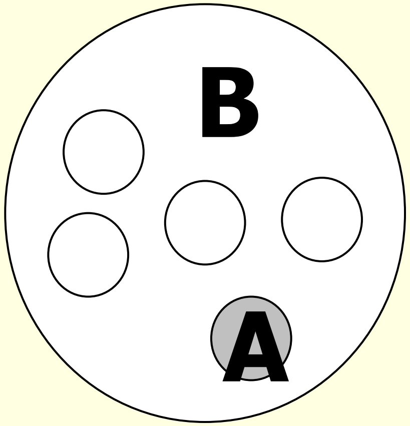
An explicit definition has the form:

A **is** **B**, **which** **C**

A — A defined concept

B — A generic concept

C — species signs

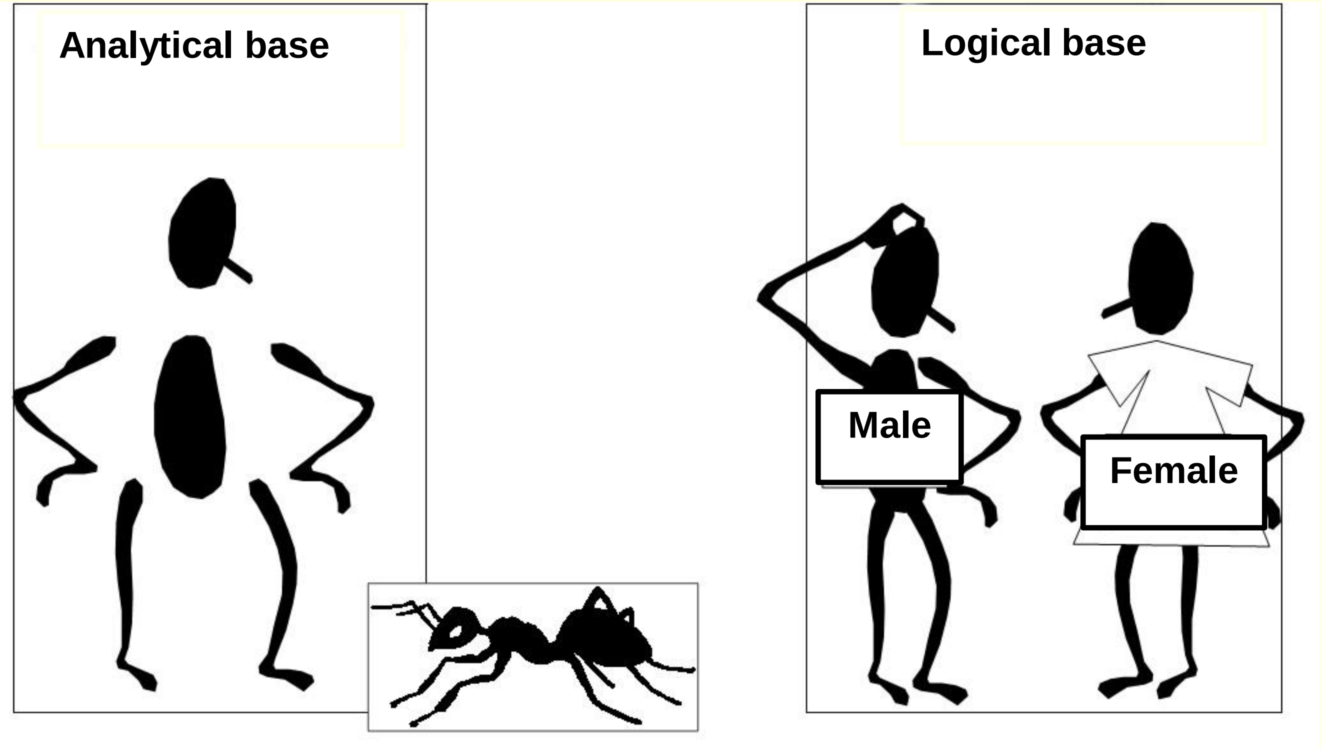


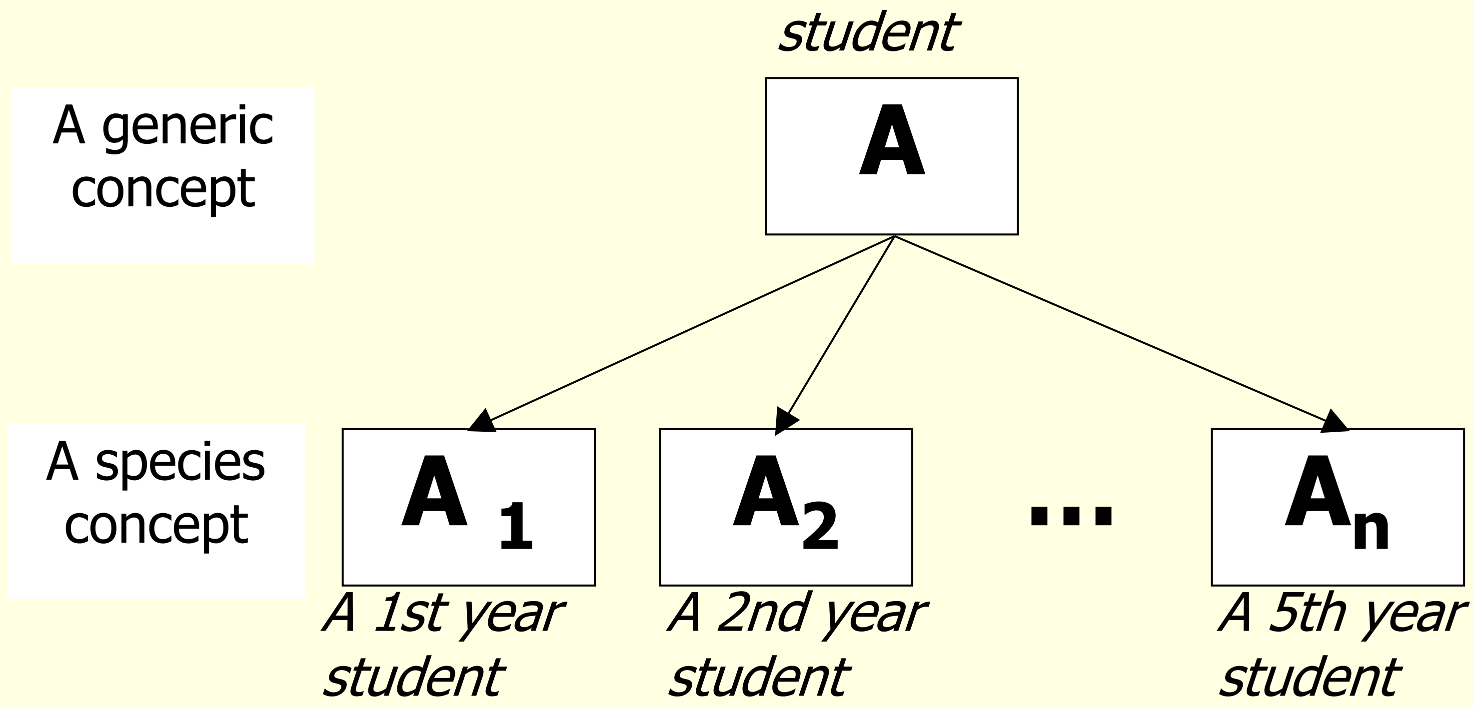
A book is a literary or scientific work that is intended to be printed as a separate published edition.

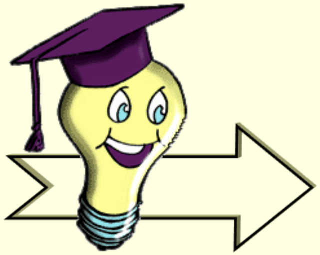
Book (in polygraphy) – one of the types of printed products: a non-periodical publication consisting of folded paper sheets or notebooks.

Classification

Classification is based on the:

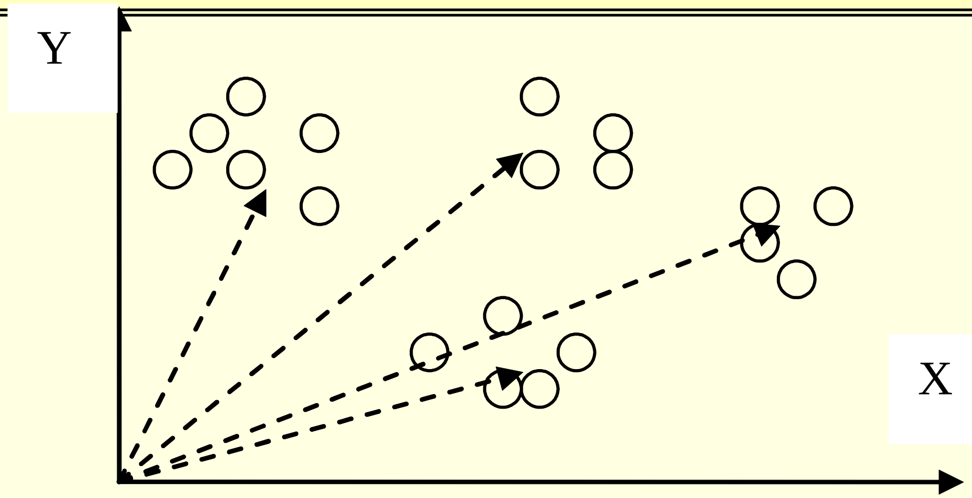



student
A generic concept
A
A species concept
A 1
A2
...
An
A 1st year student
A 2nd year student
A 5th year student



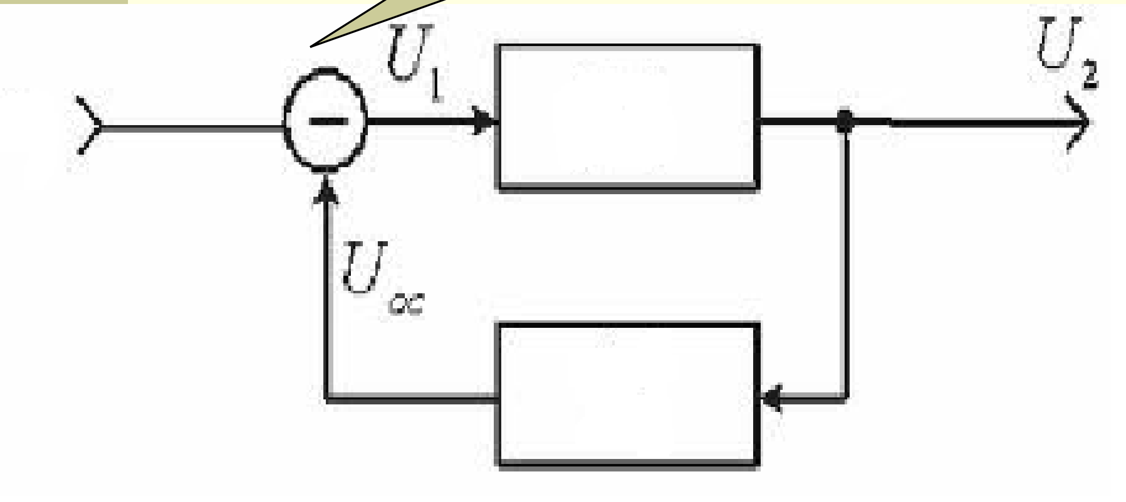
Grouping and clustering models

Subsets of objects are distinguished, which have the form of "compact" clusters of points in the metric space, where the distance between any two objects is defined.
These groupes **are called clusters.**

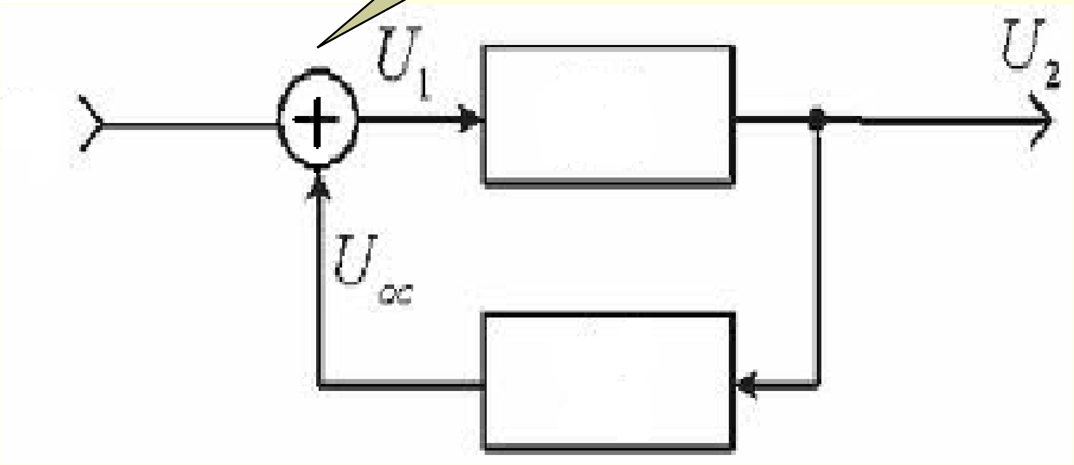


Cluster analysis is the process of dividing (classifying) a set of observed objects into subsets of closely related objects.

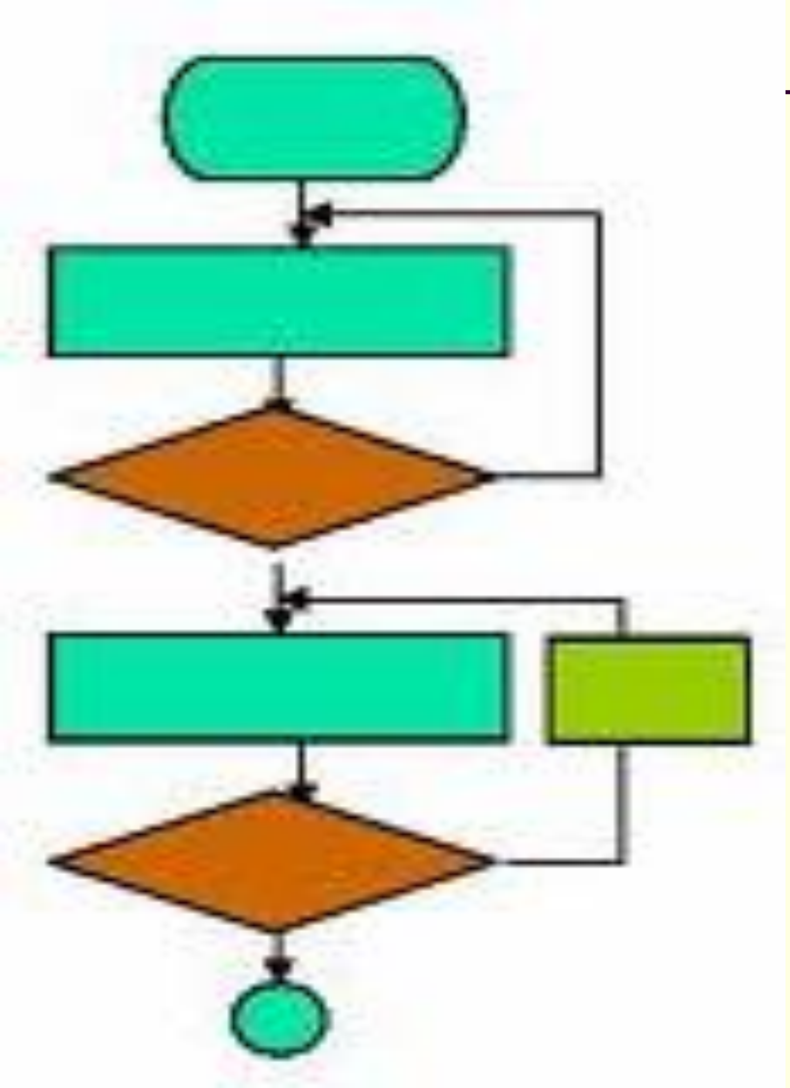
Negative feedback



Positive feedback

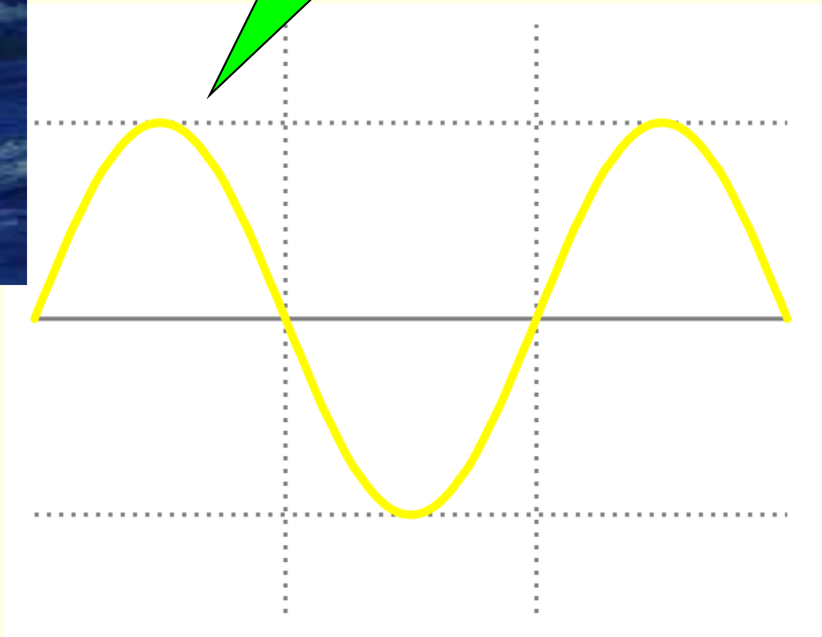


Algorithm



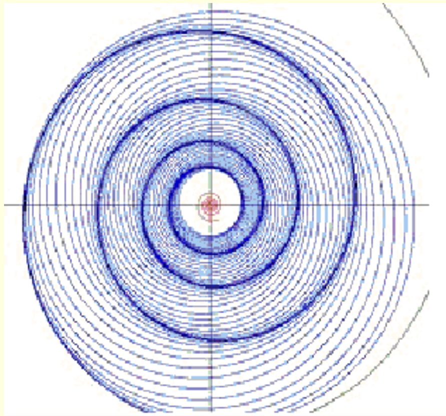
A real wave

A wave model

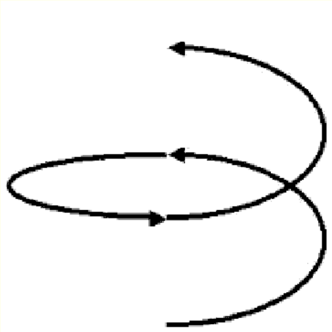


Nonlinear models of processes in the economy

Attractor



Spiral



A fractal model in computer graphics.

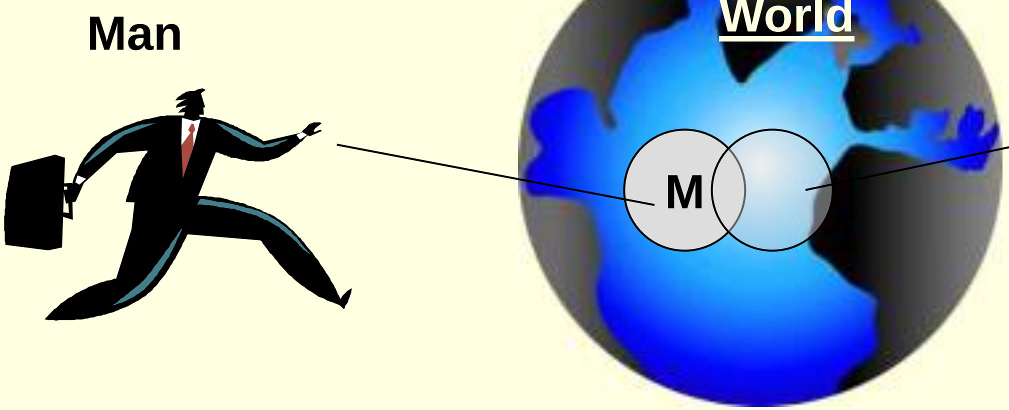
A fractal model of diffusion of innovations.

6.5. Linguistic expression of the Knowledge content

Language expression of the content of knowledge *is fundamentally different for different cultures (one of the theories):*

- **Western-analytical, exoteric** (open to all),
- **Eastern-synthetic, esoteric** (secret, available only to the initiated);
- **Slavic** – way of knowledge – word-centric, dialogic.

The Eastern path of the heart

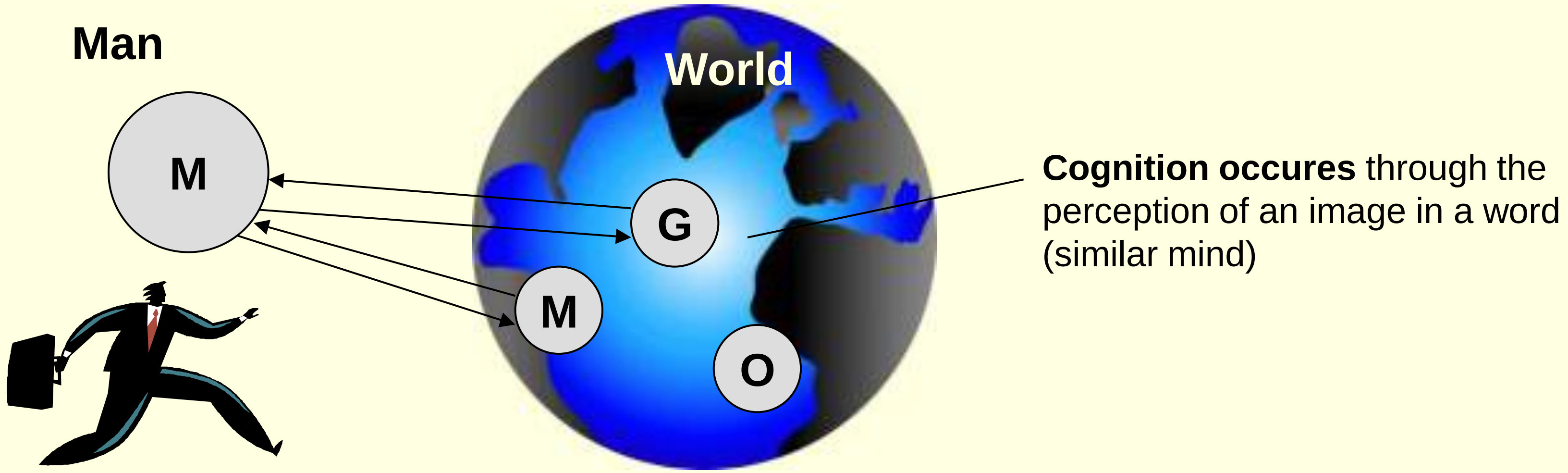


Knowledge is through mystical intuition.

A metaphor – Understanding the world through the dissolution of a person in the world

- consists **in dissolving a person** in the world;
- **comprehension of the world** with the help of mystical **intuition**, the result of which is indescribable and informationally unmeasurable.
- **The word** in the Eastern culture of knowledge can only **indicate the way** to achieve higher **knowledge** or express conclusions from it, but not this knowledge itself.

The Slavic way of the word

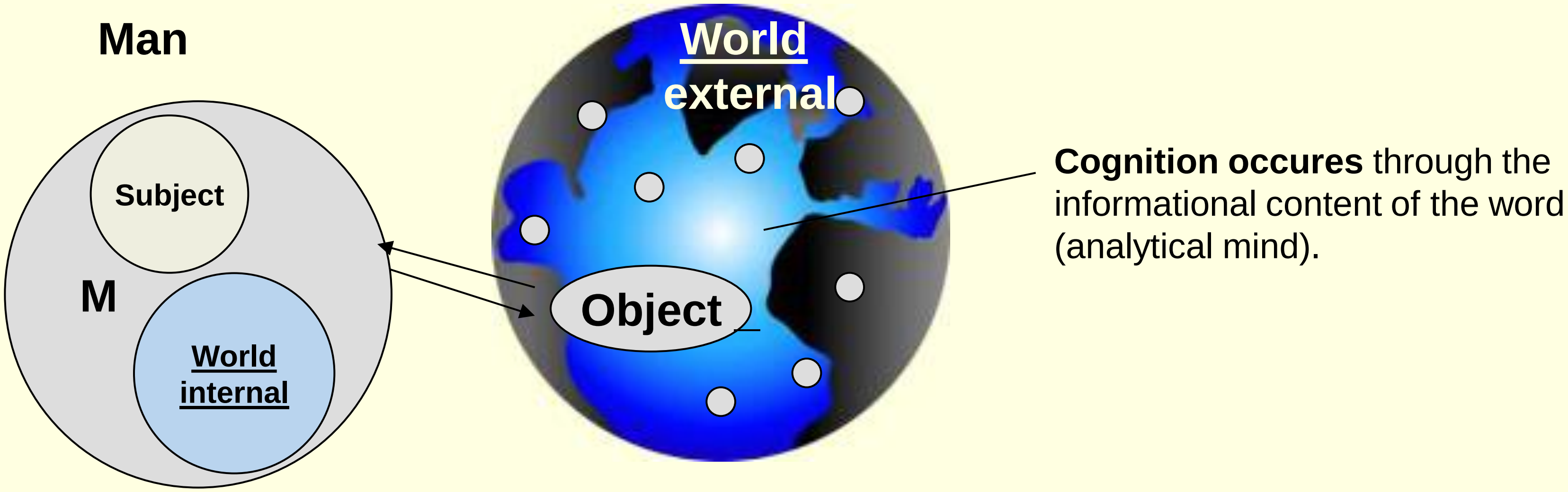


A metaphor – Understanding the world through communication with the Other

• consists not in the study of the object or the understanding of God in oneself, but in **the understanding of the world through communication with the Other person, God**);

• understanding of the world is carried out **through the perception** of an artistic **image** enclosed in a word.

The Western way of the mind



Metaphor – Understanding the world through an endless analytical process

- **distinguishes between** the inner and outer **worlds,** the object and the subject of knowledge;
- **implies** the mandatory **presence of words** as informative, symbolic carriers of concepts.

Slavic way of words:

• consists not in the study of the object or the understanding of God in oneself, but in **the understanding of the world through communication with the Other** (man, God);

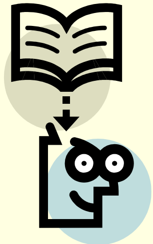
• understanding of the world is carried out **through the perception** of an artistic **image** contained in a word.

The Western way of mind:

• **distinguishes between** the inner and outer **worlds,** the object and the subject of knowledge;

• **implies** the mandatory **presence of words** as informative, symbolic carriers of concepts.

Verbal reasoning is a form of reflection *of individual and collective* ***intelligence.***

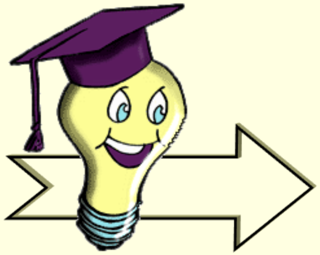


Thinking that monitors and controls the correctness of the sequential execution of all logical operations is called **discursive.**

Discourse *– a form of scientific oral or written language, which carries a developing thought, which is a discursive reasoning expressed in verbal form.*

Typology of scientific theories:

- **meaningful** (descriptive, empirical, informalized) **theories** using natural language;
- **mathematized** (formalized) **theories;**
- **hypothetical-deductive** theories are built in special formal languages.



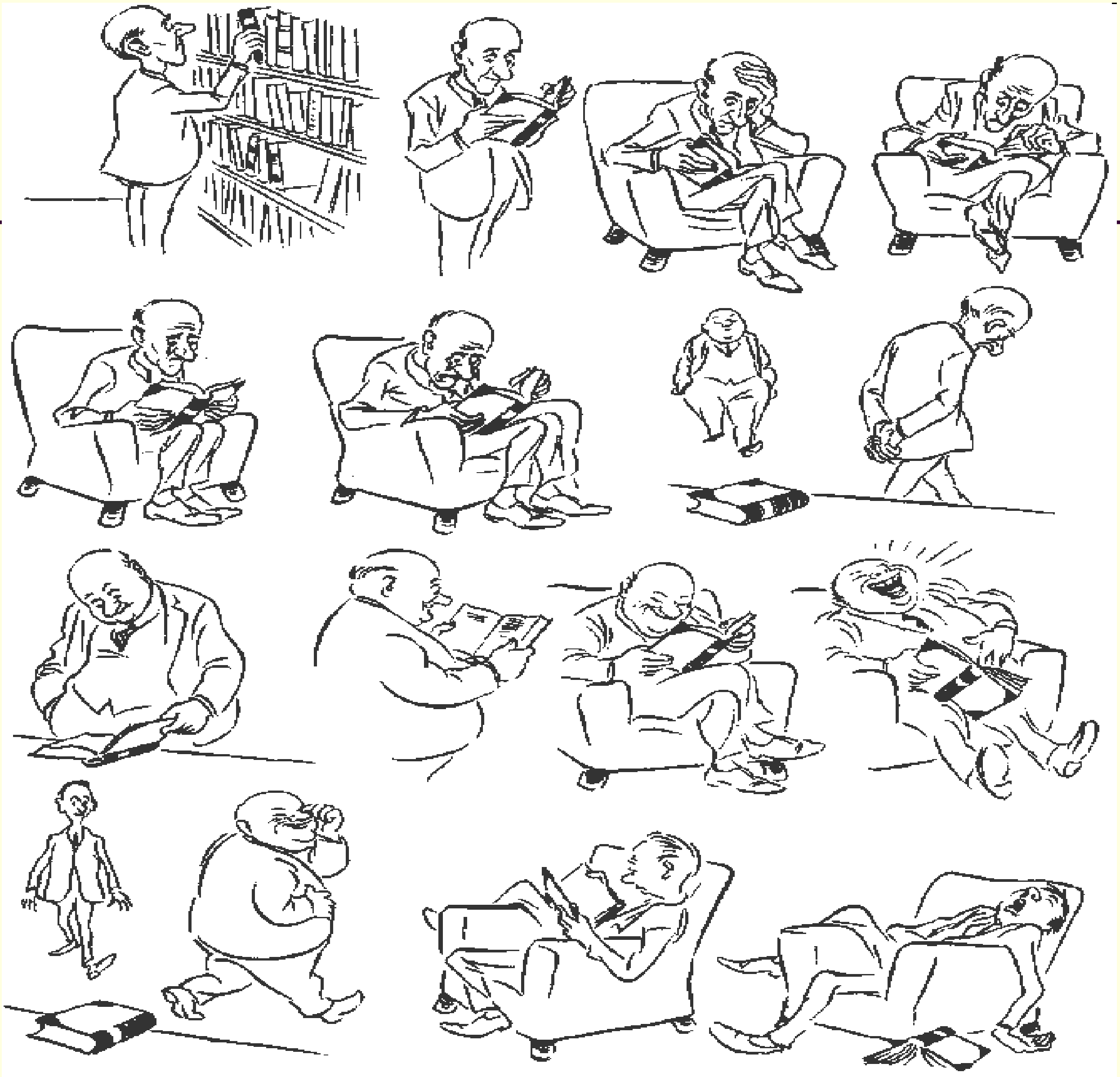
Models as an environment for modeling

A scientist has a desire to investigate the situation.

An experiment is a research method.

- A scientist tries to justify his opinion.
- A scientist is forced to take risks when he tries to represent the situation with the help of some model.
- An experiment is a way of introducing certain contingencies into a model in order to see how the model reacts to such changes.
- A scientist experiments on a model instead of conducting a natural experiment.

6.6. Metaphorical visual models (Relax)

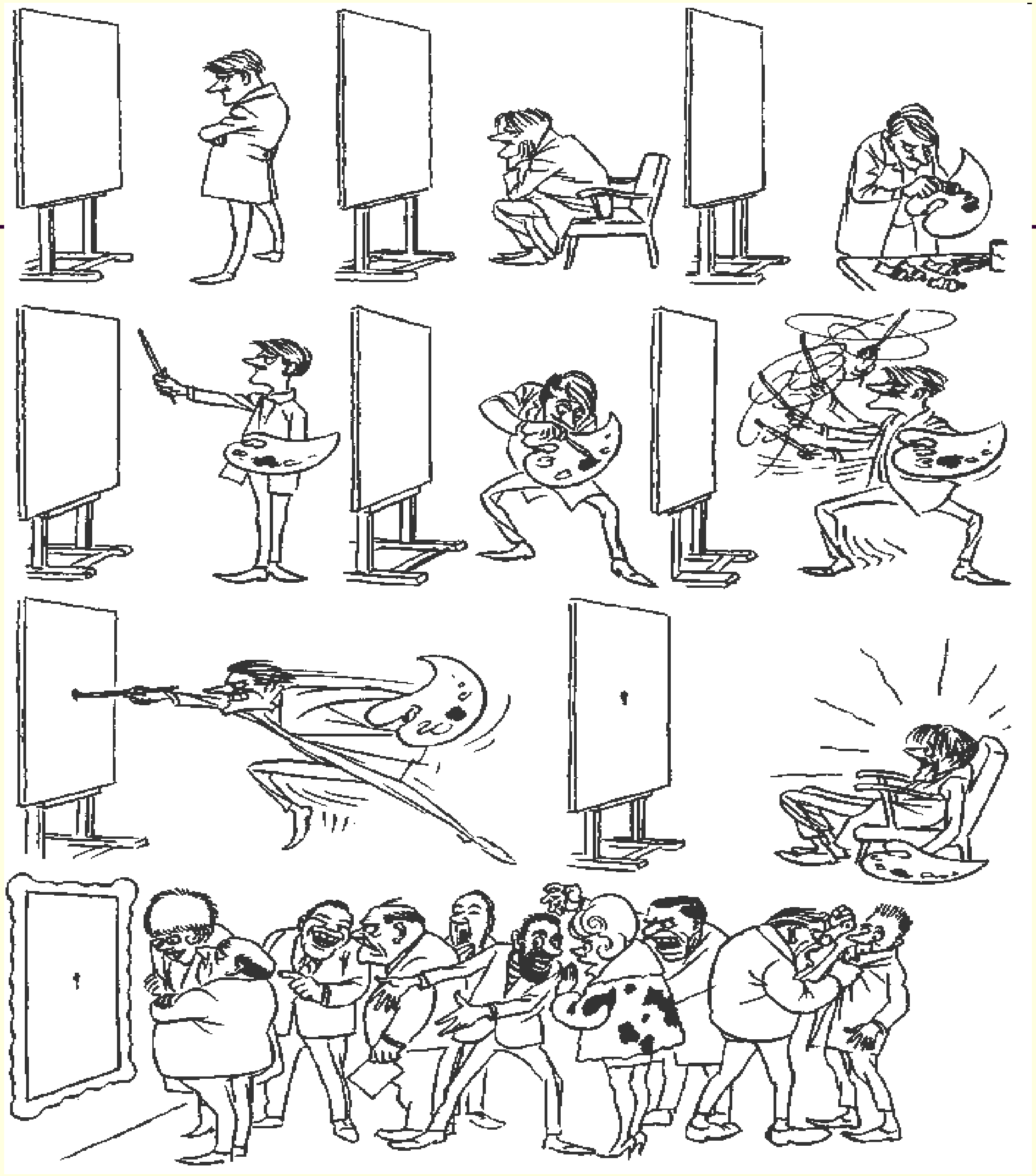


Readers of one book

Drawing by
Herluf Bidstrup

A phlegmatic person,
a choleric,
a sanguine,
a melancholic.

Peak



Drawing by Herluf Bidstrup

Control questions

1. Reveal the essence of the concept of a model.
2. Give the classification of models.
3. What are the features of cognitive and pragmatic models?
4. In what cases are static and dynamic models of economic objects and processes used?
5. What are abstract models and languages?
6. How is the quality of models determined and its assessed?
7. What is the basis for establishing the similarity between the model and the original?
8. What does the concept of model adequacy reflect? How are truth and models related?
9. What does the concept of dynamics of models mean?
10. Describe the conditions for building and using mathematical models.
11. Reveal the essence of the modeling method.
12. What features should be taken into account when modeling in economic research?
13. What is the essence of computer modeling?
14. Describe the linguistic expression of the content of knowledge for different cultures. What is their fundamental difference?
15. Give examples of basic knowledge presentation models.

The practical component

Objectives of the task:

- to acquire the skills of formulating the topic, goal and tasks of scientific research in their logical relationship;
- to learn to describe the expected scientific results of research work;
- to use supporting material;
- as an example of formulating the topic, goal, tasks and results of scientific research, Example 6.12 is given.

Example 6.12. Topic: "Models of enterprise information resource management"

- This example presents the results of a scientific study carried out by the author of the textbook and his graduate student.
- What models did you see in the material below?
- What basic models did the authors use in their research?
- How can you evaluate the quality of these models?

The rapid development *of the information economy* brought a specific resource – **information** – **into the ranks of economic resources**.

In the conditions of a new type of economy, **the information resource (IR)** is a significant factor in the efficiency of enterprises.

According to the conducted research, it was found that **the information resource of the enterprise** is:

the type of resources of the enterprise, which has *an information basis*, is produced at the enterprise or in the external environment, can exist on carriers of different nature, such as knowledge, people's skills, information systems, knowledge bases, printed materials, technologies, software products and such that lies in based on the production and intellectual activity of both enterprise personnel and agents of the external environment associated with the enterprise to achieve the goals of economic or social activity .

In the process of functioning of the enterprise, *information resources are inextricably linked with* **information work** performed by workers .

Information work is a practical or mental activity of an individual, a team, and the entire enterprise as a whole, which is performed individually or with the help of technical means to obtain, process, and use IP to ensure the goals of economic or social activity **.**

The analysis of the role *of information work* in the process of using *information resources* made it possible to build a generalized model **of the information triad** , as such, consisting of three basic elements: IP of the enterprise , employees of the enterprise , information work.

In order to effectively perform information work at the enterprise, workers must have certain personal and professional qualities.

Analysis of the peculiarities of the performance of various types of work by workers in the course of ensuring the functioning of business processes at the enterprise made it possible to conclude that the effect of *information resources* at the enterprise is manifested through **the results of** *information work* performed by workers .

Information resource → **Information work** → **The result of the execution of the business process**

In order to manage *information resources*, the carriers of which are **personnel** , it is proposed to use a generalized **model of the competences of the company's employees in information work.**

The model of competencies in information work includes:

- groups of competences;
- descriptors of competence groups;
- names of competencies;
- the level of significance of competencies for employers;
- the level of manifestation of competences among employees.

< GC, Cj, RCj, VSij >

- **GC** - a group of competencies and its descriptors (cognitive, activity, value-motivational, related to the peculiarities of perception);
- **Cj** - j-competence and its descriptors;
- **RCj** - descriptor of the importance of j-competence for employers;
- **VSij** is a descriptor of the degree of manifestation of j-competence in the i-th employee.

The analysis of the essence of the company's *information activity* showed that to ensure it, workers must constantly perform a wide range of information work.

In the process *of information work,* not only the realization of the goals of business processes, but also transformation takes place *information resource*, i.e. its development.

The study of the specifics of the use of various types *of information resources* in the process of performing *information work* showed that for the effective management of IRB, it is necessary to conduct a detailed analysis of the content of information work performed at the enterprise.

To analyze and manage **the content of information works, a model of the structure of the content of information works** in the form of an information-cognitive map (ICM)

The purpose of the analysis of **the IKK model** is the formation of **a database of IKK templates** for the most important, as well as frequently performed *informational works*. **Templates of information and cognitive maps** are collected in a single repository, which is used by an information worker (an employee who performs information work).

IKK templates are **a mental representation of the IKK structure** and serve as a means of supporting the process of IRB implementation by company employees.

In order to manage the company's IP, the results of information work together with a package of IP necessary for their implementation are entered in **the portfolio of information work**.

7. Organization of scientific activity and scientific research

System elements of the topic

7.1. Scientific activity, its varieties

7.2. A contract for scientific activity

7.2.1. A draft of applications on the state financing of scientific research

7.2.2. Planning of scientific research

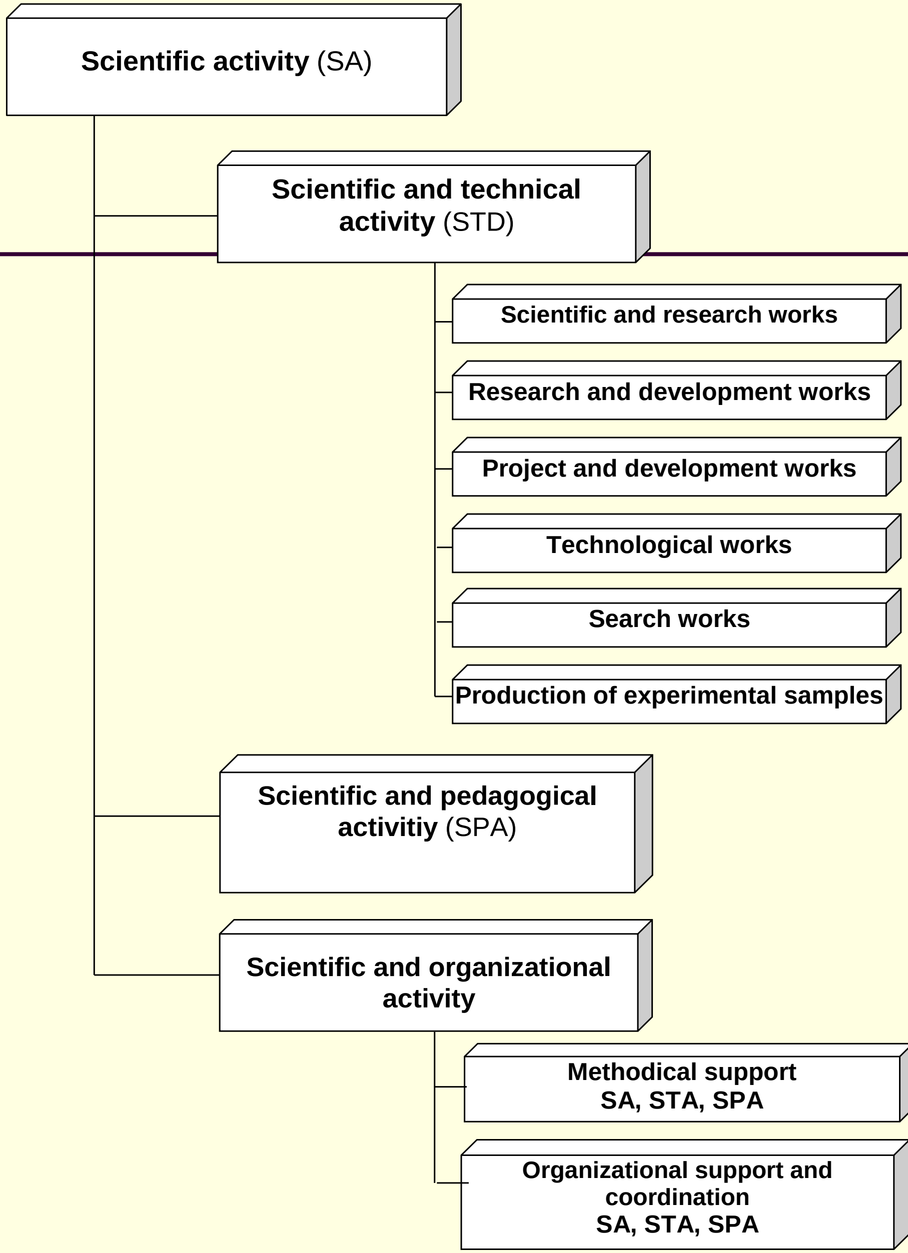
7.3. Assesment of scientific works

7.3.1. Dissertation self checking

7.1. Scientific activity and its types

- **Scientific activity (SA)** is an intellectual creative activity aimed at obtaining and using new knowledge. The main forms of scientific activity are fundamental and applied scientific research.
- **Scientific and technical activity** is intellectual creative activity aimed at **obtaining and using new knowledge in all fields of engineering and technology.**
- **Scientific and pedagogical activity** is **pedagogical activity in institutions of higher education and** post-graduate education *institutions of 3rd – 4th accreditation levels, related to scientific and (or) scientific and technical activities.*
- **Scientific and organizational activity** is activity aimed at methodical, organizational support and coordination of scientific, scientific-technical and scientific-pedagogical activities.

Types of scientific activity



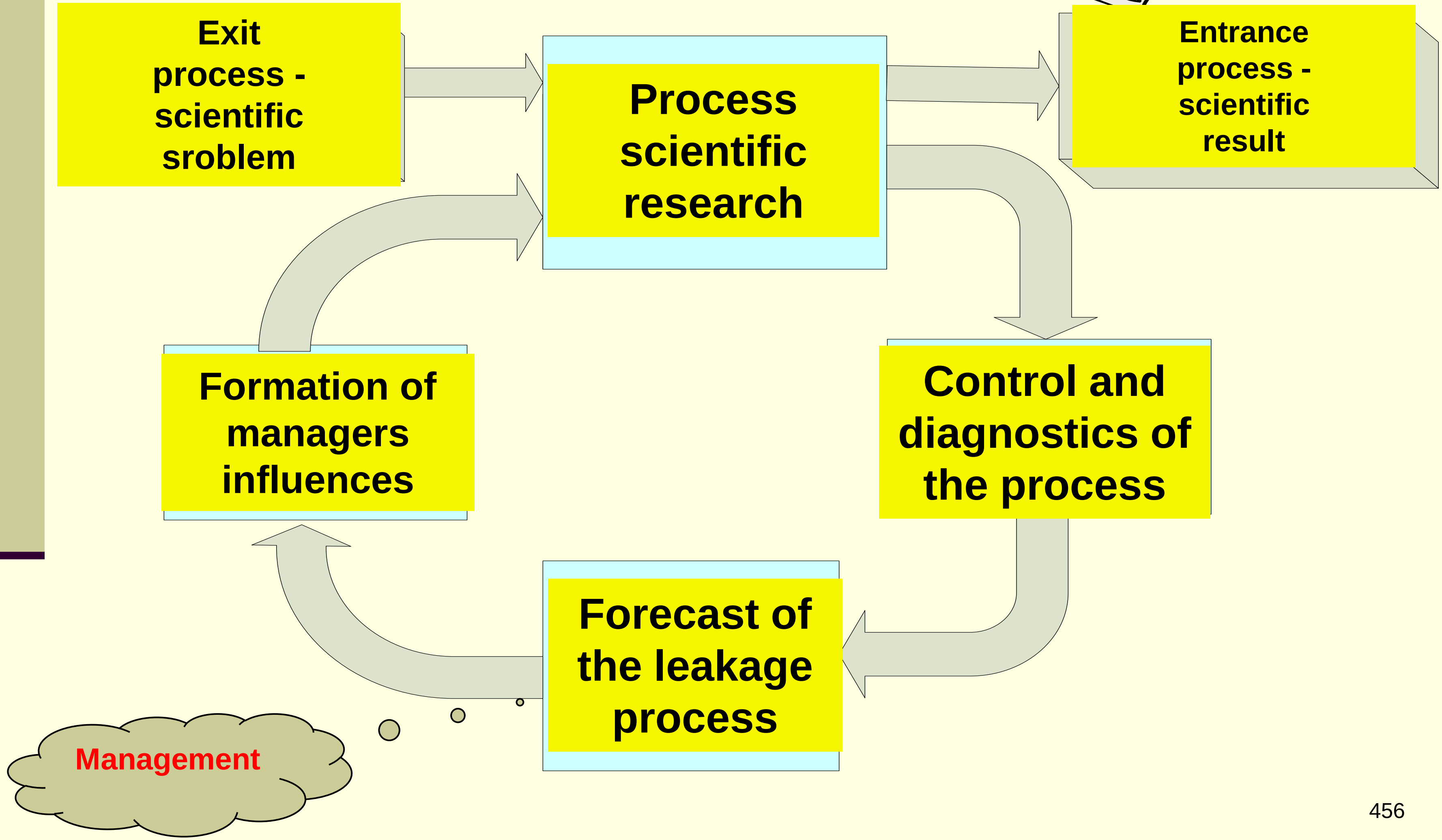
Types of scientific research

- **Basic research** is research started mainly to produce new knowledge regardless of application prospects.
- **Applied research** is researh aimed mainly at applying new knowledge to achieve practical goals, solve specific tasks.
- **Monodisciplinary research** is conducted within the framework of a separate science.
- **Interdisciplinary research** requires the participation of specialists from different fields and is conducted at the intersection of several scientific disciplines.
- **Comprehensive research** is carried out using a system of methods and techniques, with the help of which scientists seek to cover the maximum (or optimal) possible number of significant parameters of the investigated reality.
- **Analytical** research is aimed at identifying one, in the researcher's opinion, the most significant aspect of reality.
- **Critical research** is conducted with the aim of refuting an existing theory, model, hypothesis, law, etc. or to test which of these two alternative hypotheses more accurately predicts reality. Critical research is conducted in those areas where a rich theoretical and empirical stock of knowledge has been accumulated and there are proven methods for conducting experiments.

Types of scientific research
(continued)

- **Probing research** is aimed at determining the perspective of work on the topic, finding ways to solve scientific problems .
- **A clarifying study**. This is the most common type of research. Its purpose is to establish the limits within which the theory predicts facts and empirical regularities. Usually, in comparison with the initial experimental sample, the conditions of conducting the research, the object, and the method change. In this way, it is registered to which area of reality the previously acquired theoretical knowledge applies.
- **Reproducible research**. Its purpose is an exact repetition of the experiment of its predecessors to determine the reliability and objectivity of the results obtained. The results of any study must be repeated in the course of a similar experiment conducted by another scientist with the appropriate competence. Reproducible research is the basis of all science. Therefore, the method and specific technique of the experiment should be intersubjective, that is, the operations carried out during the study should be reproduced by any qualified researcher.
- **Development is** scientific research that puts into practice the results of specific fundamental and applied research.

Management of the scientific research process



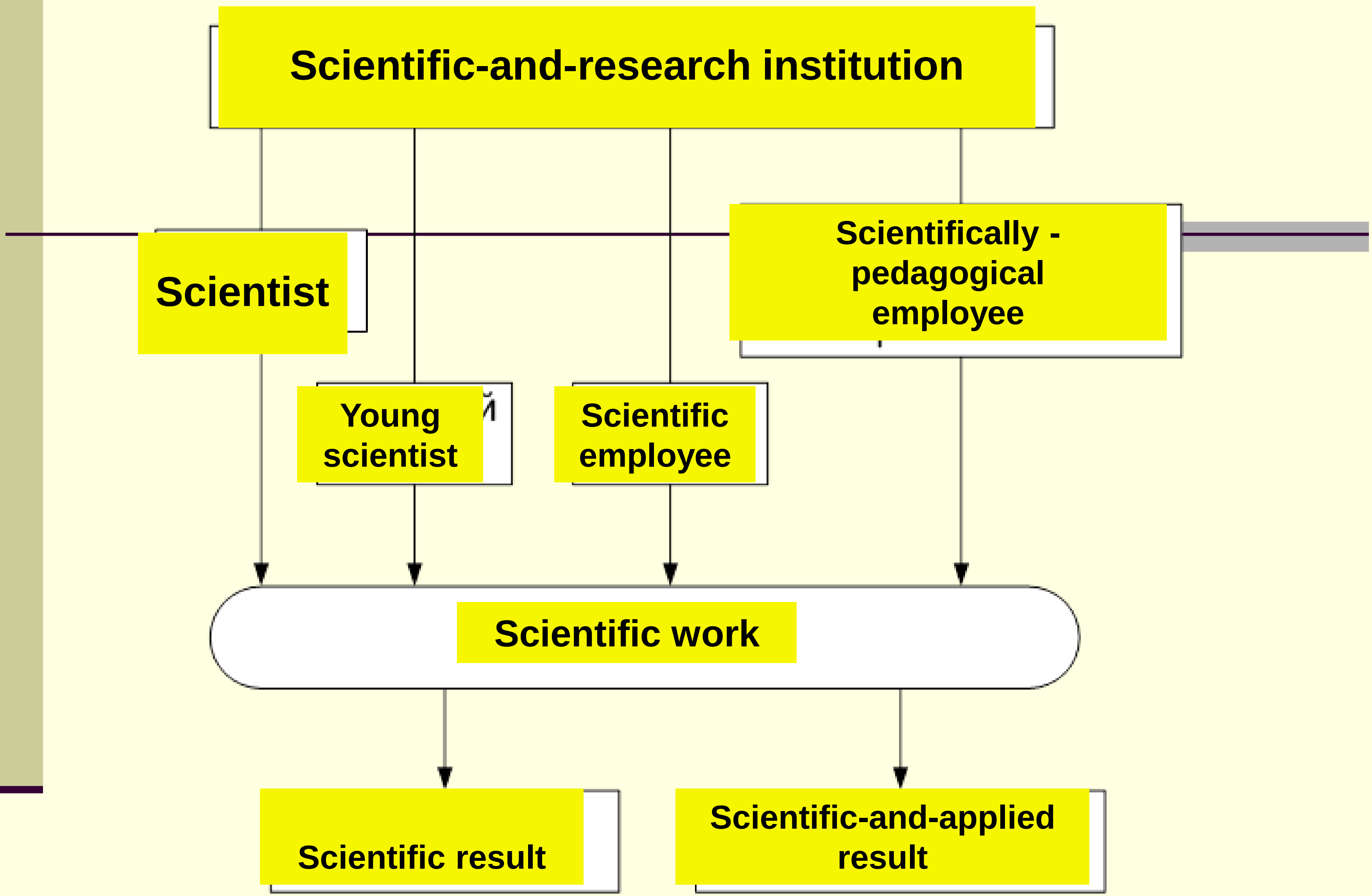
Levels of scientific research organization

- Organization of **association activities** of **scientific institutions** in the system of academies, ministries.
- Organization of activities **of a scientific institution**.
- organization of the work **of units** of the scientific institution (primary scientific teams.
- Organization of work **of a scientific worker.**

The organization of scientific research is a system of interconnected **structures and functions** that <u>ensure</u> the optimal mode and continuous improvement of scientific work with the aim of obtaining the best results.

Subjects of scientific activity in Ukraine:

- Scientists;
- scientific and pedagogical workers;
- scientific institutions;
- scientific organizations;
- higher educational institutions of 3rd -4th levels of accreditation;
- public organizations in scientific and scientific and technical activities



Participants and results of scientific activity

Definition

- **A scientist** is a person who has a full higher education and conducts fundamental and (or) applied scientific research and obtains scientific and (or) scientific and technical results.
- **A scientist** is a person who is engaged in scientific activities, according to the main place of work or in accordance with the employment contract, and has the appropriate qualification, regardless of the presence of a scientific degree or scientific title, confirmed by the results of attestation.
- **A young scientist** is a scientist under the age of 35.
- **A scientific-pedagogical worker** is a scientist who, by his main place of work, **is engaged in professional pedagogical and scientific** or scientific-technical ***activities*** in a higher education institution.

Forms of organization of scientific research in Ukraine

Traditional forms of scientific and research organization in Ukraine

- **Enterprise**: Scientific and technical research enterprises
- **Industry**: Industry scientific research
- **Academic**: Academy of sciences institution
- **University**

Scientific and technical research enterprises + Industry scientific research → **Research and development association**

New forms based on the practices of other countries

- *Innovative spinoff companies*
- *Project companies*
- *Project teams*
- *...*

Advantages of project teams

A new form of scientific work is being developed – a project team (or a creative team) – operational groups (teams of specialists) formed by large owners of capital.

- A flexible reward system **stimulates and reveals the creative potential of participating scient*ists***; scientists are free from the interference of financial services, ("non-profit groups").

- Informal association of scientists make it possible **to obtain unique combinations of specialists.** Such groups are the most competitive in solving interdisciplinary problems.

The practice of solving scientific and technical problems shows that

- 50 % of the most promising ideas for solving problems come from people who are very distantly related to them;
- 30 % come from persons with a related profession;
- less than 20 % of ideas are from professionals.

The National Academy of Sciences of Ukraine

* Is the highest scientific organization of Ukraine, which organizes and carries out *fundamental and applied research* on the most important problems *of natural, technical and humanitarian sciences*, as well as coordinates the implementation of fundamental research in scientific institutions and organizations regardless of ownership.

The structure of the National Academy of Sciences of Ukraine

- **The section of physical, technical and mathematical sciences.**
- The section bureau.
- The department of mathematics.
- The department of Informatics.
- The department of mechanics.
- The department of physics and astronomy.
- The department of earth sciences.
- The department of physical and technical problems of materials science.
- The department of physical and technical problems of energy.
- The department of nuclear physics and energy.

The structure of the National Academy of Sciences of Ukraine (the end)

- **The section of chemical and biological sciences**
- The section bureau.
- The department of chemistry.
- The department of biochemistry, physiology and molecular biology.
- The department of general biology.
- **The section of social sciences and humanities**
- The section bureau.
- **The department of economics**
- The department of history, philosophy and law.
- The department of literature, language and art history.

7.2. Contract for scientific activity

- **State budget RDPs** are *RDPs that are financed from funds allocated to a research institution through the institution to which it is subordinate.*

- **Economic contractual SRs** *are SRs that are financed by enterprises and departments of interested branches of the national economy on the basis of specially concluded economic contracts.*

- **Grants** *(from the Latin Grantees – a gift) are funds transferred free of charge by a grantor (grantor, sponsor, donor) to a private person or non-commercial (non-profit) organization and intended for the implementation of specific programs in the field of education, art, culture, environmental protection, as well as for conducting specific scientific research.*

The stages of scientific research:

the first stage is a general familiarization with the scientific problem, the choice of the research topic, the formation of research goals and tasks, the drafting of the program and the plan for program implementation, the initial determination of the expected effect from the implementation;

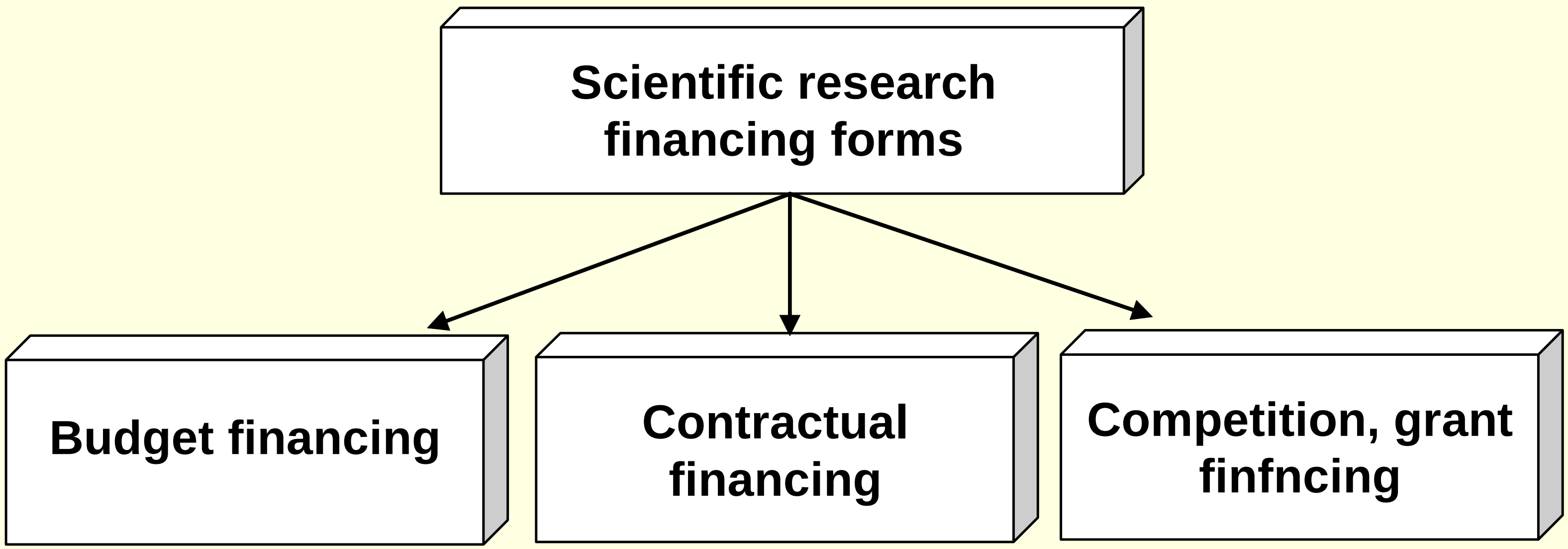
the second stage is theoretical studies;

the third stage is experimental research;

the fourth stage is analysis and presentation of the results of scientific research: processing and analysis of information, generalization of processed information;

the fifth stage is the introduction of research results into the production or practice of education, determination of the economic effect.

Forms of funding of research activities



The structure of the contract for the implementation of the research financing from state budget

Agreement No. ______ for the creation of scientific and technical products.

- **1. The subject of the contract.**
- **2. The cost of works and procedure of calculations.**
- **3. The procedure for submission and acceptance of works.**
- **4. Liabilities of the parties.**
- **5. Other conditions.**
- **6 . Annexes to this contract:**
  - 6.1. The calendar plan.
  - 6.2. The protocol for agreeing the contractual price for scientific and technical work.
  - 6.3. The technical task.
- **7. The term of validity of the contract and legal addresses of the parties.**

Annexes to the contract

Appendix No. 1
to contract No. _______
dated "___"______ 200

Calendar plan

Name of the contract

(name of scientific and technical products)

No n/ n	Name of stages	Reporting documents	Term implementation	Cost, UAH
1				
2				
3				
4				

Performer: **Customer:**

Annexes to the contract (the end)

The technical task

for carrying out research work

1. General characteristics.
2. The Purpose of the scientific and technical product.
3. Requirements for the developed product.
4. Composition and content of works on the creation of a scientific-technical product.
5. Control and reception procedure.
6. Requirements for documentation.

The structure of the annotated report on the completed research work

1. The theme of the research.
2. The terms of execution.
3. The amount of funds allocated for the implementation of the SR is UAH _________ thousand.
4. The object and subject of research.
5. The purpose of research work.
6. The main tasks, tasks or problems that had to be solved to achieve the goal.
7. Description of the scientific research process.
8. Scientific novelty and significance of the obtained scientific results.
9. Distinguishing features and superiority of the obtained results (products) over domestic or foreign analogues or prototypes.
10. Practical value of results and products..
11. Use of work results in the educational process.
12. Effectiveness of scientific research work
13. Bibliographic list of monographs, textbooks, manuals, dictionaries, handbooks, scientific articles, other publications; filed applications and received patents; topics of dissertations defended and submitted for consideration to the specialized academic council.
14. The number of personnel who participated in the execution of the SR.
15. Decision of the scientific (scientific and technical) council.

The project of fundamental/applied research at the expense of the state budget

Project name: ____________________________________ ( )

Terms of execution (years): with___by _

Amount of financing: UAH __ thousand, in particular for __ year : UAH __ thousand.

1. Abstract (up to 15 lines).
2. Research problems (up to 30 lines).
3. Purpose and main tasks of the project (up to 30 lines).
4. Problem research status (up to 30 lines).
5. Methods, approaches, ideas, working hypotheses proposed for solving the project tasks (up to 30 lines).
6. Expected results of project implementation and their scientific novelty (up to 40 lines).
7. Work of the authors on the topic of the project (for the last 5 years).
8. Expected use of results obtained (up to 30 lines).
9. Stages of work.
10. Project executors (with payment within the scope of the request).
11. Availability of the material and technical base for implementation of the project.

State standards, in accordance with which registration materials are drawn up

- **DSTU 3008-95.** The "structure and rules of registration. Documentation. Reports in the field of science and technology".

- **DSTU 3582–97.** The "information and documentation. Abbreviations of words in the Ukrainian language in the bibliographic description. General requirements and rules“.

- **DSTU 7.1-2006.** The "system of information, library and publishing standards. Bibliographic record. Bibliographic description. General requirements and rules of drafting".

- **DSTU 3278.** The "system of development and supply of products for production“.

7.3. Examination of scientific products

Typical requirements for reviewing scientific articles

1. The goal of peer review is to improve the quality of scientific articles published in the journal by evaluating materials by highly qualified experts.

2. The review procedure is anonymous for both the reviewer and the authors and is carried out by two independent reviewers (double "blind" review).

3. All reviewers must comply with the requirements for ethics in scientific publications of the Committee on Ethics in Publications and be objective and impartial.

The review covers the following issues:

The author must first think about these questions

- whether the content of the article corresponds to the topic stated in the title;
- whether the content of the article corresponds to the thematic areas of the magazine;
- whether the content of the article has a certain novelty;
- whether the article corresponds to the scientific level of the journal;
- whether it is appropriate to publish the article taking into account the previously published literature on this issue and whether it is interesting for a wide range of readers;
- what exactly the positive sides and shortcomings of the article are, what corrections and additions should be made by the author (if any).

An example of requirements for a review of an article

1. Reviewing is carried out according to the principle of two-way anonymous ("blind"), peer review (double blind) review.
2. All accepted author's materials (manuscripts) are subjected to "depersonalization" (removal of author's affiliation) for further submission for review.
3. Reviewing of manuscripts is carried out by engaged highly qualified specialists (reviewers), whose names are not disclosed.
4. Reviewers have no right to make copies of manuscripts for use in personal research and transfer manuscripts (or part of a manuscript) for review to another person in accordance with the ethical norms and requirements imposed by the Publishing House **on reviewers.**

The review should reflect an expert assessment of the quality of the manuscript, namely:

- correspondence of the content of the manuscript to its title;
- analysis and assessment of the scientific level, novelty, significance and relevance of the topic (problem); theoretical or applied significance of the research;
- correspondence of the methods, recommendations and research results used by the author to modern achievements of science and practice;
- reliability of the stated facts; complete disclosure of the topic;
- expediency and reasonableness of the presence of tables, graphs, and other illustrative materials in the manuscript;
- correlation of the author's conclusions with existing scientific concepts;

Assesment of the manuscript quality (the end)

- argumentation of the presentation and conclusions, reliability and validity of conclusions;
- assessment of the personal contribution of the author of the manuscript to the solution of the researched topic (problem);
- correspondence of the language, style and logic of the presentation to the scientific nature of the manuscript, availability of references to used literature and other sources of information, the presence of shortcomings, inaccuracies and mistakes made by the author of the manuscript.

7.3.1. The dissertation self-checking algorithm includes the following stages

- Analysis of the name of the dissertation.
- Identification and definition of the object, subject and purpose of the research.
- Analysis of each scientific result for novelty, reliability, practical significance, priority.
- Analysis of each conclusion from the sections for constructiveness and novelty.
- Analysis of mathematical models for correctness.
- Analysis of compliance of publications and approvals with requirements.
- Analysis of conclusion (conclusions).
- Analysis of the correctness of execution of acts of implementation.
- Checking the correctness of links.
- Analysis of correctness of bibliographic description of literary sources.

Analysis of scientific results

Each scientific result must be evaluated by the applicant as if he were the opponent of his dissertation and for each result, note:

- a brief summary of the scientific result;
- the novelty of the result;
- reliability of the result;
- practical significance;
- the source in which the result is published and the justification for the priority of the result.

The structure of the brief conclusions to the section is as follows

- The essence of the scientific result.
- The novelty of the scientific result.
- The reliability of the scientific result.
- Practical significance of the scientific result.
- The result is published in [(...)].
- Priority publications are [(...)].

Publication of dissertations and reviews of official opponents

Order of the Ministry of Education and Science of Ukraine dated 07.14.2015 No. 758

- On the official website of the Higher Education Institution (scientific institution), whose specialized academic council accepted the dissertation for defense, in the section containing information about the work of the council, the following are posted in reading mode:
- a copy of the dissertation in electronic form no later than 10 calendar days before the date of the dissertation defense indicated in the abstract;
- reviews of official opponents in electronic form;
- abstract of theses;
- materials are kept publicly available on the official website of the higher educational institution (scientific institution) for three months from the date of issuance of the diploma of Doctor of Philosophy or Doctor of Sciences.

Control questions

1. Describe the essence of the concept of scientific activity, its varieties.
2. Who are the subjects of scientific activity?
3. What forms of organization of scientific activity are used in the practice of domestic and foreign science?
4. What types of activities fall under the concept of scientific activity?
5. In what forms is the organization of scientific research carried out?
6. Which organization is the highest scientific organization of Ukraine?
7. What are the forms of financing scientific research in Ukraine?
8. What is "farm contract" research work (R&D)?
9. How do research firms work?
10. Reveal the content of schemes involving specialists in the implementation of scientific research topics.
11. How and why are temporary creative teams created?
12. What sections does the contract for scientific activity contain?
13. How are applications made on the state budget topic of scientific research. Planning of scientific research.

Control questions (the end)

14. What are the different types of effects from the implementation of the R&D?
15. What criteria are used to evaluate the effectiveness of research work?
16. What criteria are used to evaluate the effectiveness of the work of a scientific employee?
17. What criteria are used to evaluate the effectiveness of the work of a scientific organization?
18. What is the difference between the previous, expected and actual effectiveness of the R&D ?
19. Which of them is the most reliable?
20. What measures are used to improve the effectiveness of the R&D?
21. What are the criteria for examination of scientific projects and research (articles, abstracts, dissertations, reports)?

The practical component

Objectives of the task:

1. Study the theoretical material on the issue of organization of scientific activity and scientific research using the specified literary sources.

2. On the basis of the studied material, build a map of key concepts and issues of the topic of compliance with the rules and requirements for building mental maps.

3. Solve the problem.

3.1. Determine and formulate the scientific results of your own dissertation research, which have the greatest applied value for the economy (technology, pedagogy) of the country as a whole, or for specific economic.

The practical component

Objectives of the task:

3.2. Draw up a technical task for research work (R&D): state budget or farm contract , noting in it: 3.2.1. General data:

name, date and number of the document that provides for financing;

names of directions and sections in accordance with the Law of Ukraine "On priority directions of development of science and technology" dated 12.10.2010 No. 2519-17 "Fundamental scientific research on the most important problems of the development of scientific-technical, socio-economic, social-political, human potential to ensure competitiveness of Ukraine in the world and sustainable development of society and the state".

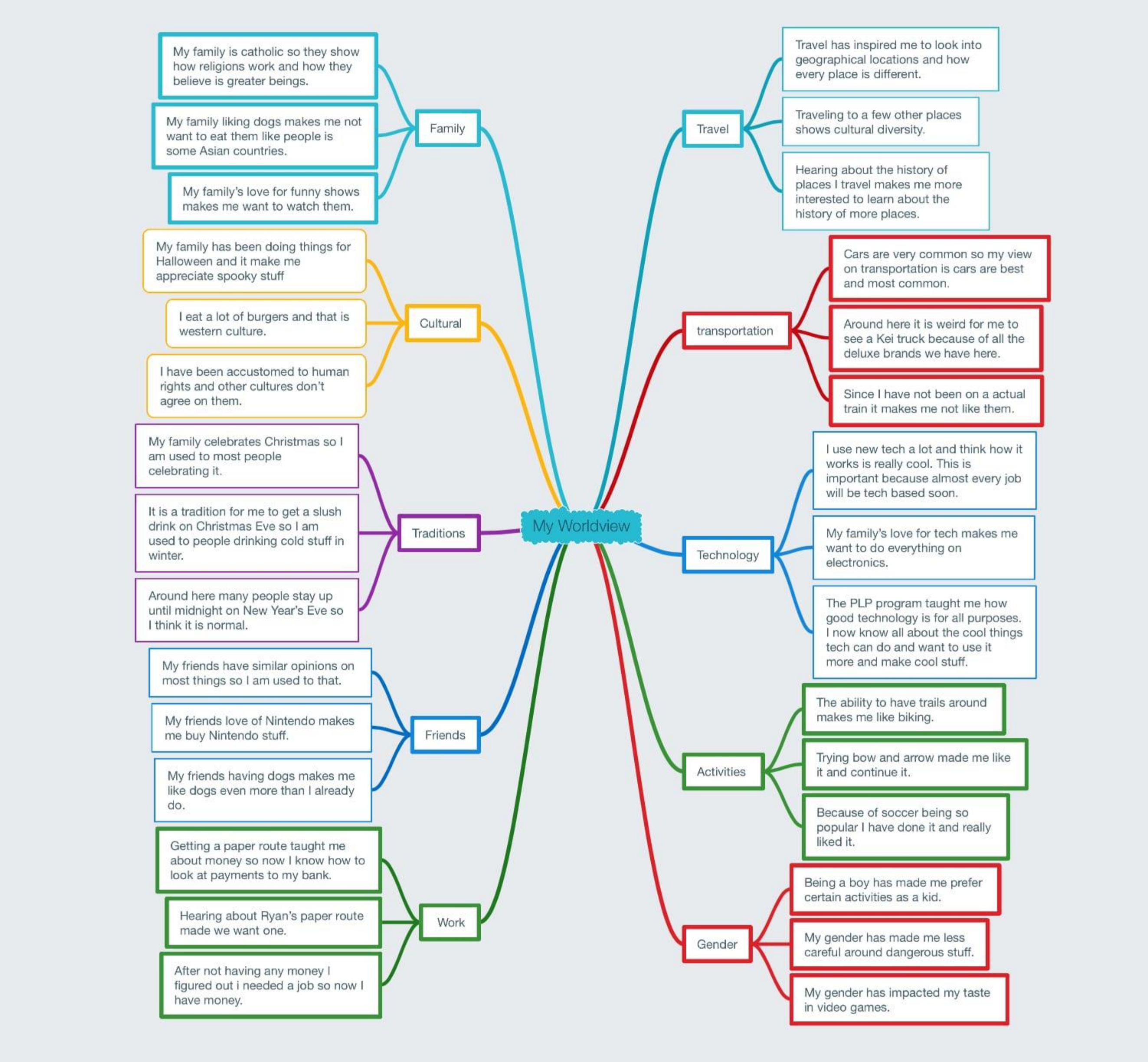
A map of knowledge

Synonymous series:

- a mind map,
- a knowledge map
- a mind maps,
- a mind map,
- a memory card,
- a thinking patterns

Mental maps (mind maps) are a special tool for displaying the thinking process and structuring information in a visual form

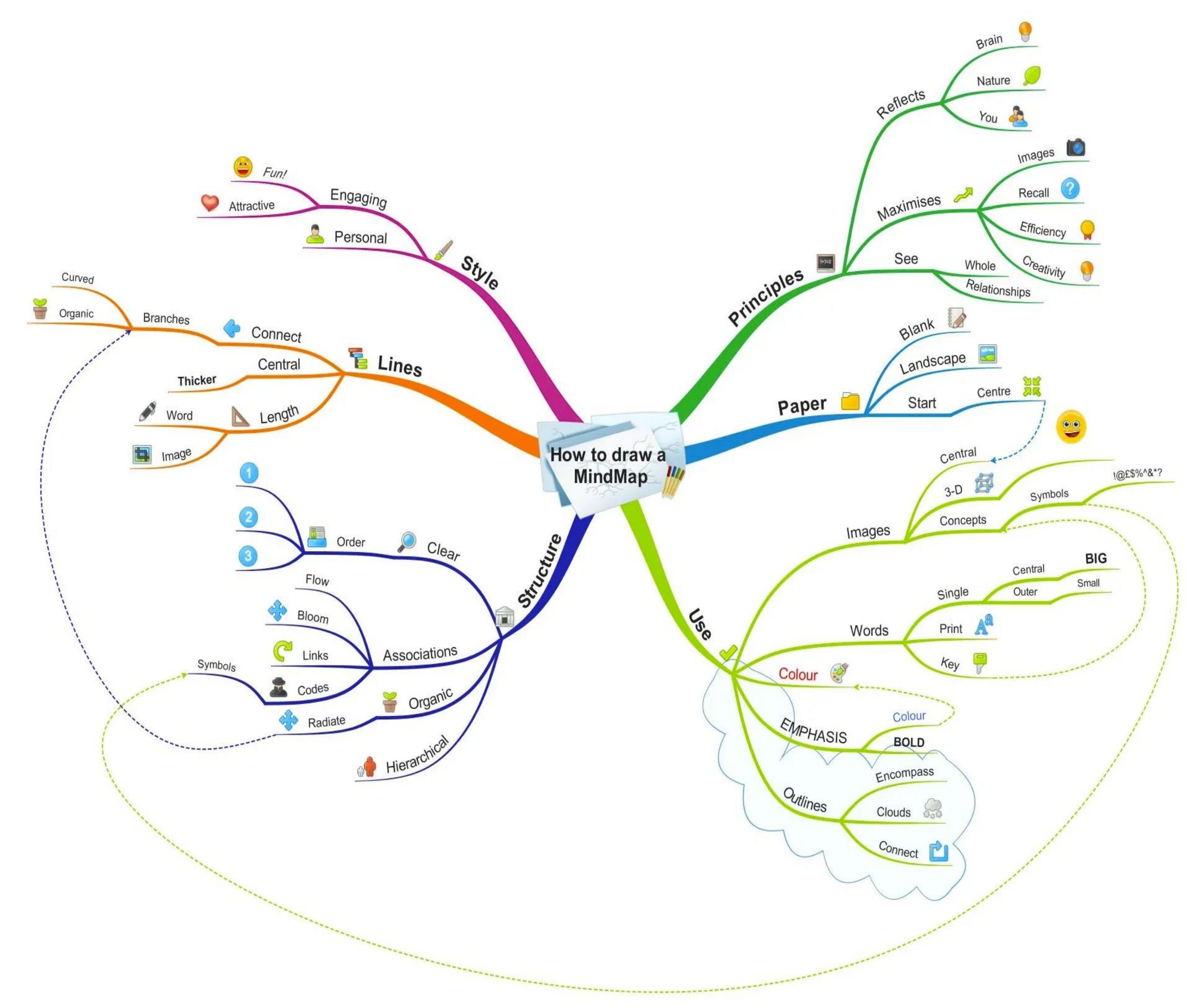
- Maps of visual images are built to create a deep emotional impression.
- Logical connections between ideas are indicated.
- The main ideas of the received information become more concise, clear and understandable.



An example of mind maps that shows their benefits

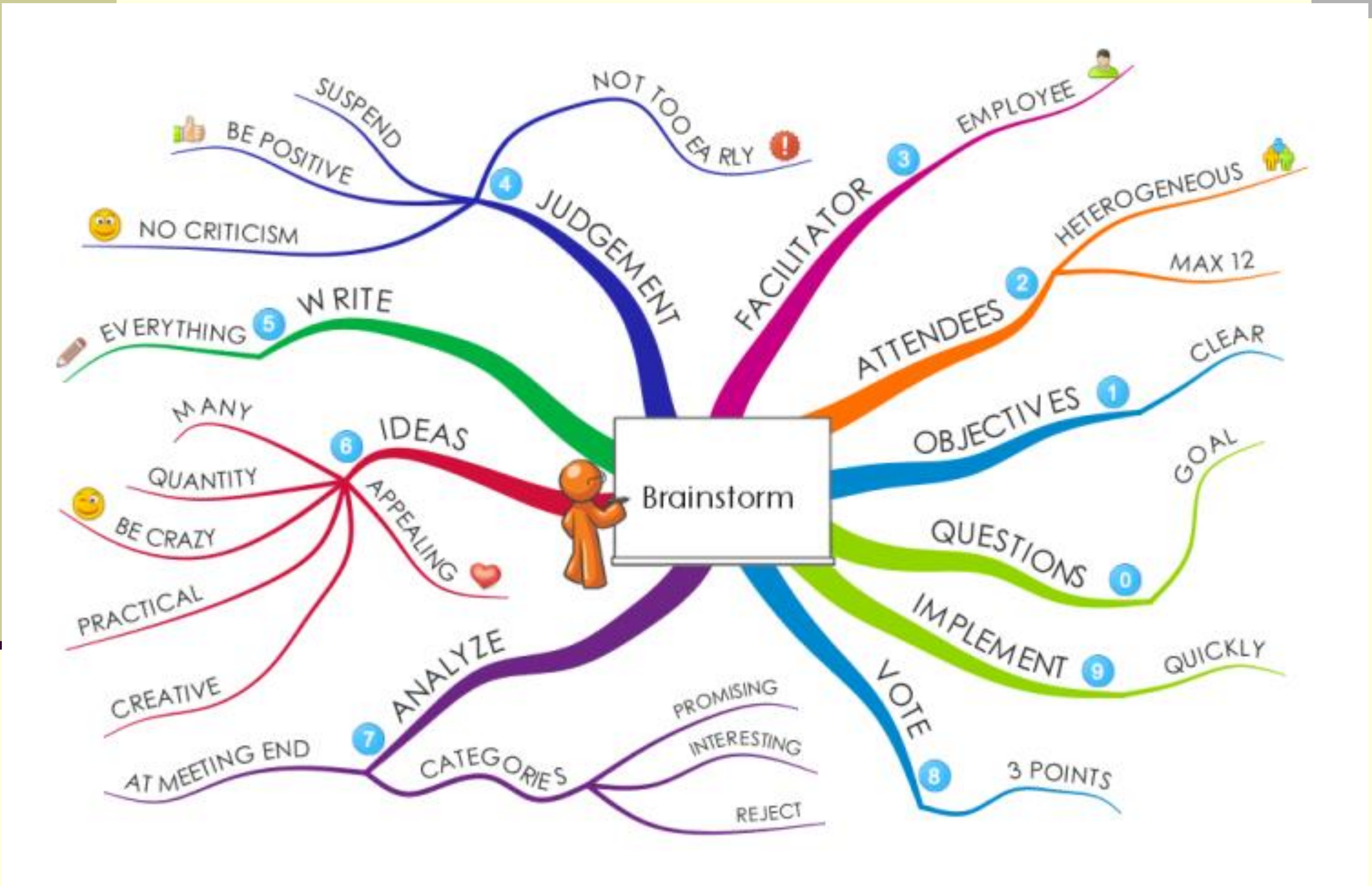
The process of building memory cards

- They use different graphic tools (pictures, symbols, arrows, different fonts). All of them are made colorful.
- On the screen, the letter is placed in landscape orientation, thereby allocating more space for the picture.
- The main idea is marked in the center of the page.
- Lines are drawn from the main idea with multi-colored markers (certain parts of the main topic).
- Each line is signed with a keyword.
- The outline can be detailed, that is, lines can be added.
- Key words are indicated by capital letters.
- There should be many pictures and symbols on the map.
- Arrows show connections between ideas.

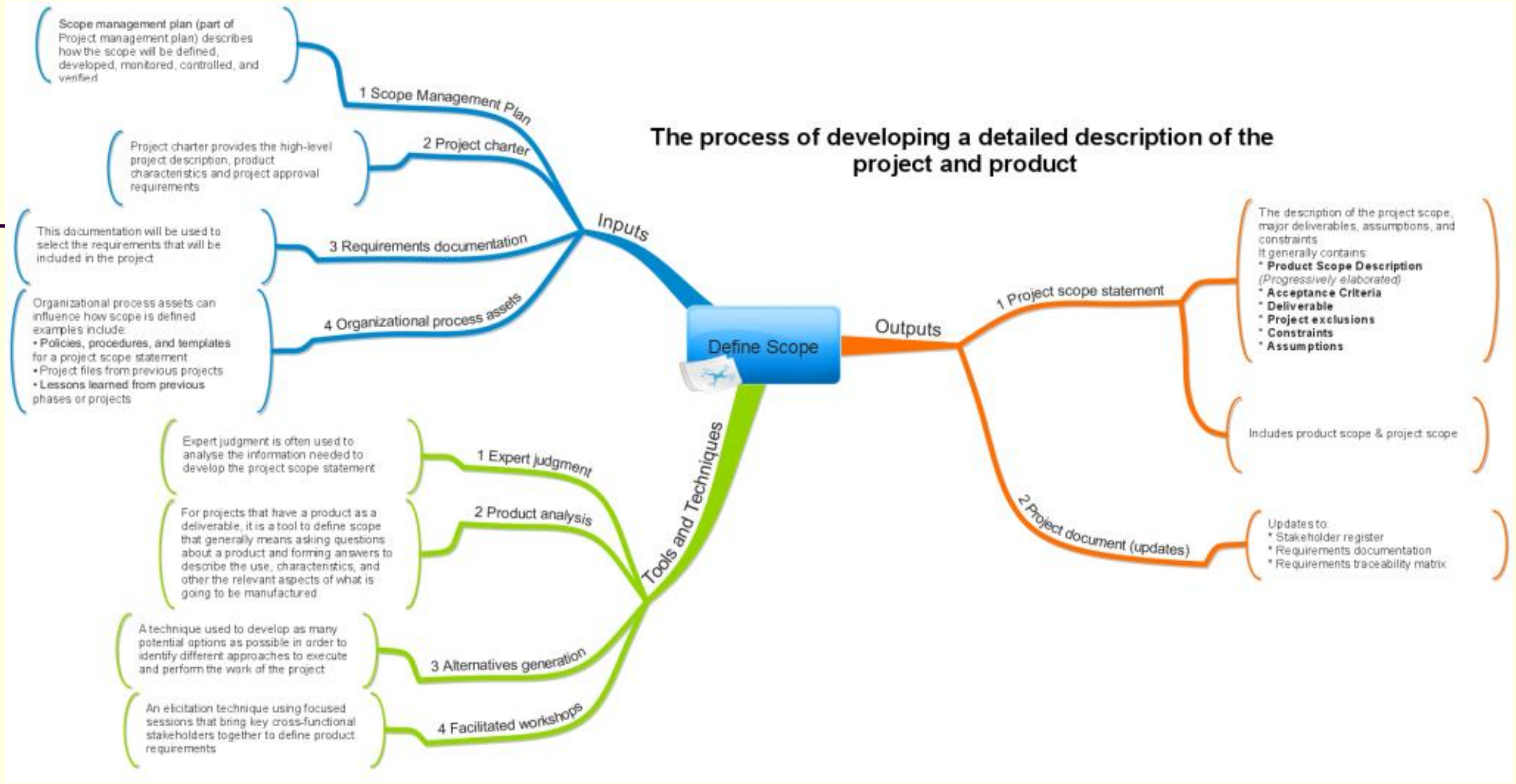


Rules for building mind maps

Examples of mental maps



The main stages and rules of brainstorming



Project support

With the help of mental maps, it is very easy to accompany projects of various scales and complexity, keep everything under control, quickly adapt to current changes, manage resources and see weak points in the project.

Best free mind map software in 2024

- ✓ GitMind (Web, iOS, Android)
- ✓ Mindmeister (Web, iOS, Android)
- ✓ Coggle (Web, Android, iOS)
- ✓ Canva (Web, Android, iOS)
- ✓ MindMup (Web)
- ✓ XMind (Windows, macOS, Linux, Android and iOS)
- ✓ Cacoo (Web, Windows, macOS)
- ✓ Mindomo (Web, Windows, macOS, Android and iOS)
- ✓ SmartDraw (Web, Windows, macOS)
- ✓ Ayoa (Web, Windows, macOS, Android and iOS)

https://gitmind.com/free-mind-map-software.html

8. Information support scientific research

System elements of the topic

8.1. Information space of the scientist

8.2. Technology of working with information sources

8.2.1. Why study literature for SR

8.2.2. What to read for SR

8.2.3. How to compile a bibliography

8.2.4. How to read scientific literature

8.2.5 . How to achieve understanding of the text

8.2.6. Linguistic constructions for writing an analytical review

8.3. Publication of the results of scientific research

8.3.1. Monograph, article, theses

8.3.2. Scientific and technical report

8.3.3. Scientometric databases of publications

8.3.4. Hirsch index

Supplement 8.1. Improving the quality of work with search engines

Control questions. Practical component

8.1. Information space of the scientist

The language of science and how it is used:

- poets use language to evoke a certain experience in the reader or listener;
- politicians use language in order to create the impression of reasonableness and general usefulness of their actions (even if they are not reasonable and not useful);
- scientists use language in order to describe the facts and characterize their relationships.

The language of science and how it is used (the end)

- a poet ***n*eeds expressiveness of the language** (the ability to vividly convey a thought or feeling);
- a politician wants **maximum emotionality** with **minimal information load**;
- a scientist needs **precision and clarity**.

The concept of clarity and completeness

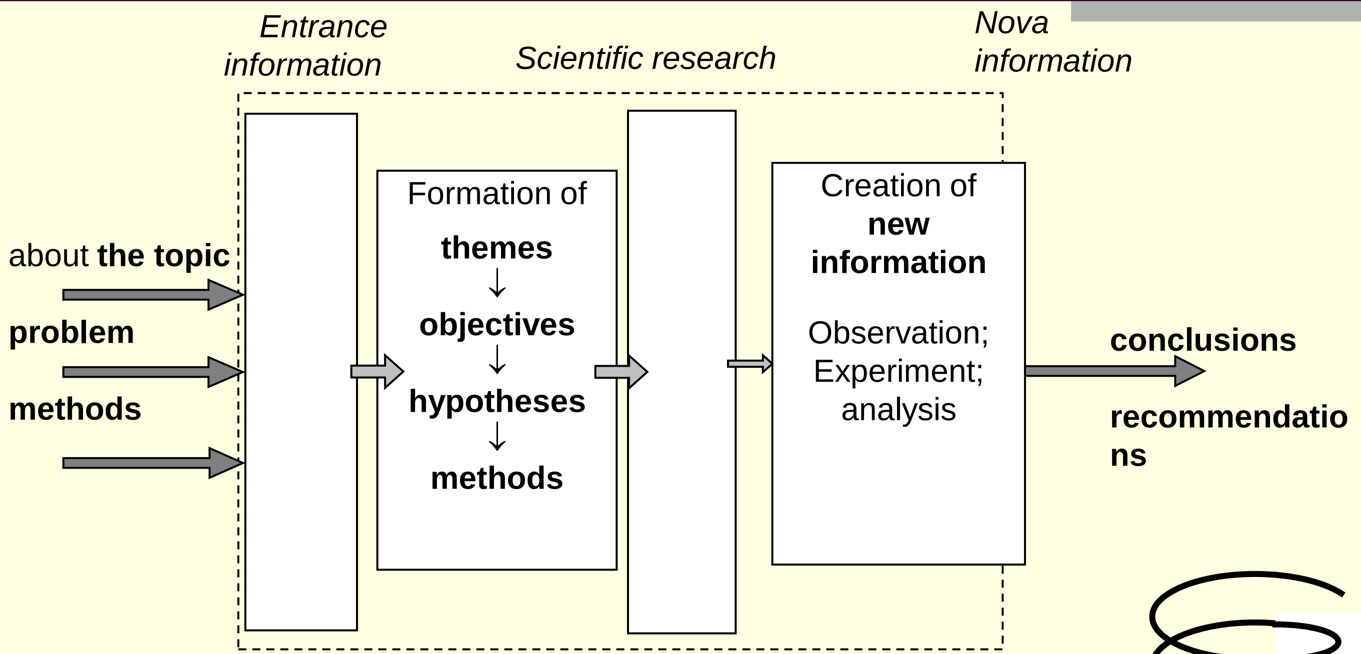
- When describing the behavior of some complex system, in order to achieve **clarity**, it is necessary to give **a complete and unambiguous** description of the facts and cause-and-effect relationships that determine its state.
- The requirement **of completeness** means that the description should **include all factors** that significantly **affect the system**.
- **Unambiguity** requirement means that each word in the description must have **only one meaning**, and the statement as a whole must be interpreted in one and **only one way**.

The main requirements for the language of science

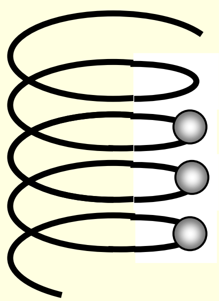
- **Clarity** that does not depend on the personal experience of researchers. Science achieves clarity through the use of terminology.
- In contrast to natural language, **the term always describes a clearly defined set of objects, processes, or their interactions and relations** which are common to all.
- If **there is no reality behind the term, it has no meaning** .
- **In science, only the use of its terms is permissible**.
- **It is necessary to first define** and then use the new term obtained in this way.
- **Terminology is not fixed,** it develops together with science.

8.2. Technology of working with information sources

8.2.1. Why is it necessary to study literature for SR?

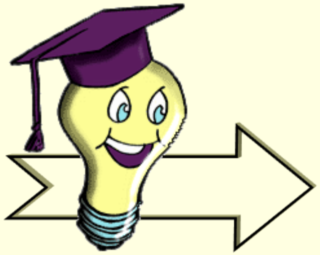


Stages of scientific research

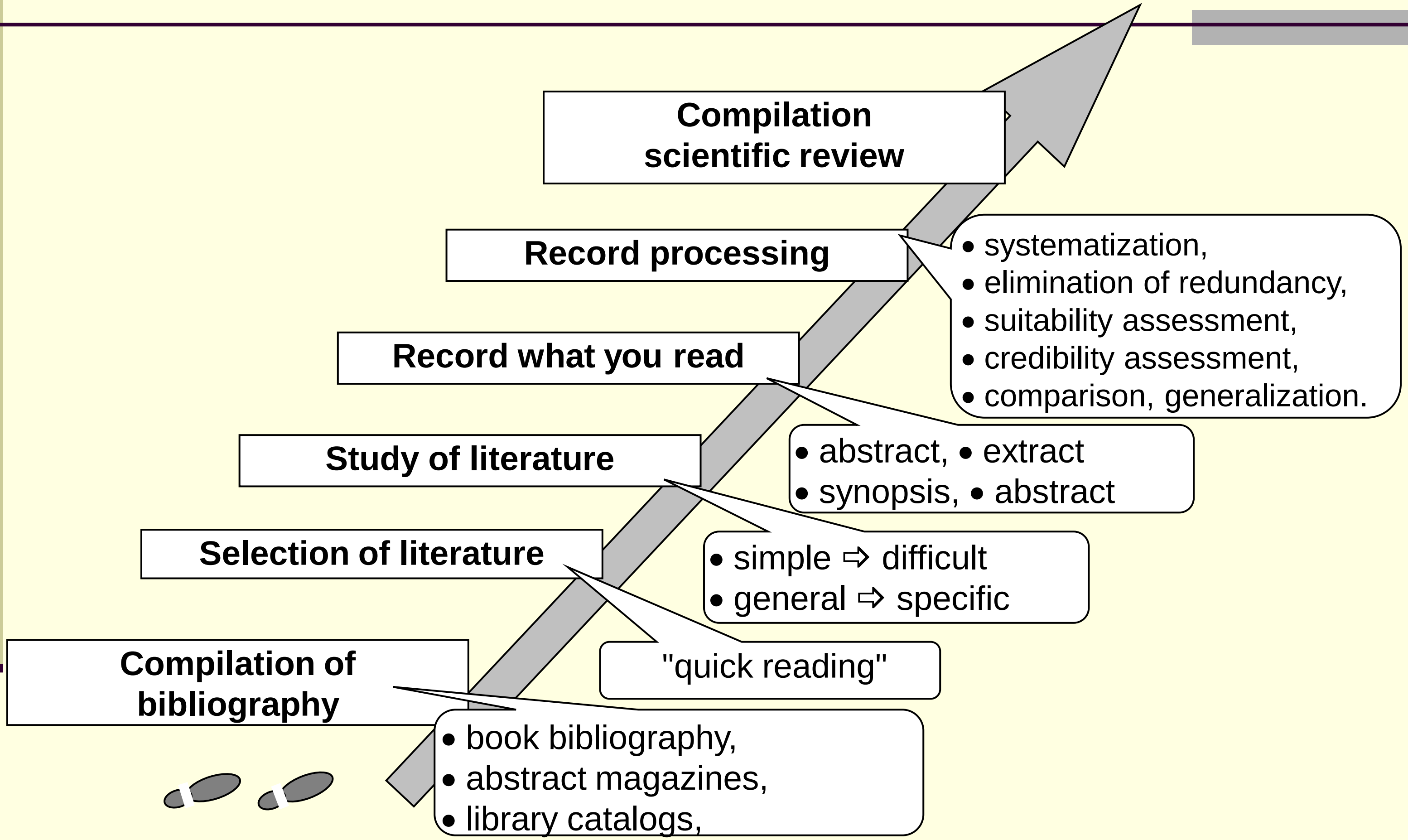


Information spiral

Studying a phenomenon without books is similar to sailing in an uncharted sea without a map.

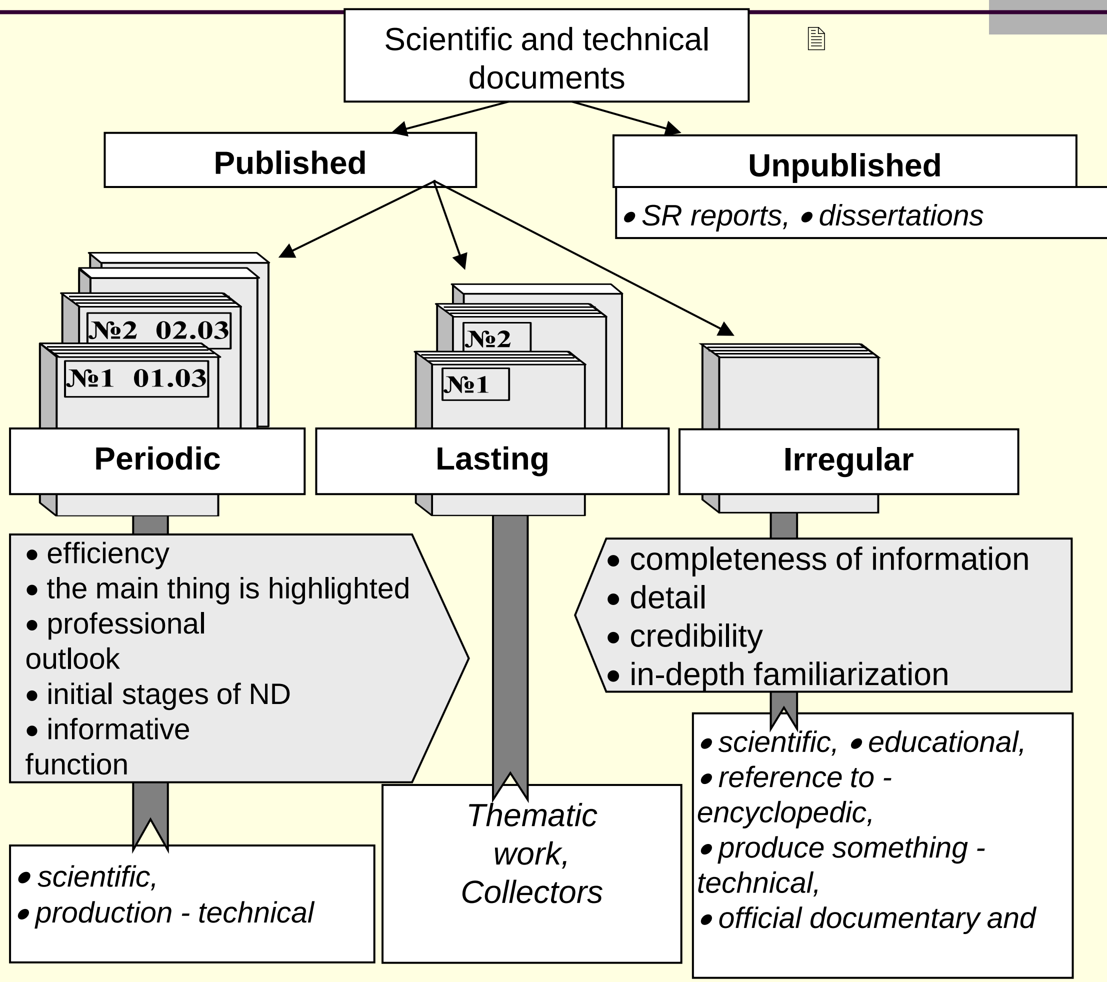


Stages of work with scientific literature



8.2.2. What to read for SR?

Typology of scientific and technical documents

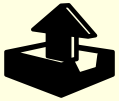


8.2.3. How to compile a bibliography?

Bibliography is a list of various informational documents with the following data: surname and initials of the author, name of the source, place of publication, publisher, year of publication, volume of the source in pages.

?

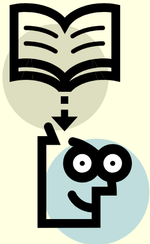
- What is worth reading?
- What research has already been done on this topic?
- What scientists work in this field of knowledge?

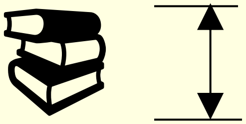


- in-book referencies
- special edition with bibliography
- library catalogues
- Internet

☒ order in libraryi

☒ self search





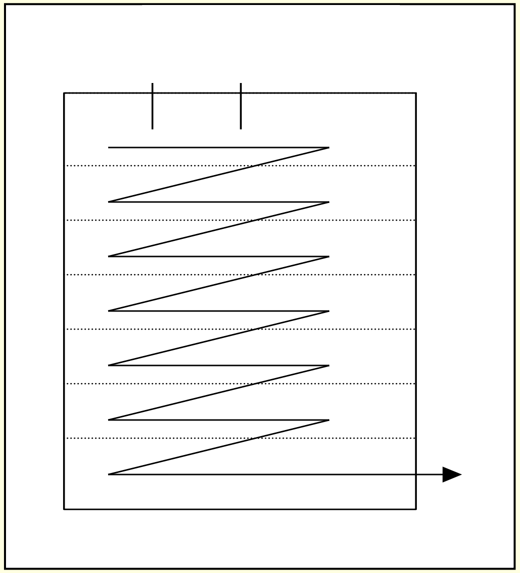
- a circle of countries and languages, a chronological framework,
- types of literature,
- the subject of the bibliography.

Ⓟ

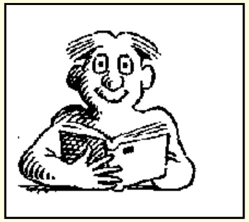
- Start with the pre-book and prescriptive bibliography.
- Learn the rules of using subject indexes.
- Write in alphabetical order.
- To select information on related disciplines.

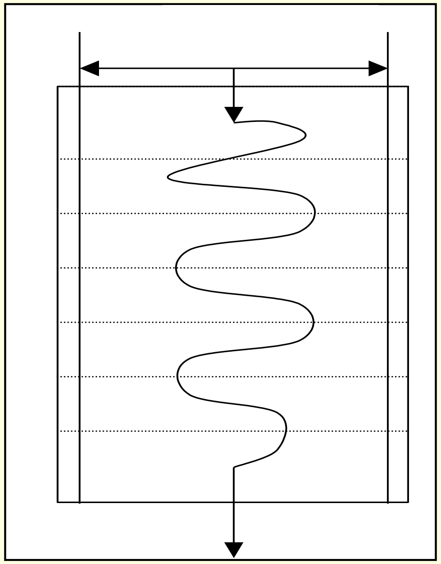
8.2.4. How to read?

• "Slow" reading • "Fast" reading



Eye movement





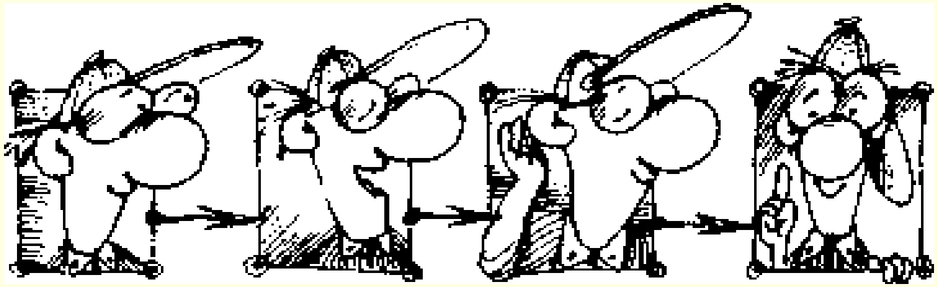
Factors that affect reading performance

Objective factors

- Out of reading.
- Illumination of the text being read.
- External noises.
- Duration of continuous reading.
- Physical fatigue.
- Speaking the text being read.
- Thesaurus.

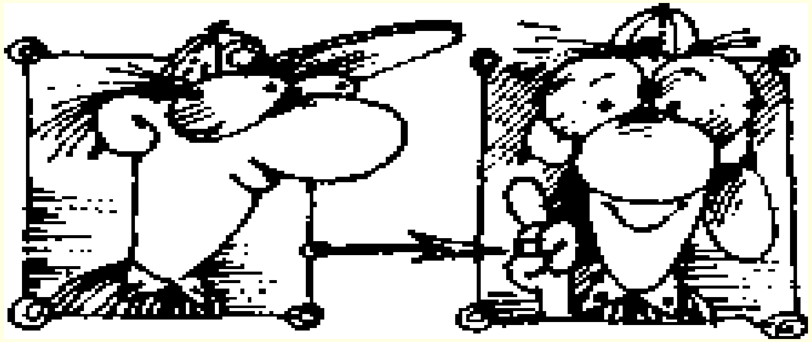
Speaking the text

Mental attitude: you can understand the text only with listening it, and for this you need to speak it, saying it out loud or to yourself – both the organs of vision and speech are involved in the reading process.



Saw spoke heard understood

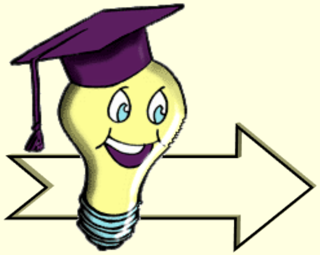
A more rational way of reading is when the muscles of the larynx are used, and the tongue, which is responsible for pronunciation, does not participate in the reproduction of the text



saw understood

Push back talking in the following ways:

- **forcefully increase the** reading speed to such an extent that you practically do not have time to speak the text;
- **expand the field of perception** so that you don't have time to say all the words that are captured by each fixation of the gaze;
- **create obstacles to speaking**;
- **create a mental attitude** for inarticulate reading.



In what sequence to read?

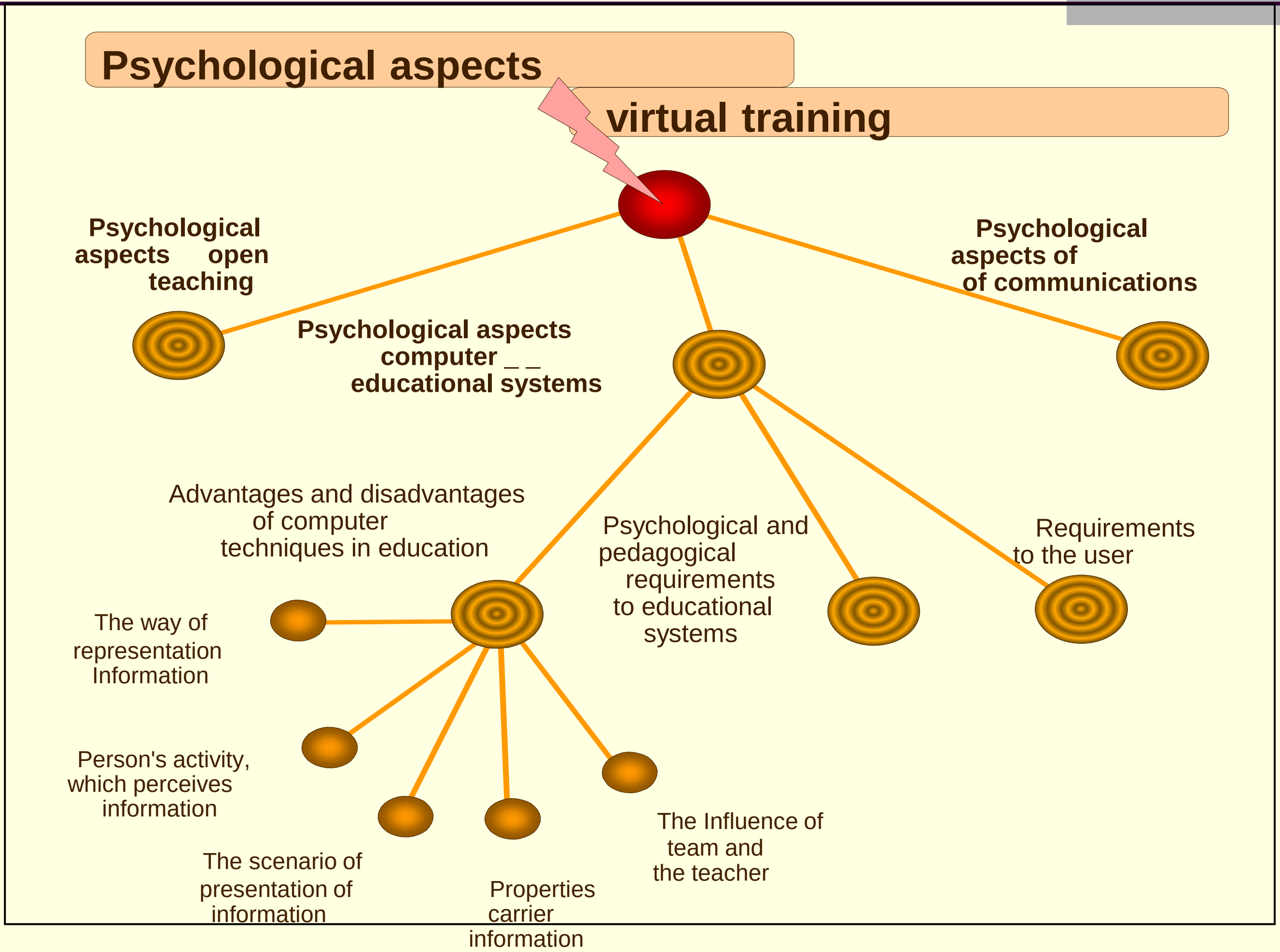
The principle "from **simple to complex**, from **general to specific**"

- simple ⇨ complexa,
- general ⇨ specific,
- theoretical ⇨ practical,
- new ⇨ old,
- monographs ⇨ rewires

8.2.5. How to achieve understanding of the text?

- **Present** the text in thesis form;
- **dissect** a difficult fragment into logical parts;
- **draw up** a diagram of the relationships of parts of the text;
- **place** the text with colored markers;
- **retell** the course of the author's thoughts to another person.

Example 8.1


Psychological aspects
virtual training
Psychological aspects open teaching
Psychological aspects computer _ _ educational systems
Psychological aspects of of communications
Advantages and disadvantages of computer techniques in education
Psychological and pedagogical requirements to educational systems
Requirements to the user
The way of representation Information
Person's activity, which perceives information
The scenario of presentation of information
Properties carrier information
The Influence of team and the teacher

Example 8.1 (the end)

- the SR object,
- the subject area problem,
- the scientific problem
- the goal of SR,
- the scientific result.

An abstract is a brief description of the printed text in terms of content, purpose, form and other features.

℗

- Convey the relation of the author of the annotation to the material.
- Note the purpose, practical value of the work.

Notes are short description of some parts or ideas of the research

℗

- accurately indicate the details of the source,
- group it in in computer files,
- put each question in a separate file,
- systematize in accordance with the SR plan,
- create separate folders for sections of the SR.

A compendium is a concise statement of the main ideas of the researched material, its most important information.

Ⓟ

- Convey the text in your own words,
- the main thing is to select a rational grain,
- provide for the addition of text,

(new material, own proposals, analysis):
leave wide fields for comments,
select numbered points .

A scientific reference is a summary of the primary document (or its part) with the main factual evidence and conclusions.

The abstract includes: the topic, the subject (object) of research, the goal, the method of conducting work, the obtained results, the conclusions, the scope of application.

Ⓟ

- make a plan of the essay.

A scientific review is a text that includes synthesized information on some issue, which is taken from some **set of** primary documents.

Mandatory elements of a scientific review:

- an abstract,
- the introduction,
- the analytical part,
- the conclusions.

Ⓟ

- The review is not written according to the authors, but according to the tasks of the SR,
- a review is written correctly when it can be published as an independent article.

Example 8.2. The record structure

Bibliographical information

- **Lepeyko T., Batkhuu G. Asian leadership model: a case of Mongolia/ Economic Annalas – XXI. 2017, №165 (5–6), 19–22 (SCOPUS).**
- **ISO 9001:2015 - Quality management systems / https://www.iso.org/standard/62085.htm.**
- **IGI Global/ Disseminator of knowledge / https://www.igi-global.com/dictionary/formal-knowledge/11382.**
- **https://en.wikipedia.org/wiki/Informal_learning.**

An abstract

Oleksyuk O. S. Micro-level financial decision support systems. K.: "Naukova dumka", 2020. – 508 p.

The monograph summarizes the experience of creating computer support systems for making financial decisions at the enterprise. A significant place is given to issues of development methodology and their implementation. Economic and mathematical models and methods of making risky financial decisions are described.

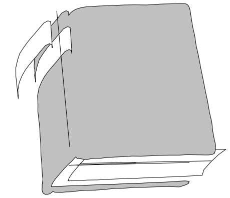
Designed for a wide range of economists, managers, graduate students; those who are interested in the development of computer support systems for financial decision-making.

Types of records

Information about the document

Data bibliography

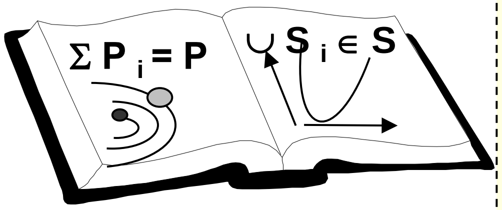
Abstract



Information about the subject area

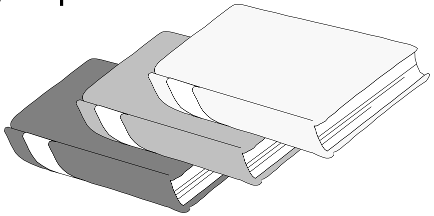
Compendium

Extracts



Information about the subject area based on a group of documents

Scientific review



8.2.6. Linguistic constructions for writing an analytical review

1. Accentuation of the main problems and issues analyzed by the author:

- The author considers the question (what ?);
- describes issues related *to* (what?);
- analyzes problems (what?);
- reveals his understanding (of what?);
- expresses the main points (what?);
- speaks (about what?).

2. Fixing the problems identified by the author:

- The author emphasizes, notes the importance of (what?);
- points to (what?);
- pays special attention (why?);
- concentrates special attention (on what?);
- focuses attention (on what?).

Linguistic constructions for writing an analytical review (continuation)

3. A list of issues that are considered by the author at the same time

The author

- touches (what?);
- mentions (about what?);
- notes (what?);
- (besides) the author touches on (what?).

Linguistic constructions for writing an analytical review (continuation)

4. Presentation of the system of author's argumentation, which involves illustrative factual material, references to other sources

The author

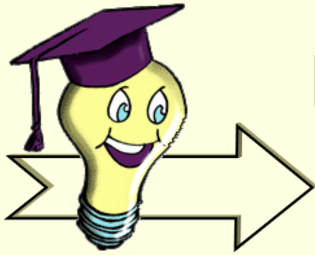
- opposes (what to what?);
- compares (what with what?);
- argues his opinion (what's wrong with what?);
- illustrates his conclusions (with what?);
- is based on the proposed classification (where?, by whom?);
- gives examples, numbers that testify (about what?);
- refers to articles (whose?);
- confirms (what?).

Linguistic constructions for writing an analytical review (the end)

5. Repeated return by the author to conceptually important provisions of the work in its various sections

The author

- specially stops several times (at what?);
- keeps coming back to the thought (probably what?);
- repeatedly draws *attention* (to what?);
- especially focuses on (what?).



Result: Once again, let's look at the whole stages of work with scientific literature

Compilation scientific review

Record processing

- systematization,
- elimination of redundancy,
- suitability assessment,
- credibility assessment,
- comparison, generalization.

Record what you read

- abstract, • extract
- synopsis, • abstract

Study of literature

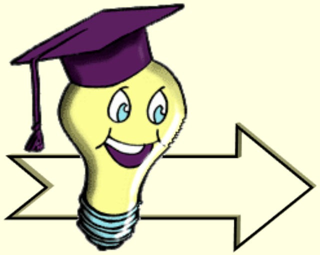
- simple ⇨ difficult
- general ⇨ specific

Selection of literature

"quick reading"

Compilation bibliography

- book bibliography,
- abstract magazines,
- library catalogs,



Citation

1. **A quote**

"Managers declare that profit is important only for shareholders, and the manager in his activities is obliged to take into account the interests of production, local public organizations and even the interests of the entire nation" [2, 144-145].

In the list of links:

2. Gvishiani D.M. Organization and management. – 3rd ed., revised. – K. : Publishing House of State Technical University named, 1998. – 332 p.

2. **Omission of words**

"Managers declare that ... the manager is obliged to take into account the interests of production in his activities..." [2].

3. **a footnote:**

"Managers declare that ... the manager in his activity is obliged to take into account the interests of production..." [2].

The footnote text:

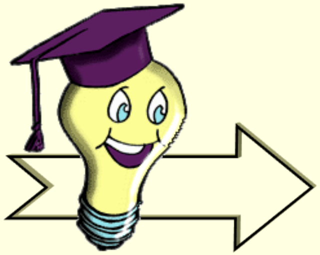
1) [2] Gvishiani D. M. Organization and management. – 3rd ed., revised. – K. : KPU, 1998. – 332 p.

4. **My opinion**

"Managers (!) declare that ... the manager in his activity is obliged to take into account *the interests of production, local public organizations and even the interests of the entire nation*" (italics mine B. V.) [2].

5. **A link** to the source:

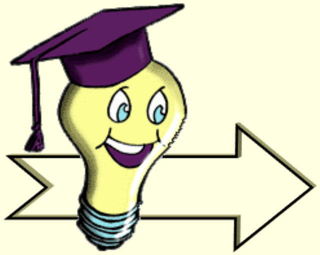
Papers [1–7] consider the issue...



Types of work with literature

Recording errors:

- excessive brevity;
- excessive detailing.



Internet search systems

Tools for finding literary sources:

- **library sites,**
- **library information systems,**
- **Internet search engines.**

Library Web-servers

Visitors' requests to the KhDNB site :

• **familiarize yourself with the rules** for using the library;

• search **for literary sources** in the electronic catalog of the KhDNB (see the *"e-KHDNB "website section*, subsection *"Electronic catalog";*

• ***search for*** literary sources **in the catalogs of other libraries of Ukraine and the world (!) (***"e-KHDNB"* section, *"Internet Resources" section*);

• get acquainted with **the catalog of periodicals stored in the libraries of Kharkiv** (section *"e-KHDNB"*, subsection *"Consolidated catalog of periodicals in the libraries of Kharkiv"*);

• familiarize yourself with **the electronic versions of some periodicals** (*"e-KHDNB" section*, *"Electronic Information Agencies" section*).

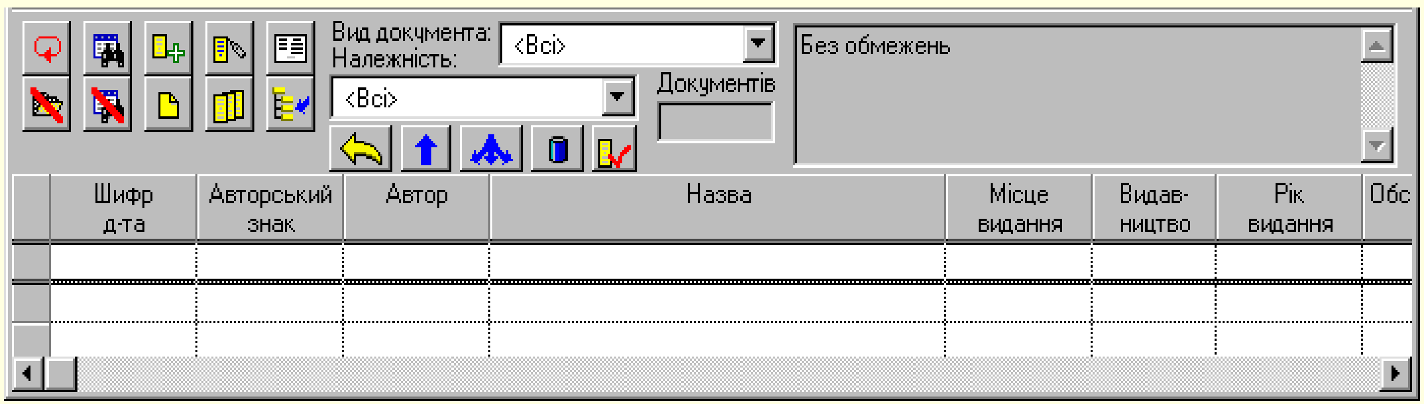
Information system of the Simon Kuznets KhNEU library

The system includes means of automating the following operations:

• **collection of the library fund** (identification of needs, order of literature, registration of receipts, accounting and analysis of the fund);

• **document processing** (creating a bibliographic description of the document, classification, creating thematic catalogs);

• **reader service** (search and issuance of documents).



A table form "Catalog" of the "UFD/Library" system

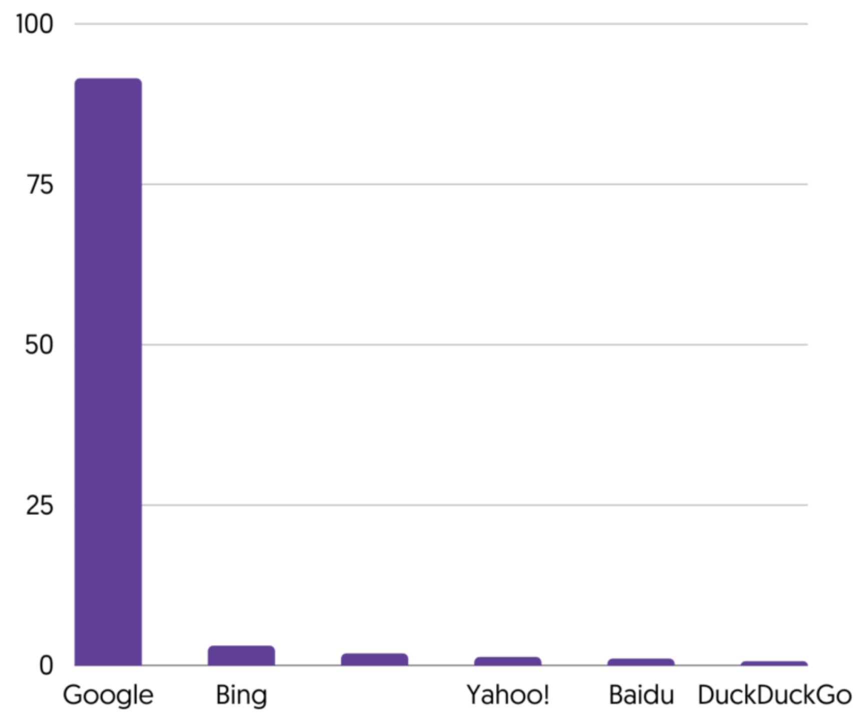
Top Internet search systems in 2024

TOP SEARCH ENGINES

Google

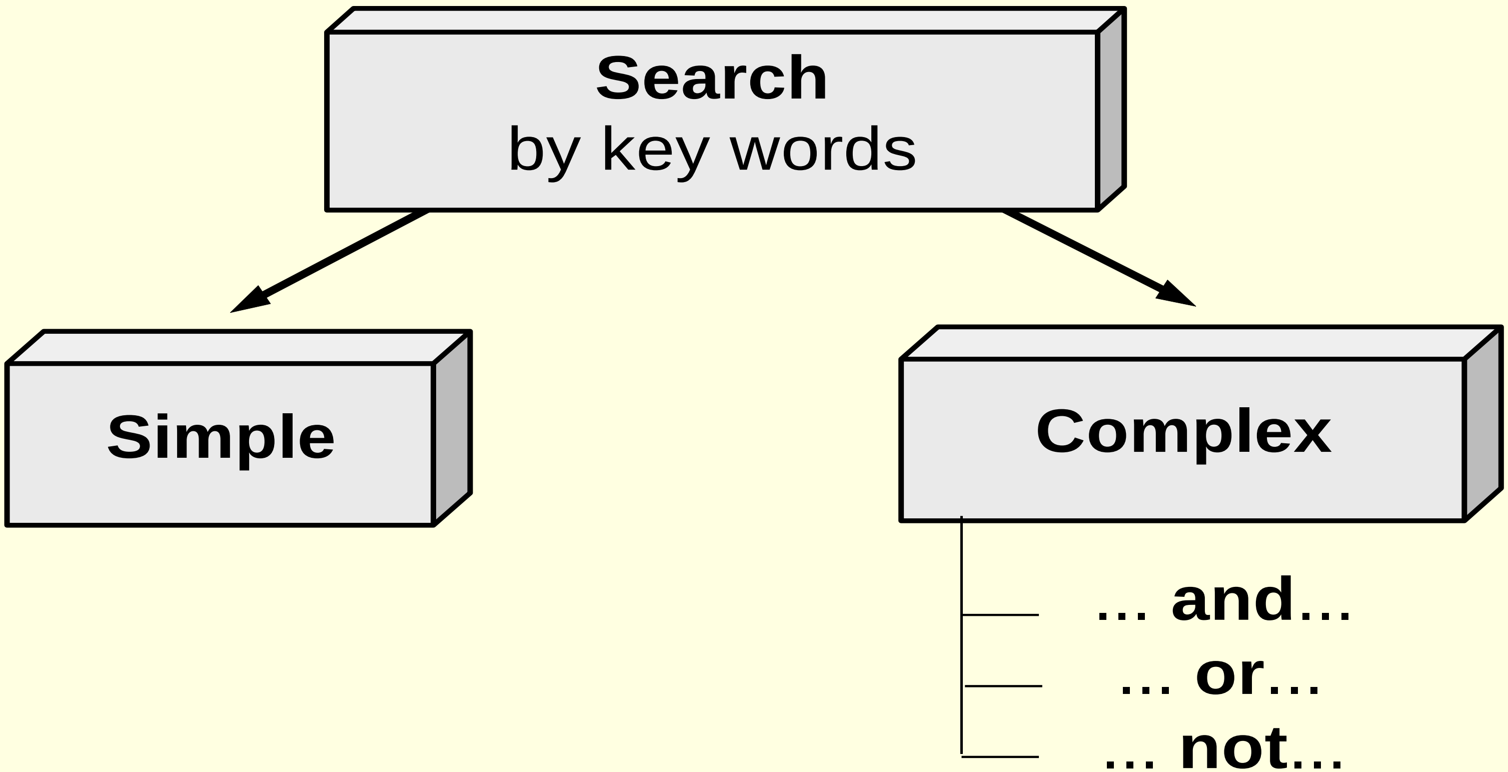
91.58%

Google is the most popular search engine with a stunning 91.58% market share compared to 3.01% of second in place Bing.



Problems of formulating requests

- Query formulation is the process of expressing an information need using keywords and combining these keywords using the system's information search language tools.
- The following factors affect the quality of the request:
  - the user's knowledge of natural language features;
  - knowledge of the structure and features of the information search language.


Search
by key words
Simple
Complex
… and…
… or…
… not…

Types of queries in search engines

- **Navigation requests** – searching for a specific place on the Internet. For example, a company website or the website of a recently visited forum, searching for a link to a blog.

- **Information requests** – such requests are entered if they want to receive certain statements or find the necessary information on the Internet.

- **Transactional requests** – in order to perform some action on the Internet – a transaction (buy, download, subscribe).

- **Vague requests** are general, specified requests (For example, mobile phone, music).

The search process

- First, there is an informational need. It initiates the search.
- The formalization of the information need is reduced to the selection of key words.
- A set of keywords with relationships between them is called a query.
- A system based on a set of documents is called an information-search space.
- The list of selected documents is called a page search results or search output.

Relevance is a measure of the correspondence of the response to the request

- Meaningful relevance is the measure of correspondence of feedback to the user's information needs.

- Formal relevance is a measure of the relevance of the query response, as a set of keywords.

- Information noise is documents that do not meet the information need, but meet the request.

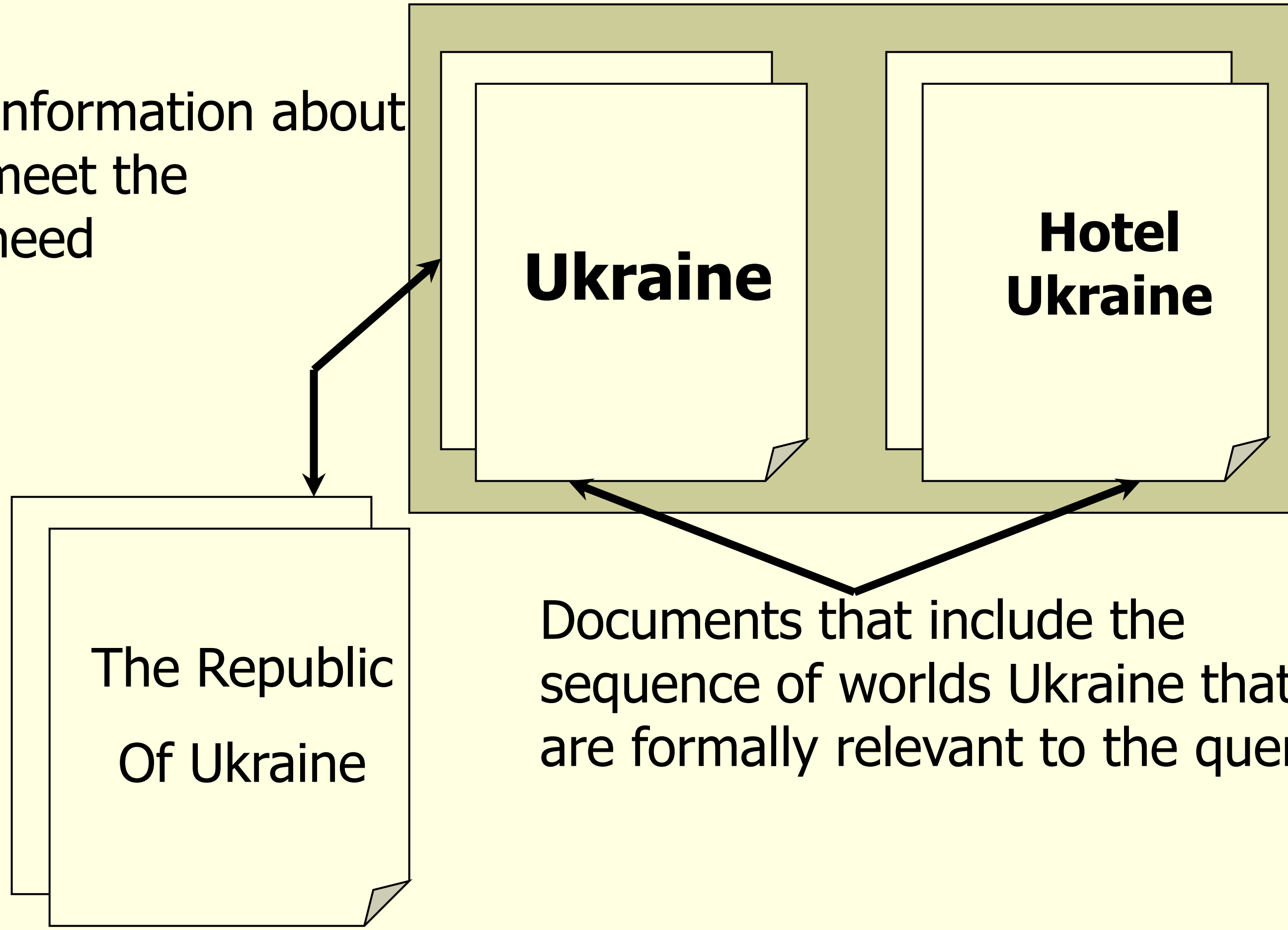
Relevance of feedback

- Documents that were issued by the information and search system are called issued.

- Documents that meet the user's information needs are called relevant.

Example 8.3. The difference between formal and substantive relevance of feedback

Documents
that include information about
Turkey that meet the
information need



Documents that include the
sequence of worlds Ukraine that
are formally relevant to the query

Main characteristics of search results

- Completeness of the search result reflects how many documents that meet the user's information needs were included in the number of issued documents.

Completeness = NR/NI,

Where

NR - number of relevant document;

NI - number of relevant document was found in the Internet.

Main characteristics of search results (continuation)

- Accuracy of the search result reflects the quality of response response to the user's information needs.

Accuracy = NR/ND,

Where

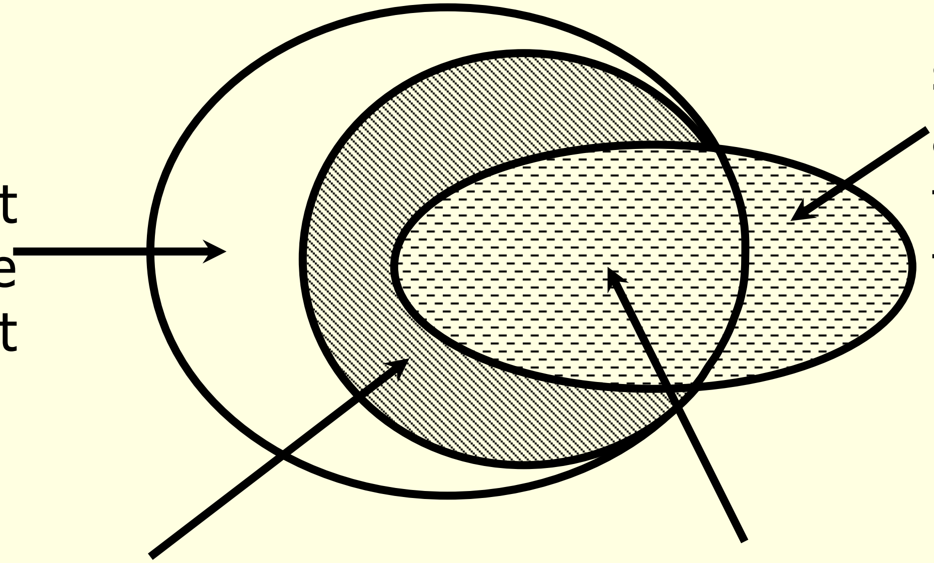
NR - number of relevant documents;

ND – number of all received documents.

Factors affecting the accuracy and completeness of the response

- Query quality.
- The right choice of information and search space.
- The search does not take place in the real space of network documents, but in a certain model, the content of which differs from the real content of the Internet at the time of the search.

Main characteristics of search results (continuation)



Main characteristics of search results (the end)

- Relevance is a characteristic that shows the availability of information about existing documents in the feedback.

- The speed of obtaining results is a characteristic that depends on
  - communication channels between the user's computer and the search server,
  - traffic of these channels,
  - request processing algorithms,
  - user request.

Taking into account the features of natural language

Increasing search accuracy:

- professionalism;
- the use of rare terms;
- the use of names and surnames.

Improving the completeness of feedback:

- the use of synonyms – words that differ in spelling, but are identical in meaning.

Information search language

- Search language operators are service words used to combine query keywords to increase accuracy:
  - logical operators;
  - distance operators;
  - operators for selecting the part of the document to be searched;
  - document subset selection operators.

Logical operators

Operator			Google
Logical I	And & space	& space (within a sentence) && (within the document)	gap
Logical or	or |	|	or
A logical no	not !	~ (within the sentence) ~~ (within the document)	not –
Grouping	()	()	()

Information search language
(Basic GOOGLE operators)

Operator	Appointment
and	Search for the 1st, 2nd and Nth word (logical "And", is used most often).
or	Search for 1st or 2nd word (logical "or").
« »	Search for the exact phrase written in « ».
+	Highlighting the main keywords in the query.
—	Exclusion of unwanted words in search results.
Website:	Search for a specific site.
Related:	Search for similar pages (often this operator is used to search for similar sites).
link:	Search for link pages.
~	Inclusion in output of synonyms of the selected word.
File type:	Search for extension documents.
Define:	Search for definitions

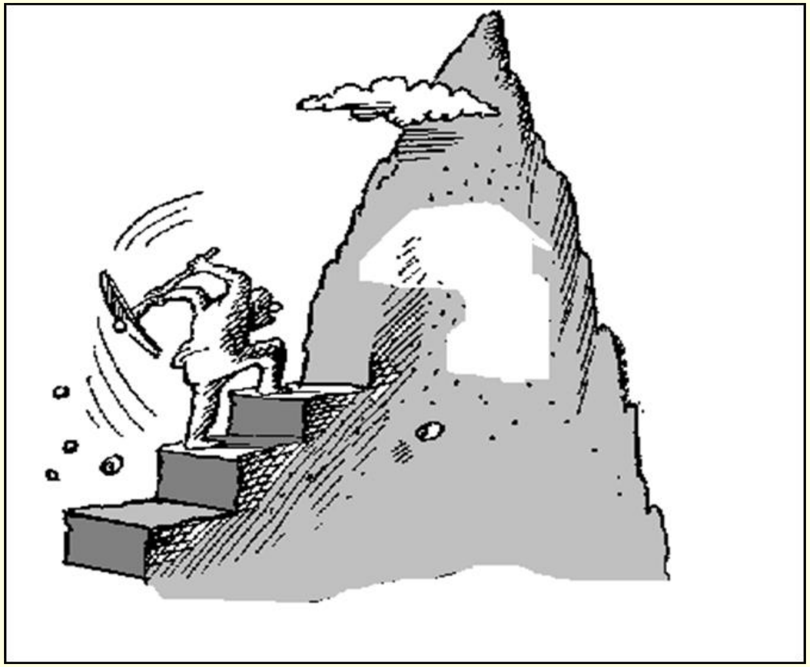
Information and search language (the end)
(Basic GOOGLE operators)

Cache:	Reference to the page that is stored in the cache of the search engine.
Allinurl:	Search for pages that include all the words from the search query in their address.
Inurl:	Search for pages that include words from the search query in their address in any order and in any number.
Anchor:	Search in the text of links.
Allintitle:	Search for pages that include all the words from the search query in their title.
Intitle:	Search for pages that include the words from the search query in their title in any order and in any number.
Allintext:	Search for pages that contain all search terms.
:	Specifies the search region.
Information:	Shows information about the page.
.	Matches the "space" character in compound queries.
Cache:	Reference to the page that is stored in the cache of the search engine.

8.3. Publication of the results of scientific research

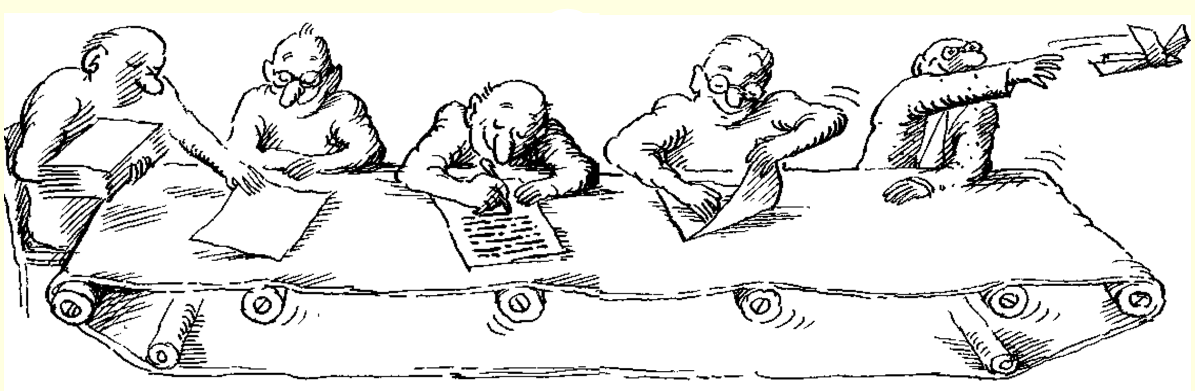
Goal publications and presentation of the results of the to academic society:

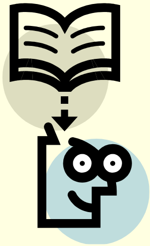
- approval of the results;
- fixing the priority;
- dissemination of information that has value for society.



Form of research results presentation

- **oral**
  - report
  - infernation
- **written**
  - **published**
    - monograph
    - theses
    - article
  - **unpublished**
    - deposited manuscript
    - scientific-research report
    - dissertation



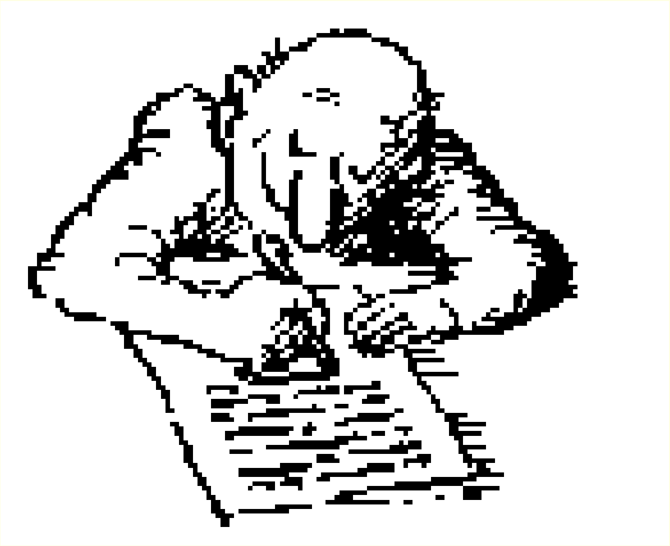


Faraday's motto: work, finish, publish

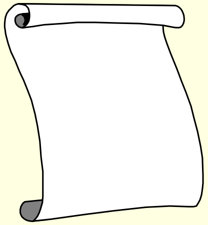
Forms presentation of research results:

1) for the results of large-scale studies:

- ✓ a monograph;
- ✓ a dissertation;
- ✓ a scientific-research report.



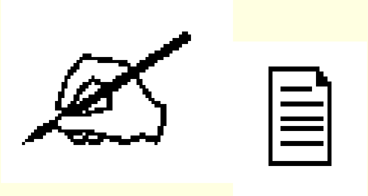
2) for the results of small studies:



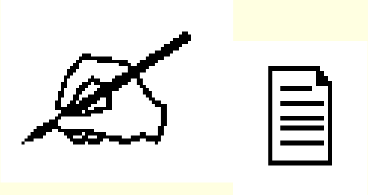
- ✓ scientific articles;
- ✓ a scientific report at conferences;
- ✓ thesis at conferenced.

8.3.1. A monograph, an article, a theses

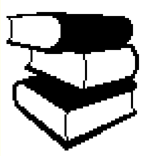
An article in a scientific journal is
written information
in volume, *often* up to 10 – 12 pages.
with a small number of graphs, figures, tables.

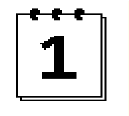


Report theses are written information
in the volume of ½ – **2 pages.** ,
includes the main provisions of the report.

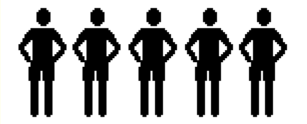


MonograpH is
description of the results
In the frame of one subject area





A monograph may include:
- scientific results;
- technical solutions;
- new facts;
- known facts.

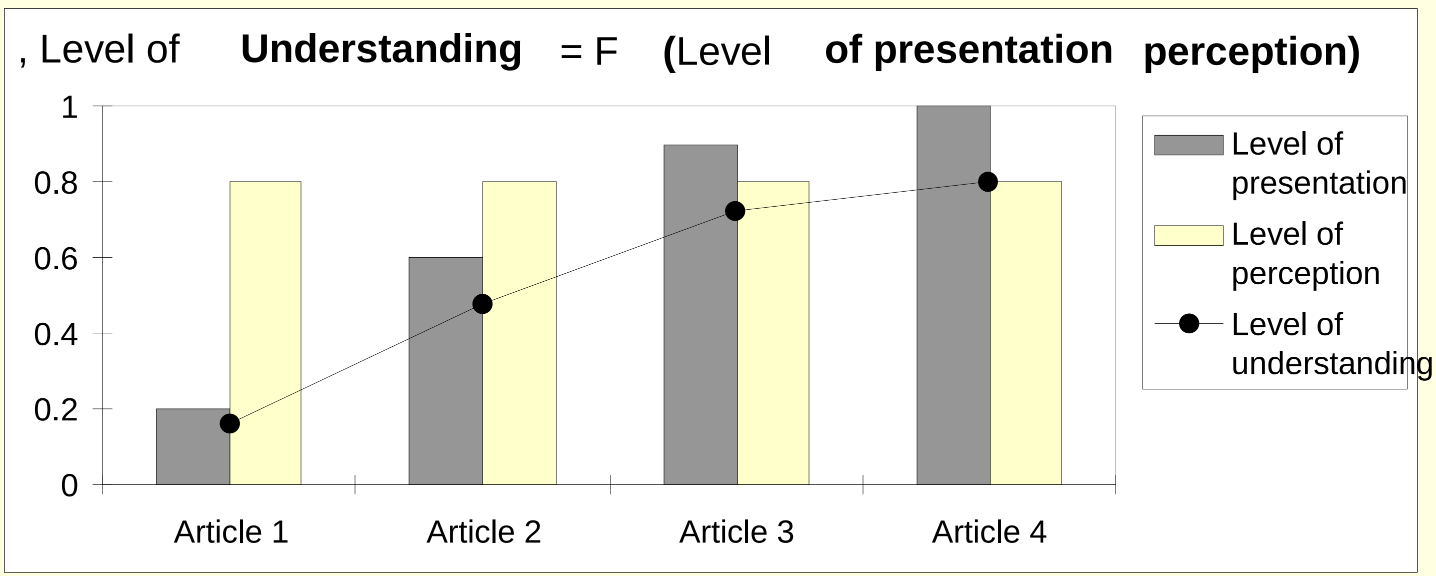


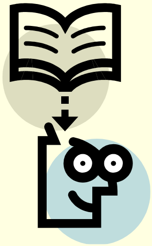
An article

Requirements for scientific articles:

1) high level of research absence of errors (logical, mathematical);

2) high level of presentation of the material, facility of the article for its perception by the reader.





Recommendations

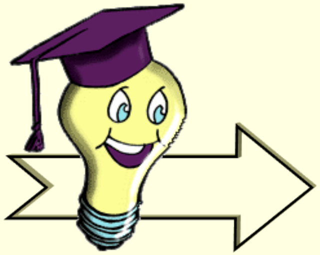
℗

- ✓ Publish on time.
- ✓ Adhere to the scientific style I will explain.
- ✓ Write clearly.

On raising the requirements for specialized scientific publications of Ukraine

Editorial boards of scientific publications
should be accepted for printing only scientific articles which have the following elements:

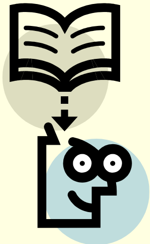
1. **PROBLEM STATEMENT,**
   Connecting of the problem with the actual and important task or problem solving
2. Analysis of studies that are devoted to the given problem
   Highlighting UNSOLVED PARTS OF THE PROBLEM
3. **GOALS** of the research formulation
4. The main research material:
   testimony about the **METHODOLOGY** of the study
   description and justification of the obtained **RESULT**S
5. **CONCLUSION**



Abstracts of the report

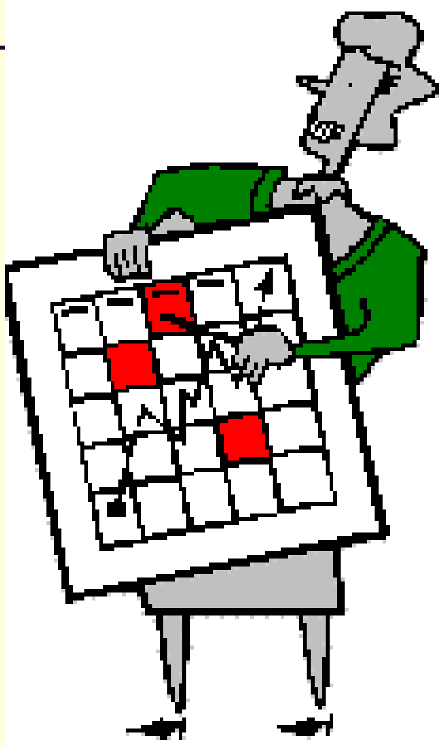
Report theses is
written information.
The volume is ½ – 2 pages. (sometimes up to 4 pages).
An abstract includes the main provisions of the report:

- **an introductory thesis** (relevance, purpose);
- **a central thesis** (the essence of the research);
- the **final thesis** (conclusions).



The main **differences** between the report and the article:

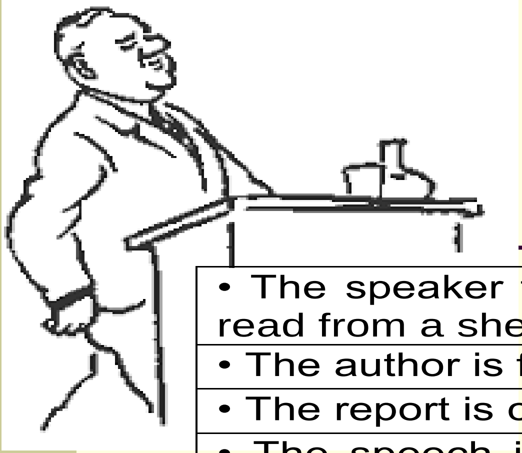
a) **oral language:**
b) **main tips:**
a significant part of the material;
in the report-comment (not a repeat);
report time **decreases by 20-30%.**
c) time limit:
4 pages in 10 minutes. text (typewritten, through 2 int .)
d) feedback.



- Illustrations allow the speaker to turn from listeners into viewers and help them understand the problem form an image.
- The use of illustrative material makes it possible to reduce the time of the report by 20 – 30 %.

In order to present the report:

- in the process of presenting the report, its **text should not be read, but told**, using the prepared plan;
- the content of the report **should not be memorized,** as in this case the speech loses its naturalness (however, it is recommended **to study the main clauses** of the beginning and end);
- **the style** of the report should correspond to **the specifics of oral language**;
- **the volume of the report should be less than the volume of the article** (it should be taken into account that in 10 minutes a person can read the material placed on 4 pages of typewritten text with two-line spacing);
- in the process of presenting the report, it is logical **to use illustrative material** – posters or slides, while in the text of the report only comments (but not repetitions) are given to the illustrative material.



Characteristics of a high-quality report

• The speaker freely talks about the work, and does not read from a sheet of paper.	☑
• The author is free in constructing a train of thought.	☑
• The report is created logically, has a good structure.	☑
• The speech includes intrigue and keeps the audience quiet.	☑
• Illustrations (posters) are actively used in the report, they are the support of the speaker.	☑
• Quite a lot of illustrations (3–5).	☑
• Illustrations correspond to the topic of the report/	☑
• Illustrations fully represent the data.	☑
• Illustrations are clear (understandable without explanations).	☑
• The illustrations are made clearly, brightly, magnificently.	☑
• Only one key point on each poster.	☑
• Mathematical dependencies are presented.	☑

8.3.2. Scientific and technical report

The Introductory part
? cover
? title page
? list of authors
? abstract
? content
? conditional designations

The content of the essay
(no more than 500 words, one page)
? the *report size.*
? the *number of parts of the report, illustrations, tables, appendices, sources.*
? *an abstract text;*
- the *object of study;*
- *The purpose of the work;*
- *research methods;*
- *results and their novelty;*
- *basic structural, technological, operational characteristics and indicators*
- *degree of implementation;*
- *relationship with other works;*
- *recommendations on the use of the work results;*
- the *area of application;*
- *economic efficiency;*
- *significance of work and conclusions;*
- *predictive assumptions about the development of the research object;*
? *a list of keywords.*

The main part
? introduction
? content of the report
? conclusions
? recommendations
? list of references

The contents of the introduction
? *description of the problem;*
? *justification of the relevance of the work;*
? *the purpose of work and the field of application.*

The content of the report *is a statement of information about the object of research, necessary and sufficient to reveal the essence of this work; special attention is paid to novelty in the work.*

Attachments

The structure of scientific and technical report

Introduction

- cover (pages 1, 2);
- title page;
- list of authors;
- abstract;
- content;
- a list of conventional abbreviations.

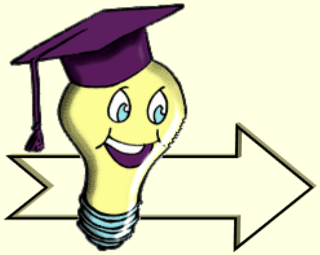
Main part

- introduction;
- the essence of the report.

chapter 1			
chapter 2			
	subchapter 2.1	fig.2.1 fig.2.2 fig.2.3	table2.1 table2.2
	subchapter 2.2	fig.2.4 fig.2.5	table2.3
	subchapter 2.3	fig.2.6	table2.4 table2.5
chapter 3			

- conclusions, recommendations;
- references.

Appendices



An abstract of a scientific and technical report

Abstract:

1) information on the number of: pages, sections, illustrations, tables, appendices, sources;

2) the text of the abstract:

- the object;
- the goal;
- the methods;
- the results, their novelty;
- the degree of implementation;
- the relationship with other works;
- the recommendations for using the result;
- the scope of application;
- the economic efficiency;
- the importance of the work.

3) keywords

The volume of the essay is ≈ **500 words ≈ 1 A4 page**

A dissertation

- ★ **A dissertation** *is a qualifying scientific work that contains a new solution to an actual scientific problem that testifies to the author's personal contribution to science and is submitted for defense for the author to obtain a scientific degree of candidate or doctor of sciences.*

8.3.3. Scientometric databases of publications

Why is the Scopus

1. It directly affects the university's rating – one of the university's reporting indicators for Ministry of Education and Science in Ukraine.

2. Necessary for the defense of doctoral (4 articles) and PhD (1 article) theses (according to the requirements of the Ministry of Education and Culture).

3. Availability of articles in Scopus is necessary when requesting state budget funding.

4. Selection of topics and areas of scientific research, determination of relevance of problems.

5. Search for co-authors, partners in scientific research, including those abroad.

6. When accepting articles in foreign journals, as a rule, they check the availability and number of authors' articles in Scopus.

Scopus (www.scopus.com)

- In 2004, the first serious competitor to Thomson's quotation databases entered the market Scientific (The Institute for Scientific Information (ISI) is a **Scopus product of the Elsevir** company.
- **Scopus** (**www.scopus.com) is the world**'s largest single abstract database.
- **Scopus** includes **17 Ukrainian magazines.**
- The Scopus database contains records up to the mid-sixties. This is a system for evaluating the frequency of citations with a breakdown by individual author's articles, the years of their publication, which allows a scientist to evaluate the citation rate of his works and justify a request for funding, confirmation of the relevance of his results, etc.
- **Scopus** provides support for finding scholarly publications and offers links to all citations from the extensive volume of available articles.

Other world scientometric databases

1. Thomson Reuters (ISI) Web Of Knowledge
2. American Economic Association's electronic bibliography, *EconLit*
3. RePEc (Research Papers in Economics)
4. Cabell's Directories Of Publishing Opportunities
5. Index Copernicus
6. EBSCOhost databases

Informal recommendations

1. Freshness of links – the half-life of a journal is 2-3 years (50 % of links are fresh).

2. Links to articles from **Scopus.**

3. Links to articles in KhNUE journals.

4. Links to the articles of colleagues at Simon Kuznets KhNUE in **Scopus** and other databases to raise the mutual rating.

5. Many self-references are undesirable – self-citation is not welcome.

6. Do not make collective and non-specific references

Informal recommendations (the end)

7. Good English.

8. Sufficient volume (8 – 15 pages in font 10 with 1 line spacing).

9. Detailed, extended, meaningful abstract.

10. Availability of JEL classification.

11. Thoughtfulness of keywords.

12. It is often suggested that be indicate authorship (a reference to their own research).

13. Authors from different countries in one article.

JEL Classification

- **The American Economic Association (AEA) classification system**
- It was developed for use in the *Journal of Economic Literature* (abbreviated as JEL) and is the standard method of classification of scientific literature in the field of economics.
- It is used to classify articles, dissertations, books, reviews and working papers in *EconLit* and is used by major publishers. Descriptions and examples can be seen in the JEL-codes guide.
- *The JEL* classifier is available on the website *of the American Economic Association (AEA).*

SJR and SNIP – what is it?

- **Source-Normalized Impact per Paper (SNIP)**

  Developer: Henk Moed, CWTS.
- **reflects the influence of contextual citation of journals,**

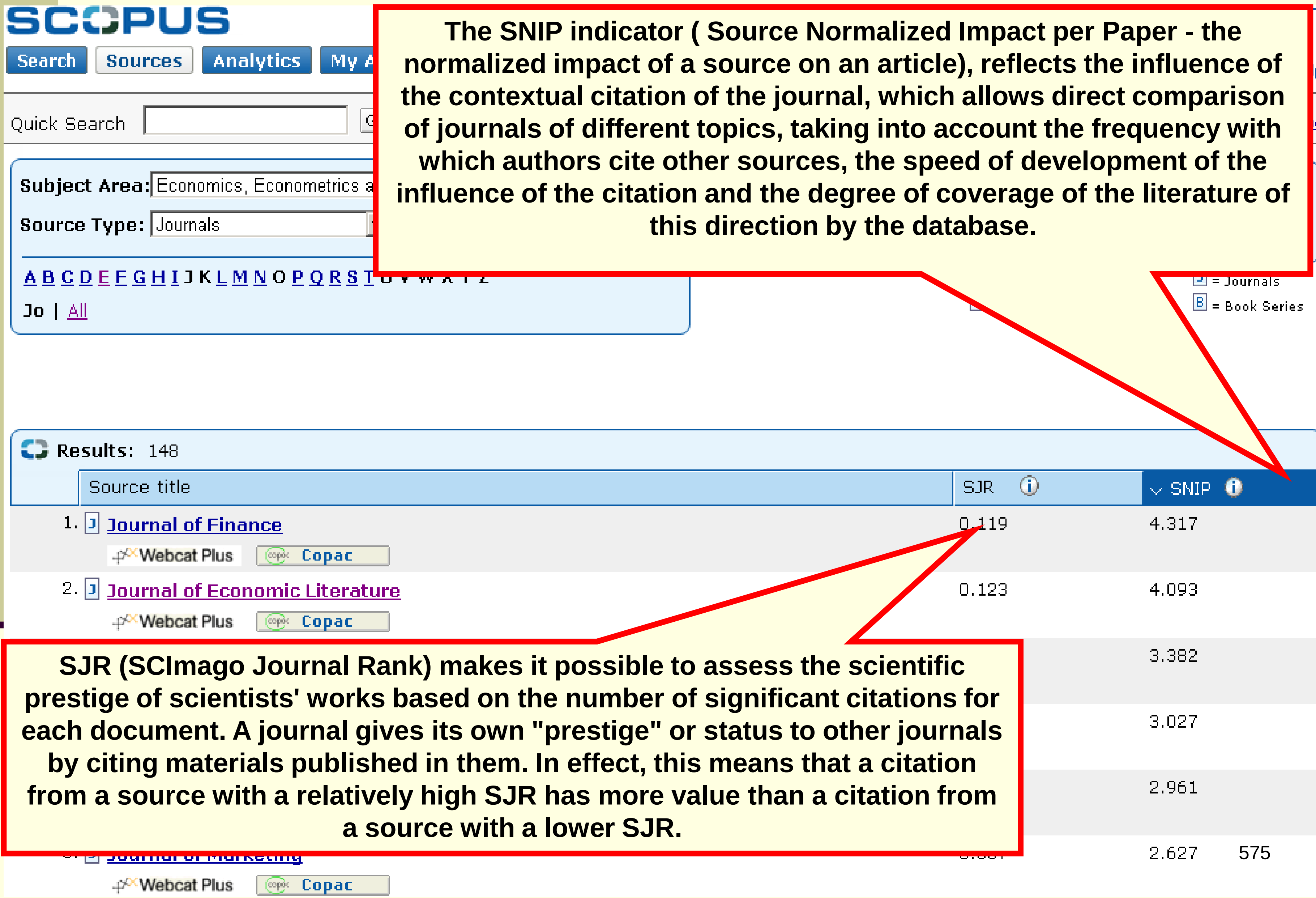
raises the ranking of journals in areas that are less well covered or in areas where researchers cite each other less. It does not depend on the classification of the journal.

- **The SCImago Journal Rank (SJR)**

  Developer: SCImago – Felix de Moya.

- **Prestige metric** Areas that are well-represented in publications tend to increase the ranking of leading journals even more.

Information about scientific sources in Scopus



The SNIP indicator (Source Normalized Impact per Paper - the normalized impact of a source on an article), reflects the influence of the contextual citation of the journal, which allows direct comparison of journals of different topics, taking into account the frequency with which authors cite other sources, the speed of development of the influence of the citation and the degree of coverage of the literature of this direction by the database.

SJR (SCImago Journal Rank) makes it possible to assess the scientific prestige of scientists' works based on the number of significant citations for each document. A journal gives its own "prestige" or status to other journals by citing materials published in them. In effect, this means that a citation from a source with a relatively high SJR has more value than a citation from a source with a lower SJR.

Journal Citation Reports (JCR)

- Based on information received since 1975, SCI databases are produced annually in the form of handbooks of statistical data reflecting the productivity and extent of use of scientific journals – **Journal Citation Reports (JCR).**

- **JCR** is a bibliometric directory that presents comprehensive and diverse citation statistics of scientific journals, which includes a wide range of indicators of the use of journals by scientists from different countries.

Sections of JCR

- A list of scientific journals, ranked in alphabetical order by name, number of references, number of published works in the journal, impact factor and immediacy indicators index, half-life time of the log.

- The impact factor reflects the quality of works published in journals. The use of the impact factor as a criterion for evaluating a journal is based on the assumption that a journal that publishes a significant number of articles that are actively cited by other scientists deserves special attention. At the same time, the higher the value of the impact factor, the higher the scientific value and authority of the journal.

The impact factor

- The classic **impact factor**, that is, what is actually understood by it is "synchronous two-year impact factor, without taking into account the current year."
- It calculated by the Institute of Scientific Information (Institute for Scientific Information®-ISI)
- It is published annually in the JCR database. The SCI appears most often when comparing the level of journals.

Calculation of the impact factor

- The calculation of the impact factor is based on a three-year period. For example, the impact factor of the journal in 2016/2016 is calculated as follows:

- *I* 2016 = A/B,

where:

- A is the number of citations during 2016 in journals monitored by the Institute of Scientific Information, of articles published in this journal in 2014 – 2015;

- B is the number of articles published in this journal in 2014 – 2015.

8.3.4. The Hirsch index

- (The H- index, Hirsch's criterion is a scientometric index proposed in 2005 by the American physicist Jorge Hirsch (University of San Diego, California).
- It is used as an alternative to the classic citation index, which is the total number of references to the works of a scientist.
- The criterion is based on the number of publications of the researcher and the number of citations of these publications.

The H- index (continuation)

For example, an h-index equal to 10 means that scientists have published at least 10 works, each of which has been cited 10 or more times. At the same time, the number of works cited less than the number of times can be any number.

The H-index (the end)

- The Hirsch index is a quantitative characteristic of a scientist's productivity over the entire period of scientific activity.
- This index is presented in reference databases Scopus and Web of Science.
- The h-index can also be calculated using free public databases on the Internet, for example, using the Google Scholar.

Supplement 8.1. Improving the quality of work with search engines

Request clarification

- To exclude documents where a certain word occurs, put a minus sign in front of it in Google or ~ or ~~ in Bing.

- For example (for WWW.BING.com : guide to France ~~agency ~~tur.

Request clarification

- To ensure that a certain word is present in the document, put a plus in front of it in both Yandex and Google.
- For example:
  school equipment + projector.
- If any word is not found, the search engine often offers synonyms instead. To exclude synonyms put the + sign.

Search for a quote within the site

- To find a document that contains a certain phrase, enclose the phrase in quotation marks.
- For example:
  "to be or not to be“.
- Within the site in Google:
- For example:
- Ukrainian site https://war.ukraine.ua/ or https://www.president.gov.ua/en

Use synonyms

- Try changing three or four synonyms at once to search. To do this, list them through a vertical bar (|) or OR.
- For example: norm|normative|rule.
- Matches KARPAT 2015 | 2025.

An exact form operator

- **Looking for names of scientists or other proper names?**
- It does not matter which case to use in the request.
- An exception is the exact form operator. On request! Shevchenko' you will find documents containing this word form in any register.
- And upon request! Shevchenko' - only documents with the form ‘Shevchenko' with a capital letter will be found.
- This is useful if the actual name you are looking for matches a common common name, for example, **a village! Cats.**

Filling in the blanks

- * sign in the query text to insert arbitrary values.
- For example:
- The Council voted on * the draft law.
- The * ambassador arrived.

Advanced search

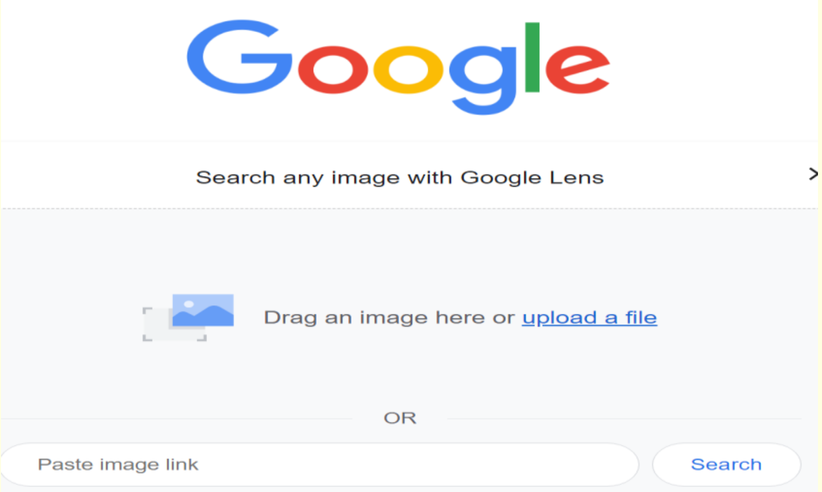
- A dictionary filter.
- The document creation date.
- Search on a specific site.
- Search for an image by name or alternative caption.
- Search for special objects.
- Search for documents in a specific language.
- Search for documents of a certain format.

Additional search services

- Pictures.
- Goods in online stores.
- News.
- Dictionaries.
- Geographical maps.
- Blogs.
- Books

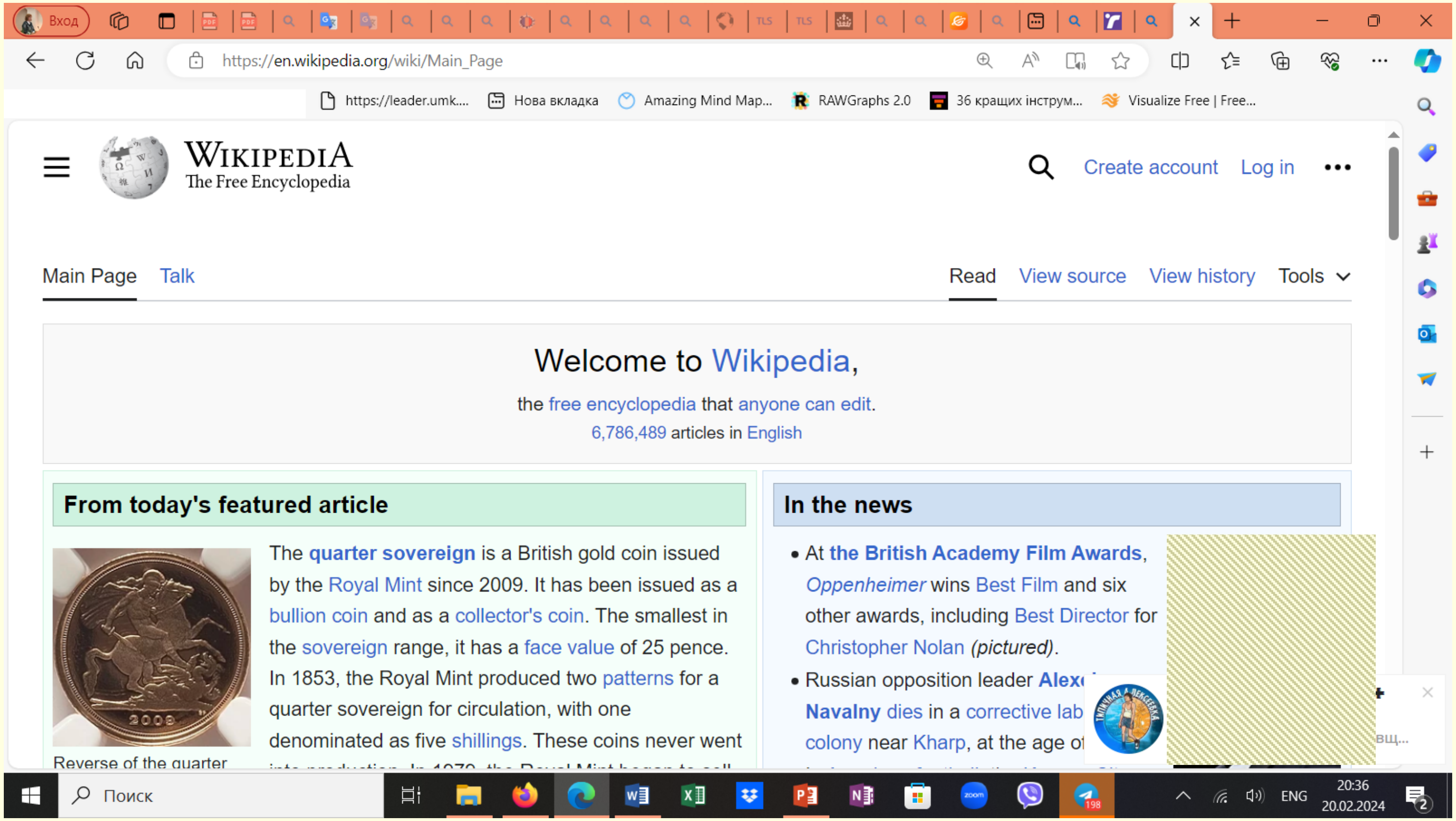
Search for pictures

image size
in pixels and Kbytes



location of the picture

Search within the site



A brief summary

Rules of "communication" with search engines::

1. Search engines usually offer **two types of keyword searches** – **simple and complex ("advanced").**
2. To perform a simple search, enter **one or more keywords** in the corresponding field of the dialog box.
3. Complex search allows you to get a more accurate result, but by complicating the user's query.
4. For a complex search, the user must be able to use additional symbols, functions, as well as logical operators **OR, AND, NOT**, (sometimes also near, close, before).

A brief summary (the end)

For example, the query **"information AND system"** will select only those documents that contain both the word "information" and the word "system".

For example, the query **"information OR system"** will select those documents that contain at least one of the words "information" or "system", or both of these words together.

For example, the result of a search for the query "**system NOT informational**" will be all documents that contain the word "system" and no word "informational".

A list of library and information Internet resources

Libraries of Ukraine:

The National Library of Ukraine named after V. I. Vernadskyi

http://www.nbuv.gov.ua/.

The National Parliamentary Library of Ukraine:

http://www.nplu.kiev.ua.

The State Scientific and Technical Library of Ukraine:

http://www.gntb.nt.org/.

The Scientific library of the Ukrainian Kyiv-Mohyla Academy:

http://www.ukma.kiev.ua/ukmalib/index.html.

The Kharkiv State Scientific Library named after Korolenko:

http://korolenko.kharkov.com.

The Scientific library of the Simon Kuznets KhNUE:

https://www.hneu.edu.ua/biblioteka.

Libraries of some countries of the world

The Library of the USA Congress):

http://www.loc.gov/.

The National Archives and Records Administration (USA):

http://www.archives.gov/index.html.

The British Library (British Library):

http://portico.bl.uk/.

Legislation of Ukraine.

Verkhovna Rada of Ukraine:

http://www.rada.kiev.ua.

Regulatory acts of Ukraine:

http://www.nau.kiev.ua.

The League: LAW:

http://www.liga.kiev.ua.

Control questions

1. Describe the role of information in conducting scientific research.
2. How is the National System of Scientific and Technical Information organized?
3. What are the types, sources of information and modes of access to it?
4. Where is economic information searched in documents and in the system of bibliographic resources of Ukraine.
5. Give a general description of the technology of working with information sources.
6. Name the main economics journals.
7. Describe the main services of the Internet and the main types of searching for scientific information.
8. What are the features of using Internet information and search systems?
9. What are the rules for formulating requests for searching information on the Internet?
10. Electronic resources: domestic and foreign databases, electronic libraries on the Internet.
11. What is the practice of dynamic reading and rational work with scientific literature?
12. What are the requirements for publishing research results in articles, monographs, reports, reports at conferences?
13. What is the purpose of scientometric databases of publications?
14. What are the features of using the Impact Factor?

The practical component

Work with libraries

- Find 2 – 4 PhD dissertations related to your topic (or at least those that are within your specialty) in **Internet digital** libraries. For each of these dissertations, provide: their e-mail address, source data (formed in accordance with the requirements for creating links), research questions (tasks) formulated in the dissertation, and scientific novelty obtained for each of these questions (tasks).
- Submit this result in the original language and in Ukrainian in the translation.

The practical component (the end)

Description of some dissertation libraries

- **Dialnet**

  The archive includes more than 48,000 dissertations, presented mainly in English and French.

- **OATD (Open Access Theses and Dissertations)**

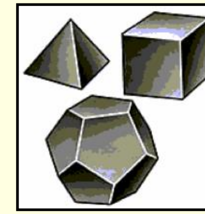
  The international database provides access to 2,800,000 dissertations

- **PQDT Open**

  Full texts of dissertations in ProQuest's UMI Dissertation database Publishing the authors of which have given consent to place their works in the public domain. Currently, open access to 27,000 works is provided in the database.

9. Project forms of scientific research

System elements of the topic



9.1 Forms of financing scientific research activities

9.1.1 Funding of scientific research and development by the National Research Fund

9.2. Methods of project management in the management of scientific research

9.3. Drawing up applications for grants

9.4. Logical table for drawing up the project

9.5. The general structure of application grant

9.6. The principles of drawing up a grant application

9.7. An application for obtaining security documents

9.1. Forms of funding of research activity

The sources of funding for scientific and scientific and technical activities are:

- funds from the state budget allocated for conducting fundamental and scientific research in accordance with the priority directions of the development of science and technology;
- funds received from legal entities or individuals for the performance of scientific and research farm contract works;
- grant funds for the implementation of scientific research works from foreign and domestic funds, legal entities or individuals;
- funds received for the provision of educational and scientific services from legal entities and individuals;
- joint financing of scientific research and development by the EU budget and project ;
- other sources in accordance with current legislation.

9.1.1. Funding of scientific research and development by the National Research Fund

- Funding by the National Research Fund is carried out on the basis of the Procedure approved by **the Resolution of the Cabinet of Ministry of Ukraine dated December 27, 2019 No. 1170.**
- This Procedure defines the procedure for competitive selection and financing of projects for the implementation of scientific research and development by the National Research Fund.
- A grant is financial resources provided by the Foundation on a free and non-refundable basis for conducting fundamental and (or) applied scientific research, scientific and technical (experimental) developments.
- A grant is provided to a grantee in the amount of full or partial cost of the works necessary for the implementation of the project.

9.2. Methods of project management under the management of scientific research

A problematic situation.

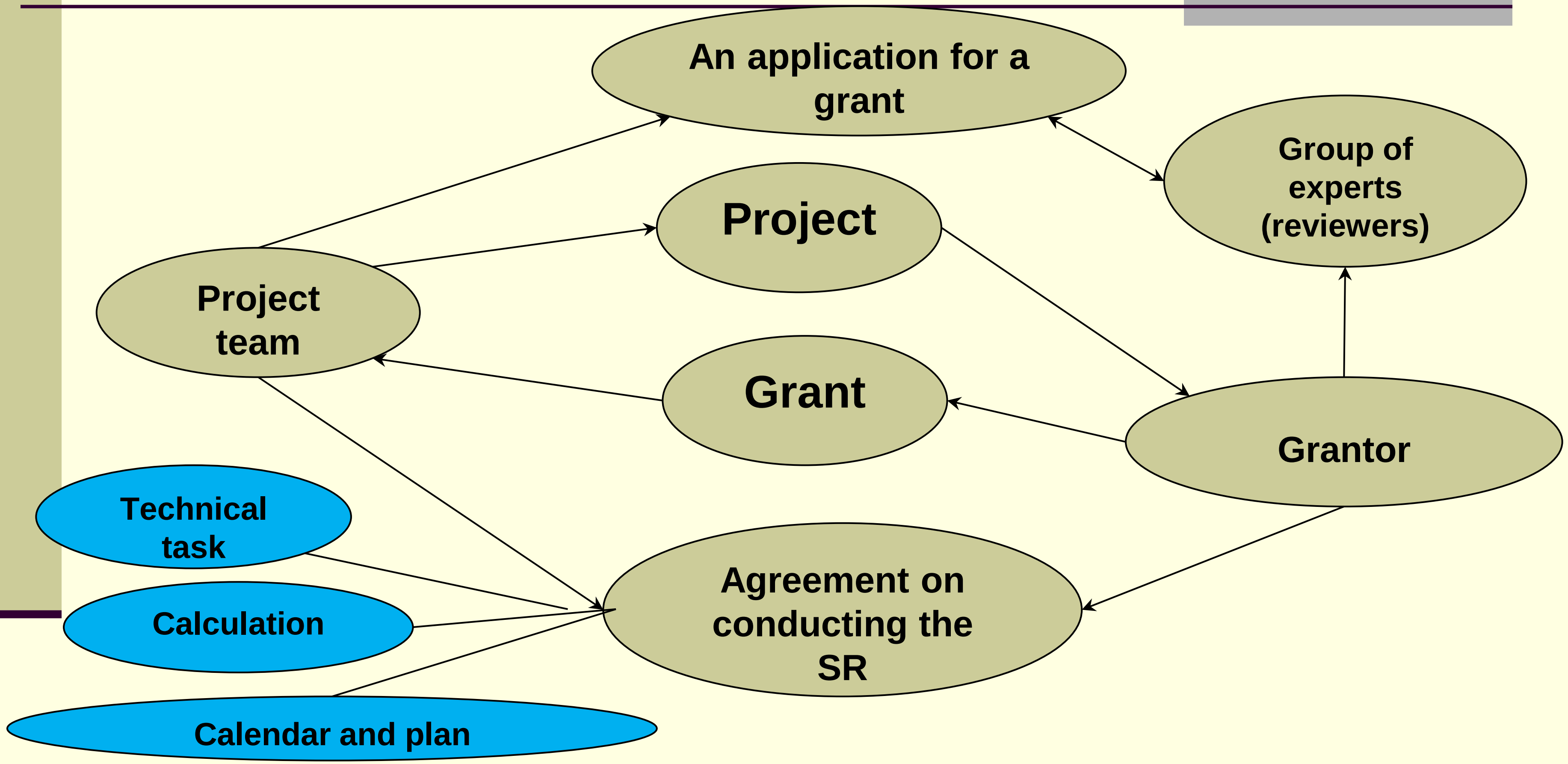
- **It is necessary to create a methodological basis for the construction of electronic stores** based on Internet services for the organization of electronic commerce.
- In the structure of the electronic store, it is necessary to include modern concepts and ideas of electronic business development.
- **Applied Purpose** is to ensure high profitability and competitiveness of the electronic store.

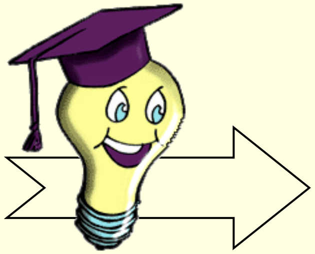
To solve the problem, **a team of specialists of various profiles is created**: a system analyst of computer systems, an economist, a web designer, a programmer, a psychologist, a mathematician, a marketer.

Methods of project management under the management of scientific Research (the end)

- Such a group of specialists is united in a structure which in management theory is called **a project team**.
- The targeted activity of the project- research team is called **"a project"**.
- The science and practice of managing such projects is called **"project management"**.

A generalized structure of the subject area "Project forms of SR"





Basic concepts of the project management theory

The German standard DIN 69901**: "A project is an enterprise (intention)** *that is largely characterized by the uniqueness of the conditions in their totality, for example: the task of the goal; temporal, financial, human and other limitations; separation from other intentions; project-specific organization of implementation".*

The English Association of Project Managers: **"A project is a separate enterprise with specific objectives**, *often including requirements for time, cost and quality of the results to be achieved".*

"A project is a time-limited purposeful change of a separate system *carried out as a complex of interrelated activities using a set of tasks, with established requirements for the quality of results, possible frameworks for spending means and resources, and a specific organization".*

- **The structural and functional model of the project as a system:**
- the structure of the subject area of the project;
- meaningful definitions of the elements included in the structure of the subject area;
- classifiers of the specified elements;
- control variables with the help of which project management is carried out.

The subject area of the project:

The goal of the project concept;
Job tasks;
Results, project resources, project budget;

Direct project participants;
Other project participants;
Project team.

The processes:

The project;

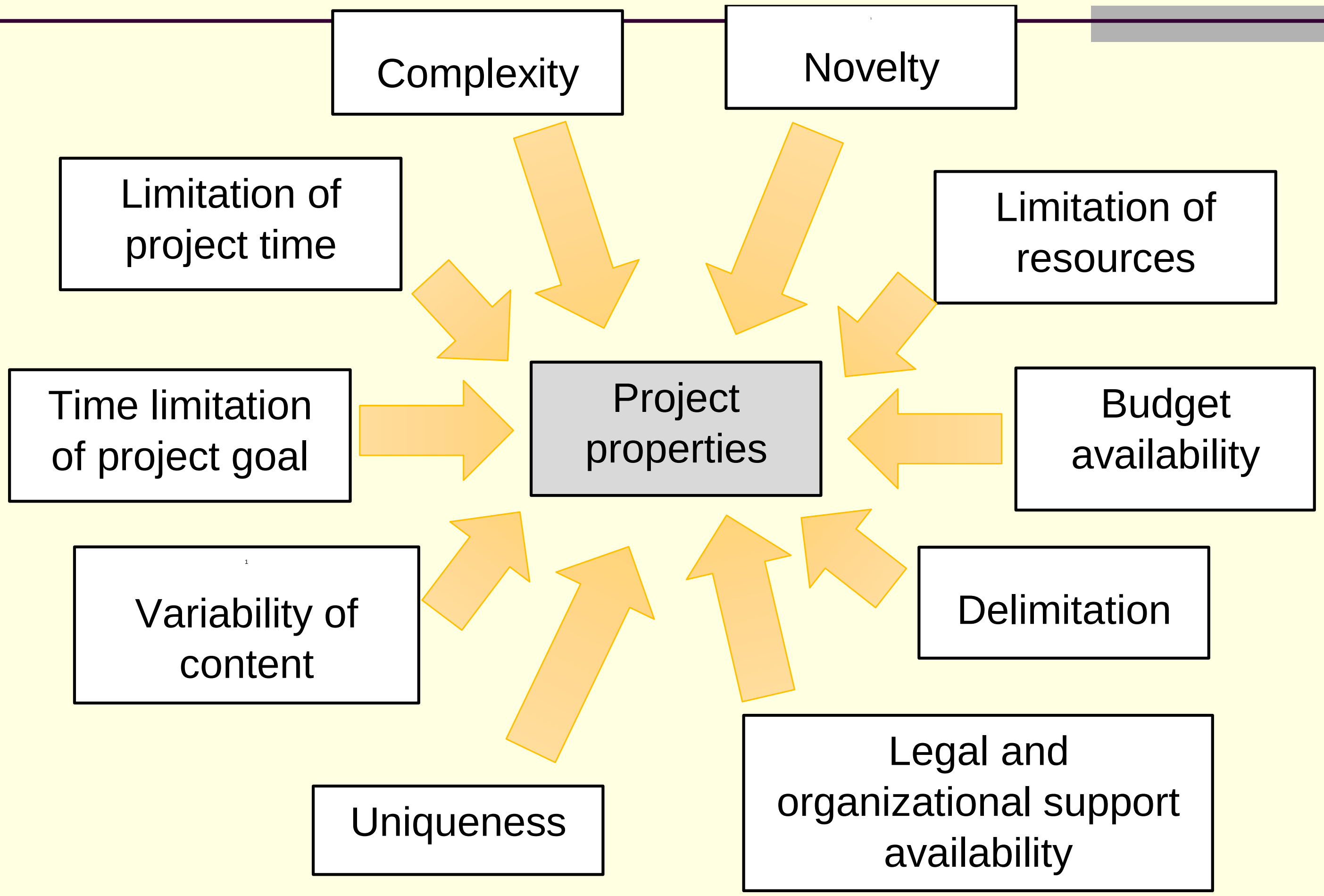
The following sub-processes (phases) can be distinguished: The process of choosing project **alternatives;**

The project **execution** process;

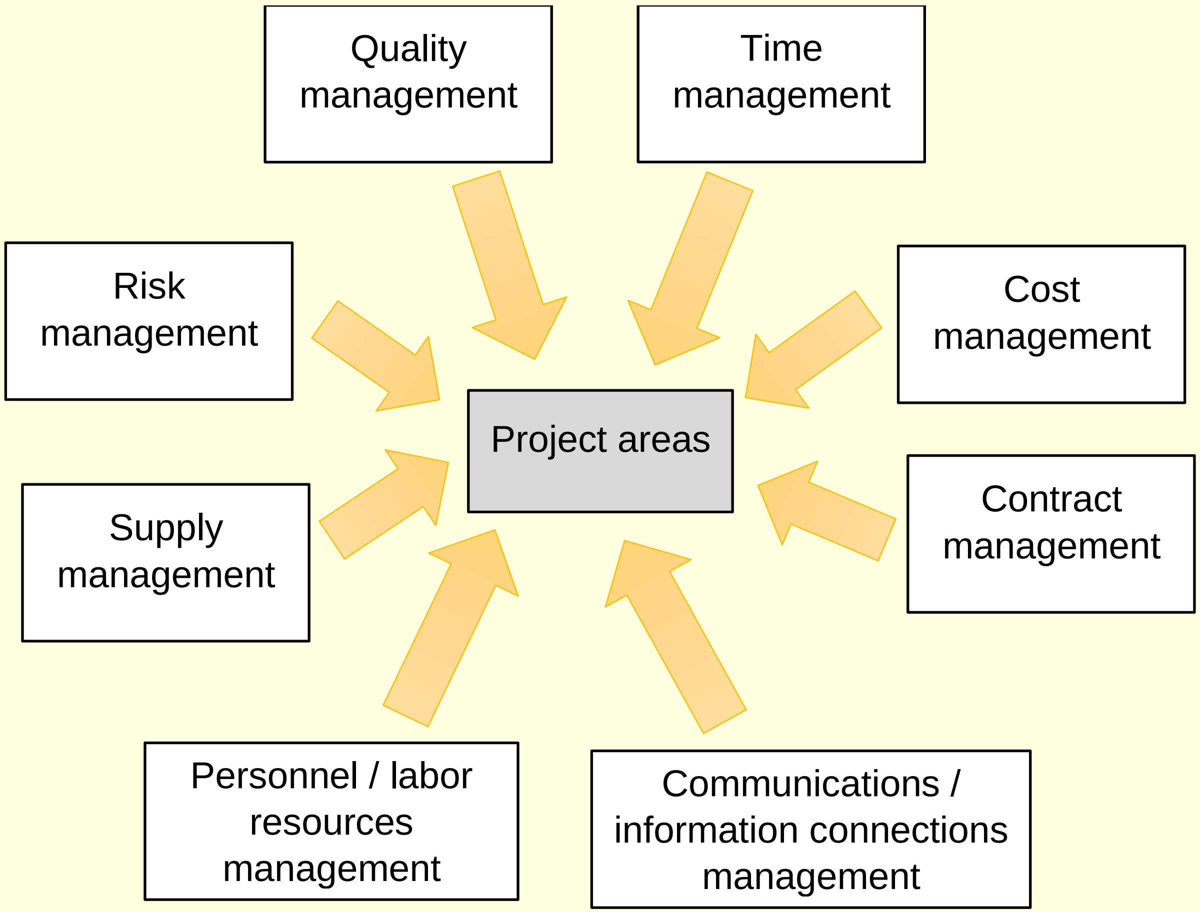
The **management** .

1. **Definition of goals,** *(what should be accomplished?).*
2. **Design** *(how to do).*
3. **Implementation***.*
4. **Application** *(operation).*

Properties of projects



The main functions in the management of the subject area of a project



9.3. Drawing up applications for grants

Grant (a grant is what is given as a gift, from the Latin **gratiis** – a gift) is **funds transferred free of charge by the donor** (a grantor, a sponsor, a donor) to a private person or non-profit unprofitable) organization and intended to perform certain work.

Information on funding sources (an example):

- Information service on charitable funds "The Foundation Center" (**The Foundation Center, 79 Fifth Auenue, New Yogk.NY, 10003 US**), which annually published directories, has libraries and databases of 24,000 private foundations;
- Kyiv branch of the European Community Programs that support scientific research, the development of new technologies, and the development of education.

When analyzing information about funds, pay attention to:

- **the projects of which subject and on whose territory** they are implemented (Ukraine, Serbia, the USA, etc.) is ready to finance this fund;
- **whom and why project prefers** (students, graduate students, representatives of the fairer sex, non-governmental organizations, research institutes, etc.);
- **what type of sponsors' activity** (purchase of equipment, business trip (travel-grant, salary for researchers, services of third-party consultants, etc.);
- whether **the applicant can be a collective or an individual** , a non-governmental organization or a state institution;
- what is **the typical grant recipient**, **the annual amount of donations, the number of grants** issued in the last year, their average, minimum and maximum **size**.

A request letter is sent to the fund (a letter of inquiry)

The request letter has to be:

- **short** (1– 2.5 pages);
- **signed by the project manager**, as well as the head of the council of a non-governmental organization or the head of a state institution (for example, the rector), (which means **the support of your project by this organization**);
- **explain why you are applying to this particular fund** (refer to the source of information about the fund);
- **in one phrase** with clear wording, justify the essence of a specific problem (**for example, the low efficiency of Web-sites of such and such a type**) and the necessity of this project;
- contain **clear information about the purpose and tasks of the project** , the methods of solving them, the expected results and the cost of the project;
- convincingly **justify** why this team of project participants or you personally **are able to implement this project**, for which describe the areas of activity, achievements and qualifications (academic degree, title, received prizes, victory at competitions, number of publications) of the project participants;
- **indicate what you expect** from the review of your request letter (a meeting with a representative of the fund or an offer to send a grant application for examination).

9.4. A general structure of the application for a grant and evaluation criteria for its sections

- **The title page** (cover page)
- **A short abstract** (summary) (0.5–1 p.).

Description of the essence of the project:

- who will carry out the project,
- why and who needs this project,
- what will be the result,
- how the project will be carried out,
- how much money will be needed.

The introduction is 0.5–2 pages long. It should contains information about the applicant organization: the nature and goals of its activities, whose needs and how it serves, which confirms its reputation.

Statement of the problem or justification of needs (problem statement or assessment needs) (on 1–3 pages) – why there was a need to implement the project.

Project goals and objectives (program goals and objectives) (0.5–1 p.). Give an idea of what the results of the project will be, whether they are verifiable.

The goal is what the project is for, its general summary.

Tasks are specific effects (different from each other) that need to be achieved during the implementation of the project. Tasks and results logically follow from the statement of the problem, they are amenable to quantitative assessment.

Methods (1–3 pages). The actions (measures) that must be carried out in order to achieve the intended results and solve the intended tasks are indicated. The following are given: the scheme of organization of work according to the project and the calendar plan.

There should be a logical chain: problem → goal → task → method.

Assessment and reporting (evaluation) (0.5–1 p.).

It should be clear from the section:

how your propose to determine whether the project has achieved its objective,

how you will monitor the project implementation process;

what the plans for evaluating the degree of achievement of the goal and evaluating the effectiveness of methods during the implementation of the project are;

who will conduct the assessment;

what are the project success criteria based on;

in which form you will report on the work performed and the funds spent.

Future funding (0.5–1 p.).

Budget (3–7 pages). Answers the questions clearly:

How much money is required from the grantor and what are the items of expenditure?

From which sources will be received other resources which needed for the implementation of the project and where they will be spent on?

Which works are performed free of charge?

What share of expenses are taxes, and what share is wages?

Are all indirect costs and the expected level of inflation taken into account?

Appendices include additional materials explaining the content of the sections of the application.

9.5. Principles of application for a grant

1. **The cover letter** usually contains the following points:
a) **The name of the project;**
b) The **implementing organization** (full name of the organization implementing the project, address, phone, fax, e-mail, bank details);
c) **The applicant organization;**
d) The **supporting organization;**
e) The **project manager;**
f) **The term of the project;**
g) The **cost of the project;**
2. **An abstract of the application** – most reviewers (experts) first read only the abstract.

Motto writing annotations : "Everything is for the comfort of the reviewer!"

The motto of writing the introduction: **"Gain maximum trust in the donor!"**

3. Introduction.

It is believed that the grant is issued based on the reputation of the organizer-applicant, and not only on the assessment of the quality of the project.

Your tasks is to prove that you are really able to dispose of the donor's funds with benefit.

In order to give the sponsor credibility **in** the applicant organization, it is desirable to disclose:

- *goals and objectives* of your organization;
- *since when* it has existed, how it has developed, what financial resources does it has at its disposal;
- *the uniqueness of your organization*, achievements and "records" associated with it;
- evaluation *of the results of previous projects* similar to the proposed one;
- *a precedent of financial support* received from other sources.

4. Statement of the problem or justification of needs

The motto of writing the chapter: "**Intrigue the grantor with a problem!**"

Possible errors:

- *expressing the internal needs of your organization* (for example, lack of money), formulating the statement of the problem;
- *thinking that everyone* (including the donor) *is well aware of* the essence and *seriousness of the problem you are solving;*
- *use of professional terms;*
- *admire quotes* bringing more than two;
- *tireing the reader with a description* technical *details;*
- *neglecting the duty to persuade* reader *(donor) that you will implement your project in principle;*
- trying *to solve all the world's problems in the next six months.*

5. Goals and objectives of the project.

The motto of the section: "**Show that the goals are achievable, the results are verifiable**".

6. Methods. Here it is important to clarify two main questions:
What is your strategy for achieving the desired results?
Why did you choose this list of possible goales?

Writing motto section: "**Demonstrate competence**!"

7. Evaluation and reporting.

The motto of writing the section: "**Make transparent all stages of work and expenses!**"

8. Budget, or cost estimate. It is possible, for example, to recommend a budget with three sections:

a) salary (personnel);

b) bases and direct costs (non-personnel direct cost);

c) indirect cost and expenses.

The list of expenditure items and required resources is as follows:

people: full-time employees + consultants + experts + contracts with other organizations;

remuneration: salary + cost of contract services + taxes + inflation;

premises: rent payment + utility payments;

business trips and transport costs;

equipment: prices + prices of consumables + inflation;

report: editing fee + printing fee + translation fee;

mailing and communication: postage + fax, telephone costs.

9.6. Application for obtaining security documents

- **An invention** (a useful model) is the result of human intellectual activity in any field of technology.
- **A patent** (declaratory patent) for an invention (a utility model) is a protective document certifying the priority, authorship and ownership of an invention (utility model).
- **Objects of the invention (a useful model)** can be:
  - a product (a device, a substance, a microorganism strain, a plant and animal cell culture, etc.);
  - a process (method), as well as a new application of a known product or process.
- **Inventions:** a protection document – a patent.
- The term of validity of a patent of Ukraine for an invention is 20 years from the date of submission of the application.

Objects of copyright

Objects of copyright are works in the field of science, literature and art, namely:

- literary works of a fictional, journalistic, scientific, technical or other nature (books, brochures, articles, etc.);
- performances, lectures, speeches, sermons and other oral works;
- computer programs;
- databases;
- musical works with and without text;
- dramatic, music-dramatic works, pantomimes, choreographic and other works created for stage performance and staging;
- audiovisual works;

Objects of copyright (continuation)

- works of fine art;
- works of architecture, urban planning and garden and park art;
- photographic works, including works made by methods similar to photography;
- works of applied art, including works of decorative weaving, ceramics, carvings, art glass foundries, jewelry, etc.;
- illustrations, maps, plans, drawings, sketches, plastic works related to geography, geology, topography, technology, architecture and other fields of activity;

Objects of copyright (the end)

- **Copyright for a work** created in co-authorship belongs to all co-authors, regardless of whether such a work forms one inseparable whole or consists of parts, each of which has an independent meaning.

- **A security document is a certificate of Ukraine.**

- Copyright for a work arises as a result of the fact of its creation and comes into effect from the day of creation of the work.

Requirements for preparing and submitting an electronic application

- Preparation of electronic applications for the object of intellectual property rights is carried out using the software of **the electronic application submission system** available through the website of the examination institution on the Internet (**http://www.uipv.org**).

- A mandatory requisite of an electronic application is **an electronic digital signature** which is used to identify the applicant (his representative) by other subjects of electronic document circulation and to confirm the integrity of the data set of the electronic application.

Control questions

1. What are the forms of financing scientific research activities in Ukraine?
2. What is a farm contract" research work (R&D)?
3. What methods of project management are used in the management of scientific research?
4. What are the specifics of the grant form of financing research works?
5. Under what conditions are applications for grants made?
6. What are the principles of applying for a grant?
7. Reveal the main content of the logical table for drawing up a project.
8 . What is the content of the general structure of a grant application?
9. Describe the process of developing an application for grants and security documents.
10. What types of activities fall under the concept of scientific activity?
11. In what forms is the organization of scientific research carried out?
12. What are the objects of copyright?
13. How is the the electronic application for an object of intellectual property rights is prepared and what are its mandatory details?

The practical component

Objectives of the task:

- get acquainted with examples of the implementation of an application for financing scientific research and an example of the implementation of R&D on the creation of a complex system;
- acquire skills in formulating an application for a grant for carrying out scientific research work;
- learn how to conduct a qualitative and quantitative analysis of a goals tree.

Task

1. Work out the content of the application material submitted in Example 9.1.

2. Try to fill in the content of the positions of the application where there are blanks marked whith dots.

3. Decompose the presented material from R&D in Example 9.2. on the review part, the research theoretical component, the experimental part and the design and construction components of the research work.

Example 9.1. The structure of the project application

(Creating an electronic learning system)

Project

basic research

which will be implemented at the expense of the general fund of the state budget.

- **Project title: Theoretical and methodological foundations of creating a support system for e-learning in a new generation higher education institution.**
- The proposed term of project implementation (at the discretion and justification of the manager – from 2 to 3 years).
- **1. Abstract** (*a summary of the project* (up to 15 lines).
- **2. RESEARCH PROBLEMS** (up to 15 lines).
- **2.1. The problem to be solved by the project.**

Example 9.1 (continuation)

- **3.1. Analysis of the results obtained by the authors of the project and other scientists for this problem, topic, object and subject of research.**
- **3.2. Analysis of the results obtained by foreign scientists** (analogous to that given in clause 3.1).
- **3.3. A list of the main publications** (no more than 10) **of foreign and domestic** scientists (except for the authors' publications listed in the appendices)**, containing analogues and prototypes is the basis for the project (up to 20 lines).**
- **4. The purpose, the main tasks and their relevance** (up to 70 lines)**.**

Example 9.1 (continuation)

- **4.1. Ideas and working hypotheses of the project.**
- **The leading idea of the research is based on the assumption…**
- **Working hypotheses:**
- 1) a combination of multimedia didactic complexes, multimedia interactive educational publications, electronic learning management systems will provide... ;
- 2) the effectiveness of e-learning depends on the quality of its design, which... .

Example 9.1 (continuation)
4.2. The goal and tasks to be solved by the project

- **The goal of the project is** creation… .
- **The objectives of the project are:**
  - performance of a system analysis …;
  - determining of the features of application …;
  - development of a concept for creating a system …;
  - developent and theoretical justification of the model ...;
  - justification and creation of a support system for e-learning ...;
  - development and experimental implementation of effective management mechanisms ...;
  - preparing scientific and methodological support... .

Example 9.1 (continuation**)**

4.3. Justification of the relevance and/or expediency of tasks, based on:

- **the state of research on issues and topics;**
- **ideas and working hypotheses of the project.**

Example 9.1 (continuatio**n)**

5. The approach, methods, principles and features of research on the project (up to 50 lines)

- **5.1. Defining the research approach, substantiating its novelty.**
- **The essence of the approach...**
- **5.2. New or updated methods and tools, methodology and research methodology, which will be created by the authors during the implementation of the project.**
- To achieve the defined goal and tasks, **the work will use a system of general scientific and special research methods:** the *abstract-logical method* – for substantiating the main provisions of the complex methodology of technological support of e-learning; the *systematic approach, methods of analysis and synthesis* – to substantiate the concept of forming an electronic learning system; *system-structural analysis* – for the formation of provisions for designing ...
- **5.3. Peculiarities of the structure and components of conducting research.**

Example 9.1 (continuation)

6. The expected results of the project implementation and their scientific novelty (up to 60 lines)

- **6.1. Precisely present the expected results – preliminary descriptions of theories, concepts, regularities, models, other provisions – which will be created, changed and/or supplemented by the authors.**
- **As a result of the implementation of the project, the following will be created: . . .**
- **6.2. Determine which of the expected results can be scientifically substantiated and proven, will be based on the laws (and which ones) of nature, and which will be useful methodical and technical developments based on practical experience.**
- **The following results can be scientifically substantiated and proven:**

(results)

Example 9.1 (continuation)

- **6.3. Prove the scientific novelty of the given provisions based on their meaningful comparison with existing analogues in the world science based on references to specific publications** (listed in Table 1)**, prove the advantages of the received over the existing.**

- **7. Practical value for economy and society**

(up to 60 lines)

- **7.1. Substantiate the value of the expected results for the needs of the development of the country and world society.**
- **7.2. Prove that in order to obtain the given scientific results, it is worth spending the appropriate funds from the state budget, that is, that the social or other effect of using the project results will exceed the costs.**

Example 9.1 (continuation)

- **7.3. Substantiate the value of the expected results for world and domestic science.**

- **7.4. Prove the value of the results for the training of specialists in the education system, in particular those with higher qualifications**, provide the names and subjects of master's and doctoral students**.**

- **7.5. Provide a planned list of informational and analytical materials, recommendations, proposals of other documents that can be transferred for use outside the executing organization.**

Example 9.1 *(continuation)*

8. Financial justification of costs for project implementation

- **8.1. The volume of salary expenses (calculation by the number of employees involved in the implementation, total and on a yearly basis).**
- **8.2. Estimated.**
- **8.3. The volume of expenses for energy carriers, other communal services (according to the types, based on a comparative calculation of previous periods, total and on a yearly basis).**
- **8.4. Other expenses (according to the type, with justification of their necessity, general and on a yearly basis).**
- **8.5. Consolidated estimation of the project (total and on a yearly basis).**

Example 9.1 (continuation)

9. The work and experience of the authors on the subject of the project

- **Work on the topic of the authors of the project for the previous 3 years.**

- **9.1. Specify the h-index of the project manager in Scopus.**
- **9.2. Specify the total h-factor in Scopus of 5 project executors (except the project manager).**
- **9.3. List of the articles in journals included in Web of Science scientometric databases, Scopus.**
- **Abstracts of the articles in Ukrainian can be found in Appendix 1**
- **9.4. Articles and abstracts of conference reports included in the scientific and metric databases of Web of Science; Scopus (for the socio-humanitarian direction, additionally Indexed in Copерernicus) , which do not belong to item 9.2.**

Example 9.1 (continuation)

- **9.5. Articles published on the topic of the project in journals that are included in the list of professional publications of Ukraine and have ISSN, articles in foreign journals that are not included in paragraphs 2–3, as well as English-language abstracts of reports at international conferences in journals that are included in scientific Web of Science metric databases; Scopus (for the socio-humanitarian direction, additionally Indexed in Copernicus).**
- **9.6. Monographs and (or) sections of monographs published on the topic of the project in Ukrainian or Russian.**

The annotations of the monographs in Ukrainian can be found in Appendix 2.

- **9.7. Monographs and (or) sections of monographs published in foreign publications in the official languages of the European Union.**

The annotations of the monographs in Ukrainian can be found in Appendix 3

Example 9.1 (continuation)

- **9.8. Documents and materials representing scientific and scientific-applied results were created and implemented outside the executing organization.**
- **9.9. Protection documents (patents, copyright certificates) for objects of intellectual property rights have been received.**
- **9.10. The candidate's and doctoral dissertations were defended by the project executors.**
- **9.11. Individual grants (scholarships), scientific internships in Ukraine and abroad, financed from the State Budget of Ukraine and/or foreign organizations (total number of months for the manager and 5 project executors.**

Example 9.1 (continuation)

- 9.12. **The number of grants**, under which performers worked, financed by foreign organizations.

- 9.13. The team of performers **performed farm contract topics** for the amount of 20 thousand hryvnias.

Example 9.1 (the en**d)**

Appendices to the Application for financing of the State Budjet

Appendix 1. Abstracts in Ukrainian of the articles.

Appendix 2. Abstracts in Ukrainian of the articles.

Appendix 3. Abstracts in Ukrainian of the monographs.

Example 9.2. R&D

Creation of an automated system of collection of information and notification of natural disasters

General characteristics of R&D

- **The problem**: Tsunamis in the Far East bring economic and social damage (untimely notification and false alarms).
- **The hypothesis** (main): Tsunamis are generated as a result of earthquakes with an epicenter in the Pacific Trough. If it is detected at the moment of its inception and reported via radio or electronic communication channels, timely measures can be taken.

A natural experiment (before and after)

1 . A working ***layout*** (prototype) of the system ***is produced***

2. A plan of experiments (tests) is drawn up

3. An application for a research vessel is made

4. An expedition is formed from the members of the R&D project

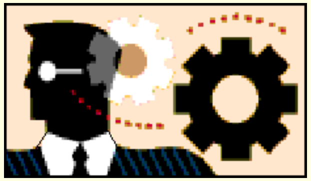
5. Experiments (tests) are conducted

The experimental ***results are being processed***

7. Additional ***scientific research is carried out*** and ***changes are made to design solutions***

10. Technology of work on the dissertation. Presentation, protection and implementation results of scientific research

System elements of the topic



10.4. Defense of the dissertation

10.3. Dissertation abstract and presentation of scientific research

10.2. Organization of work on the dissertation

10.1. Levels and degrees of higher education

10.1. Levels and degrees of higher education

- Initial level (short cycle) of higher education;
- First (bachelor's) level;
- Second (master's) level;
- **Third (educational and scientific) level**;
- **Scientific** level.

Some basic concepts

Article 5 of the Law on Higher Education

Levels and degrees of higher education

- **The third (educational-scientifi) level** of higher education corresponds to the eighth qualification level of the National Framework of Qualifications and provides for a person to acquire theoretical knowledge, abilities, skills and other competencies sufficient for the production of new ideas, solving complex problems in the field of professional and/or research and innovation activity, mastering the methodology of scientific and pedagogical activity, as well as conducting own scientific research, the results of which have scientific novelty, theoretical and practical significance.

Article 5 of the Law on Higher Education

Levels and degrees of higher education (the end)

- **The scientific level of higher education** corresponds to the ninth qualification level of the National Qualifications Framework and involves the acquisition of competencies in the development and implementation of research methodology and methods, the creation of new system-forming knowledge and/or progressive technologies, the solution of an important scientific or applied problem that has a national or global importance.

Article 5 of the Law on Higher Education

The National Qualifications Framework (NQF)

- The NQF is systematic and structured description of qualification levels based on competencies. A regulatory document adopted in Ukraine in 2011.
- The NQF is intended for use in the development, identification, correlation, recognition, planning and development of qualifications.

How the NQF is organized:

- The NQF contains a description of the ten qualification levels: from zero (ability to act adequately in known simple situations under direct control and readiness for systematic training) until nine (the ability to identify and solve socially significant systemic problems in a certain field of activity, which are key to ensuring sustainable development and require the creation of new system-forming knowledge and progressive technologies).

Awarding a corresponding degree of higher education:

1) junior bachelor;
2) bachelor;
3) master's degree;
4) PhD;
5) Doctor of Sciences (DSc).

Article 5 of the Law on Higher Education

Doctor of Philosophy (PhD)

- PhD is **an educational and at the same time the first scientific degree** obtained at the third level of higher education on the basis of a master's degree . The degree of Doctor of Philosophy **is awarded by the specialized academic council of** a higher educational institution or scientific institution as a result of **successful completion** by the student of higher education **of the relevant educational and scientific program** and **the public defense of the dissertation in the specialized academic council**

Article 5 of the Law on Higher Education

Doctor of Sciences

- DSc is **the second scientific degree** obtained by a person at the scientific level of higher education on the basis of the degree of Doctor of Philosophy and involves **the acquisition of the highest competencies** in the field of development and implementation of research methodology, conducting original research, obtaining scientific results that provide solution to important theoretical or applied problems of national or global importance and published in scientific publications.

Article 5 of the Law on Higher Education

10.2. Organization of work on the dissertation

- **A dissertation** (from letindissertatio – essay, discussion, judgment, report) is a specially prepared **scientific work** with **the rights of a manuscript**, which is performed for public defense for obtaining a scientific degree.

- **A dissertation** is a qualifying scientific work that contains **a new solution to an actual scientific problem**, testifies to **the author's personal contribution to science,** and **is submitted for defense** for the author to obtain the scientific degree of Doctor of Philosophy or Doctor of Sciences.

Research methodological apparatus

Design > contradictory>
problem > relevance of research >
object > subject > purpose > hypothesiS >
Tasks > new

Methodological foundations.

Research methods.

Research methodological apparatus

Plan →

(as a rule, it is not formalized in writing, but is constantly kept "in the mind": in what direction the researcher wants to move, what new scientific knowledge he wants to obtain)

Research methodological apparatus (the end)

Topicality research

(it sheds light on what tasks are facing practice and science in the aspect of the chosen direction in specific socio-economic conditions; what, by and large (in a general overview), has been done by predecessors, and what remains undiscovered, what still needs to be done).

10.2.1. Dissertation structure

- The title page;
- an abstract;
- the contents;
- a list of conditional designations (if necessary);
- the main part;
- references;
- Appendicies.

Order of the Ministry of Education, Culture and Sports No. 40 dated January 12, 2017 “About the approval of the requirements for the design of the dissertation”.

Each of these elements, as well as the main body and appendices sections, must start on a new page.

10.3. The dissertation abstract and presentation of scientific research

- To familiarize yourself with the content and results of the dissertation, an abstract is submitted in the state and English languages, that is a generalized summary of its main content in accordance with the established model.

- The abstract of the dissertation should briefly present **the main results of the research**, indicating **the scientific novelty** and the presence of practical significance.

Order of the Ministry of Education, Culture and Sports No. 40 dated January 12, 2017 “About the approval of the requirements for the design of the dissertation”.

The dissertation abstract

The abstract also states:

- the surname and initials of the recipient;
- the thesis title;
- the type of dissertation and scientific degree for which the applicant is applying;
- the specialty (code and name);
- the name of the university or the name of the scientific institution in which the training was carried out;
- the name of the scientific institution or the name of the university in whose specialized academic council the defense will take place;
- the city, the year;
- the volume of the annotation is 0.2 – 0.3 author's sheet.

A sample

Appendix 2
to the Requirements for Dissertation
(paragraph 2 of Section III)

Abstract

Sorokina N.V. Formation of the professional foreign language competence of future philologists by means of multimedia technologies. – Qualifying scientific work on manuscript rights.

The dissertation for obtaining the scientific degree of Candidate of Pedagogical Sciences (Doctor of Philosophy) in specialty 13.00.04 "Theory and Methodology of Professional Education" (012 - Preschool Education). The Institute of Pedagogy of the National Academy of Sciences of Ukraine, Kyiv, 2016.

Abstract content.

Keywords.

List of publications of the acquirer.

Abstract theses

A set of keywords:

- must correspond to the main content of the scientific work;
- display the research topic and provide the thematic job search;
- the number of keywords is 5 – 15;
- keywords are presented in the nominative case.

A dissertation

After the keywords, a list of the awardee's publications on the topic of the dissertation is provided. Scientific works are indicated:

- in which **the main scientific** results of the dissertation are published;
- which certify **the approval of the dissertation materials;**
- which **additionally reflect the scientific results** of the dissertation.

The list of used sources of the dissertation

- is formed by the recipient of a scientific degree at his choice (optionally – at the end of each section of the main part of the dissertation) in one of the following ways:
- in the order of appearance of links in the text;
- in alphabetical order of the surnames of the first authors or titles;
- in chronological order.

Bibliographic description of the list of sources used in the dissertation

- can be issued by the recipient of a scientific degree at his choice:

- taking into account the National Standard of Ukraine **DSTU 8302:2015** "Information and documentation. Bibliographic reference. General provisions and rules of drafting“;

- or **one of the styles** included in **the recommended list.**

10.3.1. A recommended list of styles for designing a list of scientific publications

1. MLA (Modern Language Association) style.
2. APA-1, 2 (American Psychological Association) style.
3. Chicago/Turabian style-1.
4. Harvard style-1.
5. ACS (American Chemical Society) style.
6. AIP (American Institute of Physics) style.
7. IEEE (Institute of Electrical and Electronics Engineers) style.
8. Vancouver style-1.
9. OSCOLA.
10. APS (American Physics Society) style-1.
11. Springer MathPhys Style-1.

Appendix 3 to the Dissertation Requirements (item 11 of Chapter III)

See in PNS according to the discipline (MOODLE): Standards and styles Short guide Kravchenko S.A._2016

10.4. Defense of the dissertation

- **Attestation** of persons who obtain **the degree of Doctor of Philosophy** is carried out by a permanent or one-time **specialized academic council** of a higher educational institution or scientific institution accredited by the National Agency for Quality Assurance of Higher Education, **based on the public defense** of scientific achievements **in the form of a dissertation**. The recipient of the Doctor of Philosophy degree has the right to choose a specialized academic council.

P 3. Article 6 of the Law on Higher Education

P. 5. Article 6 of the Law on Higher Education. ORDER of the Ministry of Education, Culture, Sports, Science and Technology of 07/04/2015 No. 758

- **Dissertations** of persons obtaining the degree of Doctor of Philosophy, as well as the reviews of opponents **are published on the official websites** of the relevant higher educational institutions (scientific institutions) in accordance with the legislation.

- **Dissertations** are accepted for defense (scientific reports) **performed by the recipient** of a scientific degree **independently**. The detection of **academic plagiarism** in the dissertation (scientific report) submitted for defense is grounds for **refusal to award** the corresponding **academic degree**.

P. 6. Article 6 of the Law on Higher Education.

The document on higher education (degree)

- The diploma of the Doctor of Philosophy, Doctor of Science indicates **the name of the higher education institution** (scientific institution) in which the training was carried out, **the name of the higher education institution** (scientific institution) in **the specialized academic council** of which (whose) scientific achievements are protected, as well as **the name of the qualification**, which consists of information about the scientific degree obtained by the person's, field of knowledge and/or specialty.

Resolution of the Cabinet of Ministers of Ukraine

The Procedure adopted in the Resolution of the CMU regulates the following issues:

- carrying out an experiment on awarding the degree of Doctor of Philosophy by specialized academic councils of higher education institutions (scientific institutions);
- establishing requirements for the level of scientific qualification of persons who obtain the degree of Doctor of Philosophy;
- formation of specialized academic councils of higher education institutions (scientific institutions);
- cancellation of decisions of specialized academic councils of higher education institutions (scientific institutions).

The CMU Resolution uses the following terms:

- **attestation of the recipient** – a complex of consecutive expert actions regarding the assessment of the scientific level of the recipient’s dissertation and scientific publications, establishing the level of acquisition by the recipient of theoretical knowledge, abilities, skills and relevant competences for the purpose of state recognition of the level of scientific qualification of the recipient by awarding him a scientific degree;
- **attestation case of the acquirer** – a case that is formed from documents related to the attestation of the acquirer, according to the established list in accordance with the legislation;
- **Doctor of Philosophy degree holder** – a person studying at a higher education institution (scientific institution) at the third level of higher education with the aim of obtaining a Doctor of Philosophy degree in a field of knowledge and/or specialty;
- **specialized academic council of a higher education institution (scientific institution)** – a specialized academic council formed by the Ministry of Education and Science with the right to accept for consideration and conduct a one-time defense of the dissertation of a person who obtains the degree of Doctor of Philosophy, with the aim of awarding him the specified degree.

Resolution of the Cabinet of Ministers of Ukraine (the end**)**

- **the head of the specialized academic council** of a higher education institution (scientific institution) is a full-time scientific and pedagogical (scientific) employee of the institution of higher education (scientific institution) where the council is formed, who has a doctor of science degree;
- **the opponent** is a person who is not a full-time employee of the institution of higher education (scientific institution) where the council is formed, and who has a scientific degree and is a competent scientist in the scientific direction on which the applicant's dissertation was prepared;
- **a reviewer** is a person who is a full-time employee of the institution of higher education (scientific institution) where the council is formed, and who has a scientific degree and is a competent scientist in the scientific direction on which the applicant's dissertation was prepared;
- **close persons** - spouses, children, parents, brothers and sisters, grandfather, grandmother, grandchildren, adoptive parents, as well as other persons who live together, are connected by common life and have mutual rights and obligations with the specified subject in the first part of Article 4 of the Law of Ukraine "On Principles of Prevention and Counteraction of Corruption“.

The acquirer submits the following documents to the council:

- an application for attestation;
- a copy of the first page of a passport of a citizen of Ukraine or a passport document of a foreigner;
- a copy of the master's degree. In the event that a document on higher education is issued by a foreign institution of higher education, a copy of the document on the recognition of this document is additionally submitted;
- a copy of the name change certificate (if necessary);
- an extract from the order on enrollment in postgraduate studies (attachment to a higher education institution (scientific institution);
- an academic certificate on the completion of the relevant educational and scientific program;
- a conclusion of the scientific supervisor or the relevant structural unit in two copies;
- a conclusion on scientific novelty, theoretical and practical significance of the results of the dissertation in two copies;
- a thesis in printed form (three copies) and in electronic form;
- copies of scientific publications included in the dissertation topic, on which the source data of the relevant publications must be indicated.

The main scientific results of the dissertation must be covered **in at least three scientific publications** that reveal the main content of the dissertation.

Such scientific publications include:

- at least one **article in periodical scientific publications of other countries** which are members of the Organization for Economic Cooperation and Development and/or the European Union, from the scientific direction on which the applicant's dissertation was prepared.
- **articles in scientific publications** included in the list **of scientific specialized publications of Ukraine (a monograph or a section of a monograph** published in co-authorship.
- A scientific publication in a publication assigned to the first - third quartiles (Q 1 - Q 3) according to the SCImago classification Journal and Country Rank or Journal Citation Reports is equal to two publications, which are counted according to the first paragraph of this clause.

The acquirer submits the following documents to the council (the end)

- that repeat scientific results published earlier in other scientific publications that are already included in the dissertation topic are
- If **ideas or developments belonging to co-authors are used in the dissertation** , with which the applicant has joint scientific publications and documents on conducting dissertation research, the applicant must note this fact in the dissertation with a mandatory indication of personal contribution to such publications and documents
- **The applicant certifies with his own signature on the title page** of the dissertation that the scientific achievements submitted for defense are his own work and all borrowed ideas, scientific results, quotations are accompanied by proper references to their authors and sources of publication

10.4.2. The structure of the thesis defense report

Build a report with the following functional parts:

- the topic of final work (dissertation), the object, the subject and purpose of research;
- results submitted to the defense;
- characteristics of the subject field, characteristics of the research object, names of leading scientists and their achievements in this subject field ("the giants on whose shoulders you stood"); scientific niche for your dissertation;
- research problems and the logical scheme (structure) of solutions to them;

The structure of the thesis defense report (the end)

- the essence of the first scientific result: statement of the problem, solution method, practical significance. The novelty of the result in terms of setting, method, and use;
- the essence of the second, third and other results of the dissertation;
- the essence of the experiment, its design, implementation, results, comparative analysis with theoretical provisions and other results;
- description of implementation: what, where, how, when, what was achieved, what was confirmed;
- Final conclusions.

Control questions

1. What scientific degrees are awarded in the system of certification of scientific personnel of Ukraine?
2. What are the structural components of the system of certification of scientific personnel in Ukraine?
3. Define the thesis.
4. Name the main features of the work on the dissertation in comparison with other types of research works.
5. Name the main sections of the thesis content.
6. List the main requirements for dissertations.
7. On the basis of which criteria is the research topic selected?
8. According to what indicators is the analysis of the structural adequacy of the dissertation performed?
9. What is the purpose of the dissertation abstract?
10. What are the requirements for the presentation of scientific research, the content and structure of the report?
11. What types of work are involved in the planning of preparation for the defense of the dissertation.
12. Describe the procedure for defending a dissertation.
13. Where is the preliminary examination of dissertation works held?
14. What stages precede the defense of a dissertation in a specialized academic council?
15. What is the procedure for defense of the dissertation?
16. What activities are carried out by specialized scientific councils? In which organizations are they created?

The practical component

Task 1.

Write an introduction to your dissertation using the traditional requirements for its structure and content.

Task 2.

Create the structure of the main part of the dissertation

(see subsection 10.2.1.).

Auxiliary material. Based on Dissertation and scholar degree.

- **The structure of the main part of the dissertation** indicates which sections and subsections should be highlighted, and how they can be related to each other.

Supporting material

There are 5 main types of construction of the main part of the dissertation:

- a systemic problem;
- theoretical and applied;
- Software;
- theoretical – methodical;
- time-historical periodization.

- In **the system-problem design,** the entire structure of the dissertation is "stringed" to a scientific problem: **The essence of the problem and its statement → proposed methods of solving the problem → confirmation and practical significance of solving the problem**
- **The theoretical and applied construction** of the main part of the dissertation consists in its division into component parts according to the principle: **Theoretical foundations of the researched topic → Applied aspects of the researched problem → Practical recommendations** . The researcher goes from theory to practice and solves an applied problem with the creative application of theory.

Supporting material (the end)

- **The software design of the main part** of the dissertation is aimed at works with a clear applied orientation**: Goals → Ways → Means.**
- **The theoretical-methodical design** involves the construction of the work according to the principle: **Theory → Methodology → Technology.**
- **The construction of time-historical periodization** is built according to the following scheme: **Period 1 → Period 2 → Period 3** (study of the stages of the development of events or scientific ideas).

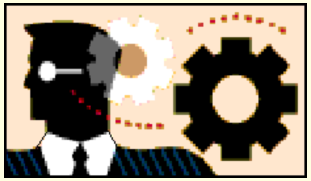
The practical component

Task 3.

Process the Regulatory and Legal Acts and other necessary documents regulating postgraduate studies, preparation, defense of the dissertation and publication of scientific articles (as of January 3, 2020) on the website of the Laboratory of Effective Research:

11. Technology and psychology of scientific creativity. Development of abilities for scientific activity

System elements of the topic

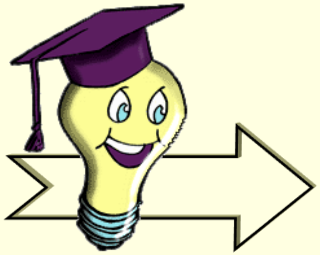


11.1. Principles of systematic thinking in scientific creativity

11.2. Abilities to conduct scientific activity and their development

11.3. Communications and the art of presentation

11.1. Principles of systematic thinking in scientific creativity



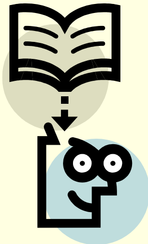
Basic hypotheses of the nature of creativity

Hypothesis 1. The human brain, perceiving information with the help of five senses, processes it both consciously and unconsciously, outside the limits of logic.

Hypothesis 2. Information is considered as a special property of the structure of space and has only a limited ability to disperse. Practically no unit of information that has arisen once is not lost, forming the so-called "information field".

Creative processes of an individual are:

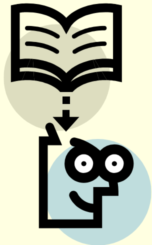
- **independent creation of fundamentally new information based on the processing of already existing information,**
- **a kind of "connection" of it to the "information field".**



"Each of us creates our own representative "map" of the world in which we live - that is, some kind of "reflection map" or model that we use when deciding what to do. Therefore, each of us can create a different model of the general world and find ourselves live in a slightly different reality."

(Source: Richard Bandler / Use your brain for change. - https://www.goodreads.com/book/show/822202.Using_Your_Brain_For_a_Change)

Example 11.1. As long as someone's mind did not create a "map" of such concepts as "atom", "virus" or "the earth in the shape of a ball", the data of these sides of reality could not influence either the actions of our ancestors or ourselves.

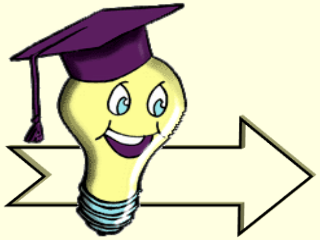


The researcher's creative process is implemented through his basic representational system

Language patterns (L). Specific linguistic forms indicate a representational system.

Example. 11.2. Linguistic forms of representative systems.

Visual	Audial	Kinesthetic
see	hear	grab
watch	listen	touch
watch	sound	feels
clear	call	firm
bright	resonant	difficult
draw	noisy	address
sad	loud	rude
educate	express	connect
show	speak	move

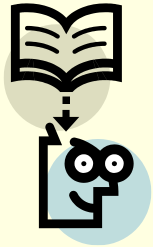


Thinking

Thinking is an active process of reflection of objective reality mediated by the first signal system, : nature, society, human activity, education, movement and development of knowledge.

Vertical thinking is the process of processing information, which takes place during a series of consistent, well-established, well-founded steps that allow you to get a meaningful conclusion. Correctness of steps is the most important point of such thinking.

Lateral thinking is the process of processing information for the development of creative abilities, which is based on intuition – a means of transforming ideas in an uncertain situation.



Thinking (continuation)

Household thinking (common thinking) is spontaneous and empirical cognition, which is a direct connection of cognition with practical activity.

Main features:

- **research knowledge**, which does not rely on any theoretical concepts;
- **not connected** with a specific **object of knowledge** ;
- **does not have specific methods and means** of cognition;
- **the result** of this knowledge is expressed and fixed **in the instructions, regulations** , which contain prescription rules, as well as **in practical experience**.

Thinking (continuation)

Scientific thinking is consciously created cognitive activity, which is based on the mediated and generalized attitude of the qualities and relations of objects and phenomena in their contradiction and development.

Main features:

- **availability** of an **object** and special **subject research**;
- use **of special scientific research methods**;
- **specific research results** in the form of scientific facts, classifications, laws, hypotheses, theories.

Thinking (the end)

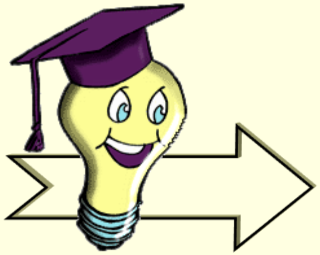
Practical thinking is thinking of a political figure, head of collective work, manager. An intermediate position between everyday and scientific thinking.

The main differences from everyday thinking:

- **it has** a clearly defined, formally delineated **subject thinking;**
- **it uses specific methods, means**, tools of knowledge from the arsenals of science about nature, man, society, thinking.

The main differences from scientific thinking :

- **the main goal is practical** (not theoretical) **activity**;
- **ensuring success** in a specific (locally defined) field **of activity** (**not the production of new knowledge**);
- much **more use of intuition**, heuristic thinking.



Creative process as a result of self-organization of thinking

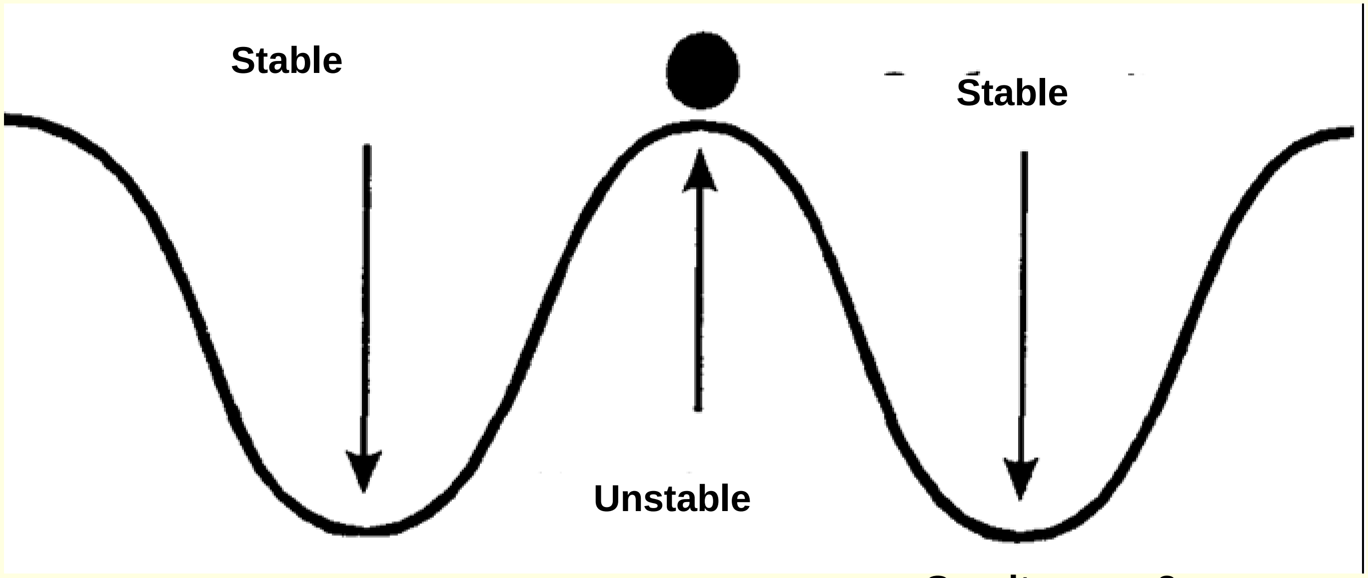
The theory of self-organization: **when quite a number of complex interacting elements are connected together, instead of the expected disorder, order "spontaneously" emerges from their interaction.**

Hebb's rule: If two interconnected neurons in the same state react simultaneously, the existing connection between them is established.

itself **is just a complex combination of lines and shadows**.

Example 11.3. What do you see in the picture?

The images of a young and an old woman are actually not on paper, but in our minds .



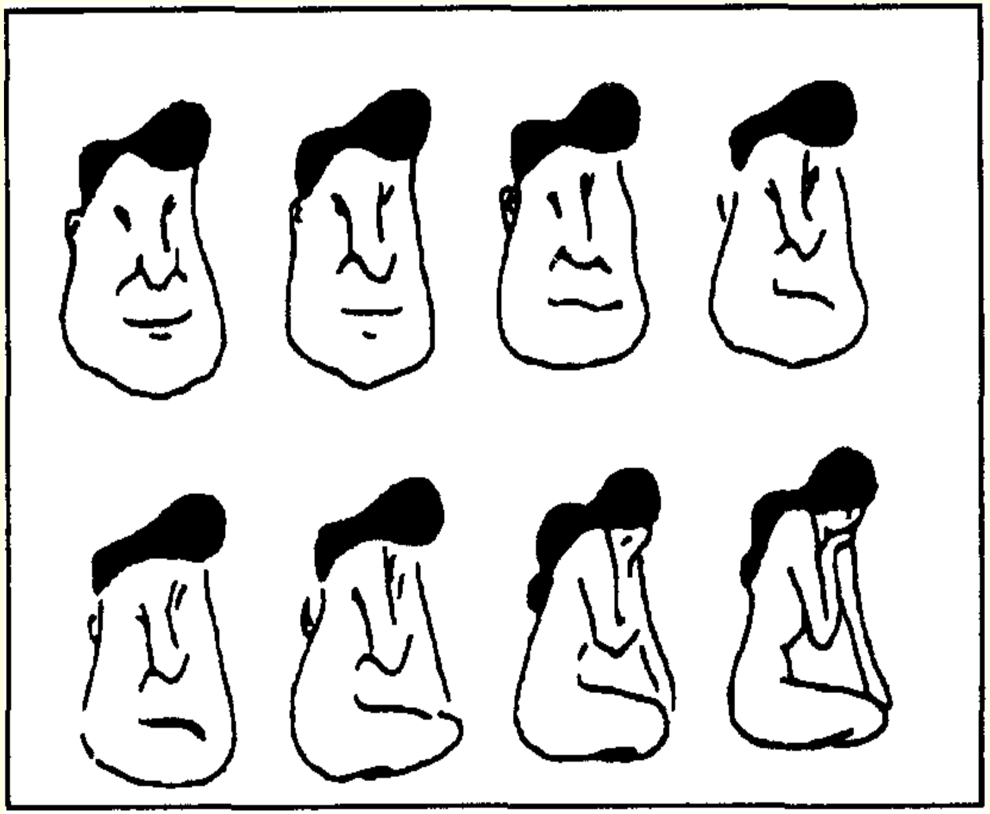
Gravity zone 1
A young woman.

Gravity zone 2
An old woman.

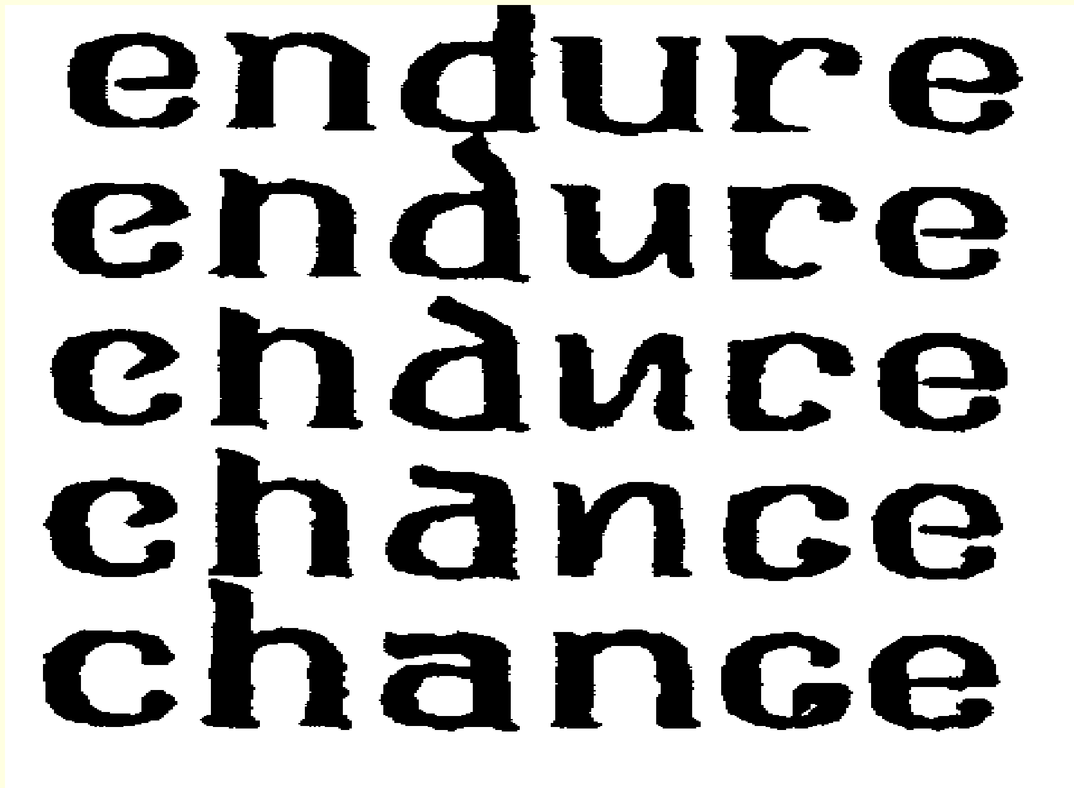
The "field" of gravity zones of the drawing.

Example 11.4. "Gravity zone fields":

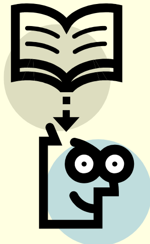
- the face of a man who gradually transitions or "transforms" into a female figure;
- the mutual transition of the words "**endure**" and " **change** " are two verbal "attraction zones“.



A man's face or a woman's figure?

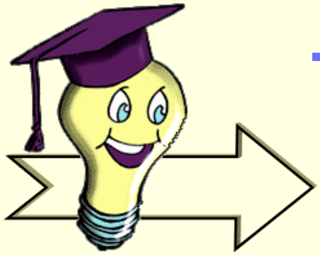


"Stay" or "change"?



The description of the process **of scientific creativity** is related to the study of interaction at a number of different levels of personal experience:

Spiritual	**Vision and purpose**
Who I am	Identity Mission
My belief system	Beliefs, metaprograms . Permission and motivation
My abilities	State, strategy, Direction
What I do	Peculiarities of behavior and actions
My environment	External context Reactions



The process of human cognition of the surrounding world

The process of cognition is based on sensations, perception, representation and operations of logical thinking

Feeling is an elementary **result of the influence of the objective world on the senses**, the transformation of the energy of external irritation in a person into a fact of consciousness.

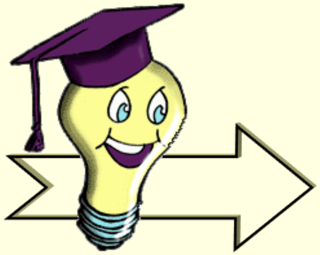
Perception (reception) is **reflection**, copy of objects and phenomena at the moment of their impact on the senses. It presents us with the external side of the object. Perception gives knowledge of objects, phenomena, not qualities.

Presentation (imagination) is **a specific image of an object** or phenomenon that previously affected the senses. Perceptions are more stable than direct contemplation.

Operations logical thinking: comparison, analysis, synthesis, abstraction, generalization, induction, deduction.

Comparison is comparison of subjects or phenomena with the aim of highlighting similar or excellent qualities any measurement and assessment lead to comparison of two or more values.

In general it is imaginary selection of essential signs of one subject or phenomena.



Logical forms of thinking – concepts, judgments, conclusions

Forms of thinking are types of thought construction.

Universal forms of thinking: concepts, judgments and inferences.

Local logical forms of theoretical thinking: hypothesis, theoretical idea, theory.

Judgment (statement) is **a form of logical thinking** which records **the presence or absence** of any characteristic of the object, states of the object, the relationship between them.

Language is the external, formal form of the thinking process. Formal logic deals with it.

A conclusion is a form of logical thinking that forms new knowledge based on already known judgments, which are called premises of judgments.

In any conclusion, three elements are distinguished.

- **Initial knowledge** is expressed in judgments – references.
- **Conditional knowledge** is a rule of inference.
- **Brief knowledge** is a new judgment, a judgment-conclusion.

According to the method of obtaining derived knowledge are distinguished:

- **inductive,**
- **deductive,**
- **translational** (translation is the movement of thought from the general to the general, from the partial to the partial, from the individual to the individual. Translational conclusions are the conclusions of relations and conclusions by analogy).

11.2. Abilities to conduct scientific activity and development of this abilities

The main questions that a young scientist should ask himself

1. Who?	Who does science? Who achieves success in scientific activity?
2. What?	What abilities are necessary for successful scientific activity?
3. Where	Where, from what is a favorable climate for doing science formed?
4. How?	How to properly organize scientific work?
5. Why?	Why do some people choose a scientific career? Why do scientists choose this or that field of activity?

Scientific research creativity

Methods of research of the scientist's personality

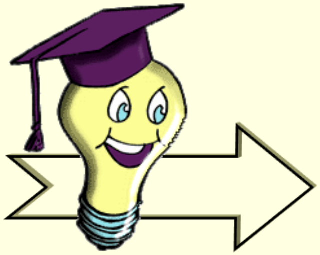
- Studying the experience of outstanding scientists
- Testing and survey
- Model experiments
- • • •

Detection of **psychological features** of scientists

Analysis of factors, responsible for formation and implementation **of creative abilities**

The role of learning **motivation** in science activity

Objectives of research of the scientist's personality



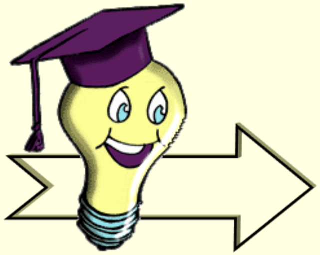
Features of gifted scientists

Character traits

- reticence, restraint:
- tendency to resort to deep thoughts;
- curiosity;
- skepticism and criticality;
- emotional stability,
- desire for dominance and impact on others.

Properties of intelligence

High level of intellectual activity



Three levels of intellectual activity

❸ Creative

Initiative in choosing goals

The solution to the problem does not become the end point of the research.
The researcher seeks to understand the reasons for the pattern he discovered.

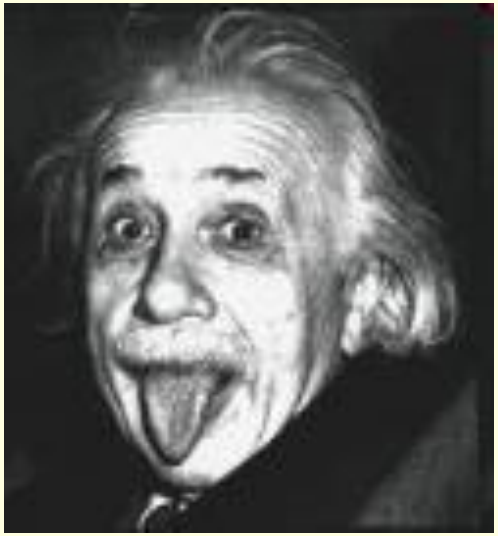
❷ Heuristic

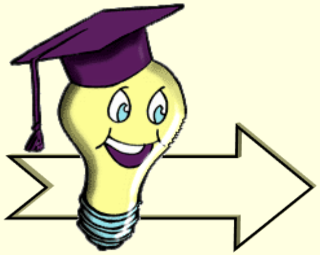
Manifestation of intellectual *initiative* in *achieving the set goal.*
The initiative is not stimulated by external factors.

❶ Work

Uninitiative intellectual activity.

A psychological portrait of a creative personality





Creativity

1. **Vigilance in search of problems** *(Serendipity).*

2. **The ability to surprise.**

3. **The ability to summarize reasoning.**

4. **The ability to transfer experience.**

5. **Ease of generating ideas.**

6. **Speed of speech.**

7. **Flexibility and originality of associations.**

8. **The ability to evaluate actions.**

9. **The ability to complete research.**

10. **Intuition.**

A. E. Brown gives the following list:

- Creative personalities **show curiosity** and constantly ask "why?" "what if?“.
- They show **flexibility and openness to the perception of** new information (in other words, they never reject the idea – "we've already tried it – it doesn't work".
- They are able **to see a problem where others do not see it**, and formulate it.
- They show **high sensitivity to needs,** noticing them earlier than other people.
- They are able **to connect and combine different information in an unexpected way.**
- **Being unorthodox and opposed to authoritarianism**, they boldly question the usual and generally accepted ideas.
- They show **mental "restlessness", strong motivation** and **emotional involvement** in what they do.
- They are more **inclined to solve problems, rather than master new facts** and phenomena, oriented to achieving the goal, rather than application of one or another method.
- They are n**ot necessarily** distinguished **by high intelligence.**

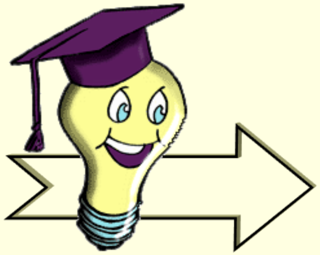
D. Hall in his book "Become the first" names the following qualities of a scientist:

- Very often **they are dissatisfied with the existing state**. They consider their achievements not a reason to relax, but degrees in the struggle.
- They are capable of **spontaneous, quick decisions**. These people have a lot of strange behavior from an ordinary point of view.
- They are not desperate heads. they **weigh the shortcomings**, **plan** the next steps, **calculate the share of risk**.
- They have **a free attitude to everything new**, unusual. They adapt quickly, **more open to fresh ideas**. They adapt faster and easier than others, **are able to act in extreme situations**.
- They have **high self-esteem**. They tend to say, "I can." No failures will break their will. They appreciate failure as a useful lesson: every obstacle is an incentive to move forward. They **respect the achievements of others**, but **do not envy them at all**, **they are not hindered by other people's ambitions**. They are sure that they could achieve the same themselves.

J. Guilford singled out 4 main qualities characteristics of a creative personality

(Source: Guilford, JP (1967): Some theoretical views on creativity. In: Helson , H. (Ed.): *Contemporary approaches to psychology.* NY: Harper and Row, pp . 421-428 .)

- **Originality, non-triviality, unusualness** of expressed ideas, pronounced desire for intellectual novelty. Almost always and everywhere he tries to find his own solution, different from others.
- **Semantic flexibility**, that is, the ability to see an object from a new angle, discover its new use, expand its functional application to practice.
- **Figurative adaptive flexibility**, that is, **the ability to change the perception of an object** in such a way as to see its new sides hidden from observation.
- **Semantic spontaneous flexibility**, that is, the ability **to produce** various **ideas in an uncertain situation**, in particular in one that does not contain guidelines for these ideas.

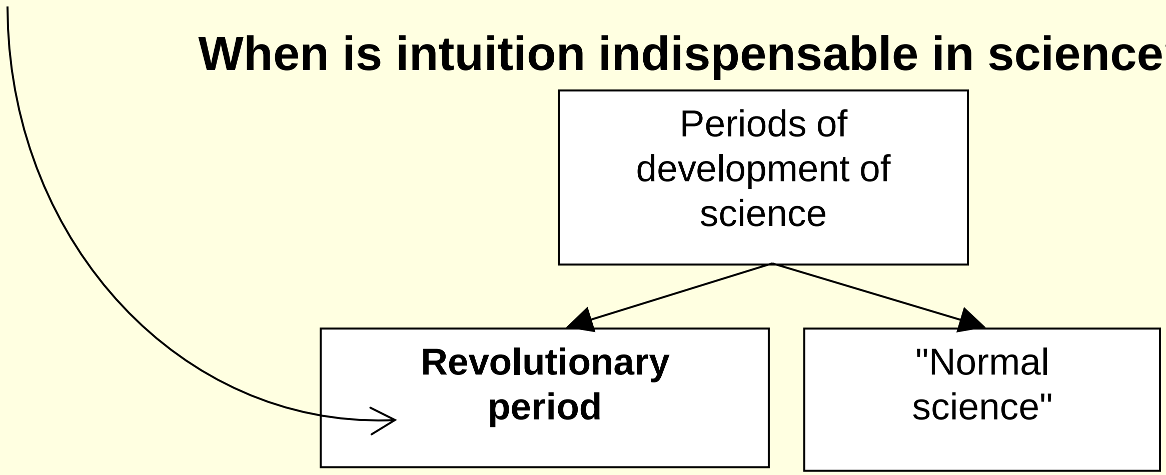


Intuition

Intuition is an unconscious mind that provides knowledge, bypassing reasoning and conclusions.

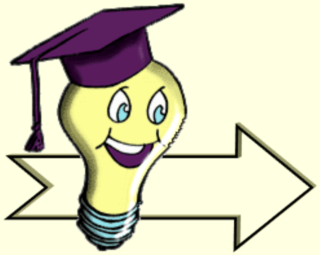
Intuition is a momentary understanding without rational thinking.

When is intuition indispensable in science?



What is the nature of intuition?

Intuitive enlightenment is born from the fusion **of sensory** and **rational** forms of cognition.

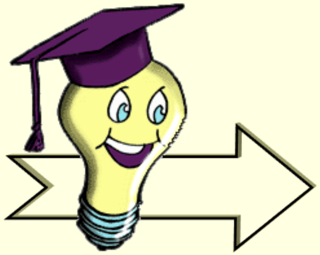


Principles of organization of scientific work

1. Constantly think about the subject of research.
2. Discipline the mind, develop the ability to concentrate.
3. Avoid uncritical acceptance of other people's ideas.
4. Do not work without a plan.
5. Control the progress of work, limit the depth of processing.
6. Choose individual methods of involvement in work
7. Select an individual mode of operation.
8. Adhere to the principles of scientific thinking:

- the principle of Occama's edge;
- rodin's principle;
- principle of selection;
- principle of ordering.

9. use techniques to activate creative thought.



Incentives that motivate scientists to do scientific research

- Physiological need for creativity
- Calling

- Love for Nature
- Passion for beauty regularities
- Curiosity

- Willingness to benefit
- Need for approval
- Halo of success
- Fear of boredom

Vocation is a more social concept than a biological one. A vocation is formed from the innate qualities of the psyche, the conditions of upbringing and the needs of society.

Example 11.5. Motives of future scientists: Questionnaire "How I see myself after defending my PhD thesis" (15 respondents)

More freedom	1
Career growth	4
Organization of your own enterprise (firm)	3
Expanding knowledge	3
Feeling confident	4
Self-realization	1
Ability to teach	3
Realization of your own potential	1
Self-affirmation	2
New discoveries in your field of knowledge	2
Sharing experience and knowledge with students	2
Personal development	1
Learning more about your field	2
Becoming an expert in your field	1
Gaining new experience and testing your one's abilities	1
Applying your knowledge to practice	1
Becoming more successful	1
To be useful (oh) to society	1
Expanding the perspective of your life and level of thinking	1
Getting a well-paid and favorite job	1

Difficulties on the way of a scientist:

1. A large amount of painstaking, monotonous work:
2. Presence of peculiar internal conflicts.

Types of conflicts

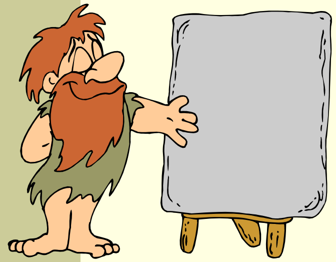
- Conflicts **between creative ideas and the possibilities to implement them**
- **Epistemological** conflicts related to the test of objectivity
- **Social and ethical**

11.3. Communications and the art of presentation

Reporting to the scientific community and protecting scientific results, a scientist must have a professional command of the communicative component of the scientist's competence

Communication performs three functions:

- **Communicative**, which includes the exchange of information;
- **Interactive**, which involves the organization of interaction;
- **Perceptual**, which reflects the process of perception and formation of the image of another person and establishment of interaction.



The communicative competence should reflect such skills as the ability

- *to conduct verbal and non-verbal* information exchange,
- to diagnose personal *properties* and *qualities of an interlocutor*;
- *to develop strategy, tactics and techniques, interaction* with people, organize their joint activities to achieve goals;
- *T o identify oneself with the interlocutor*, to understand how he himself is perceived by the communication partner and **empathically** relate to him.

Empathy ("Passion", "suffering") is a conscious empathy for the current emotional state of another person, without losing the sense of the external origin of this experience.

Indicators of the development of the communicative component of the scientist's competence

- **readiness to demonstrate the** competence (i.e. motivational aspect);
- ***possession of knowledge*** of the content of competence (i.e. the cognitive aspect);
- **experience of demonstrating** competence in a variety of standard and non-standard situations (i.e. the behavioral aspect);
- **attitude to the content** of the competence and the object of application of the competence (the value-semantic aspect);
- **emotional and volitional regulation** of the process and result of the manifestation of the competence.

Conflict-free communication

Rules of conflict-free communication:

- speak only to be understood;
- first understand and then ask to be understood.

Principles of conflict-free communication:

- tolerance of the interlocutor;
- favorable self-presentation;
- minimizing negative information.

Communicative failures and ways to overcome them

Communication failures:

- communication **barriers** – factors that prevent communication (for example, lack of knowledge of the language);
- communication **obstacles** – factors that reduce the quality of communication;
- communicative **failures that** are the result of communicative obstacles.

Reasons for communication failures

1. Differences in the pictures of the interlocutors' world.

An example of a dialogue from a textbook on the Russian language for Japanese:

– *Did someone call me?*

– *So.*

– *Who?*

– *No one.*

2. Differences in assessments, different mental models of reality among interlocutors.

For example:

– *What kind of abomination is this?*

– *Why the abomination? This is not an abomination, this is a beloved guinea pig.*

3. Violation of the rules of language etiquette

for example, *a dialogue in transport*:

– *Well, move on!*

– *This is another requirement!*

4. Incorrect reading of linguistic intent:

– *Why did you call Sasha?*

– *Is he bothering you?* (The question is understood as dissatisfaction).

Types of communication failures

- Verbal (phonetic, lexical, grammatical, etc.)
- Non-verbal (related to gestures, facial expressions, looks, etc.)

Conditions for successful communication

Adherence to the principles of Leach courtesy:

1. The postulate *of tact*.
2. The postulate *of generosity*.
3. The postulate *of approval*.
4. The postulate *of modesty*.
5. The postulate *of consent*.
6. The postulate *of sympathy*.

Non-verbal communication is one of the most important factors of successful communication

Non-verbal communication is the exchange of non-verbal messages between people and the interpretation of these messages.

Non-verbal messages:

- Situational;
- synthetic;
- unexpected and spontaneous.

People learn non-verbal language in natural conditions through observation, copying, imitation.

Ways of communication (verbal and non-verbal)

- Non-verbal communication complements verbal communication.
- Non-verbal behavior contradicts verbal messages.
- Non-verbal behavior replaces verbal behavior.
- Non-verbal actions serve as regulators of verbal communication.
- A non-verbal action repeats a verbal message.

Rules and techniques of public speaking during a scientific discussion

Stages of public speaking

- Preparation.
- Getting in touch.
- Concentration of attention.
- Attention support.
- Argumentation and persuasion.
- Completion of the performance.

10 mistakes of a beginner speaker

When making a report on a scientific topic, avoid the mistakes described below.

Mistake 1: Inconsistency.

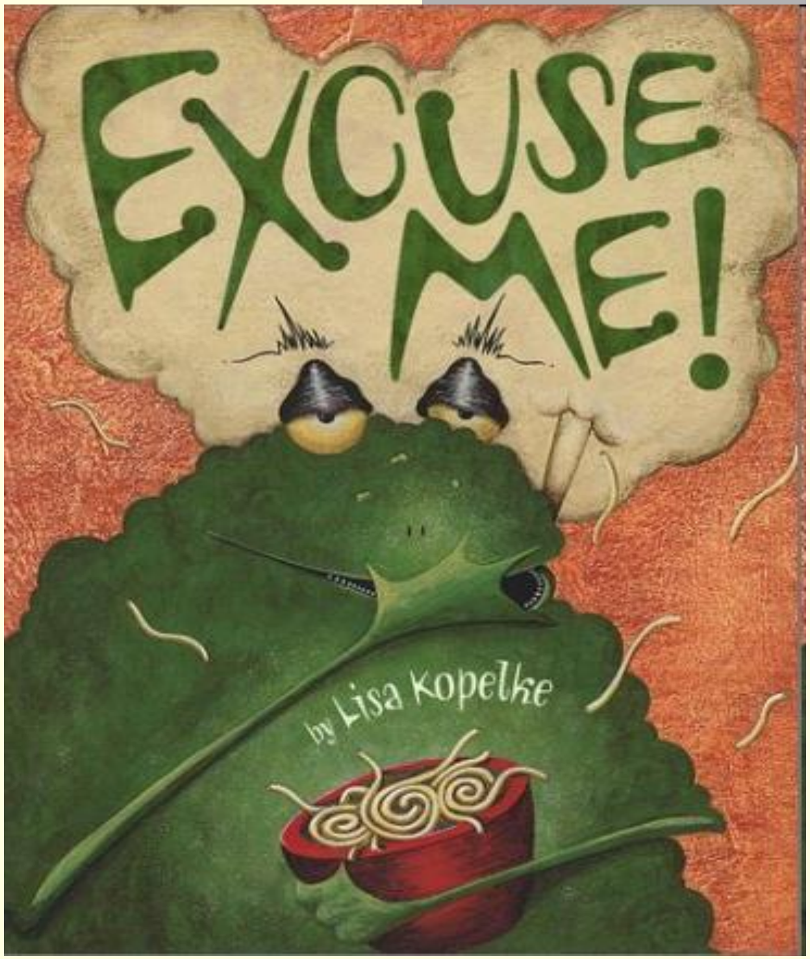
The content of your words differs from the tone of speech, posture and body language.

The audience has an unerring sense of the speaker's mood and well-being

10 mistakes of a beginner speaker (continuation)

Mistake 2: Excuses.

Listeners don't care whether you care or not, how long you've been preparing your talk, and what experience you have in public speaking.



10 mistakes of a beginner speaker (continuation)

Error 3: Apology.

This error is similar to the previous one. Beginning teachers like to apologize, offering to take the blame for the poor quality of the report off them.

"Please forgive me for ... (my cold voice, my appearance, poor quality of slides, too short speech, too long speech, etc.)".

10 mistakes of a beginner speaker (continuation)

Mistake 4: Eyes and eyebrows.

Are you really sure that you have a good command of your facial expressions?

Controlling facial expressions is not easy for an untrained person.

10 mistakes of a beginner speaker (continuation)

Mistake 5: Choice of words.

We hear and understand individual words before we understand the whole sentence.

We react faster and less consciously to the meaning of individual words than to the meaning of sentences.

10 mistakes of a beginner speaker (continuation)

Error 6: Lack of humor.

10 mistakes of a beginner speaker (continuation)

Mistake 7: Omniscience.

The scientist is proud and puffed up, bursting with awareness of his own importance. He always thinks he is smarter than the audience he addresses.

10 mistakes of a beginner speaker (continuation)

Mistake 8: Fussiness.

Distracting from the fear of the public, a novice scientist (educator) can:

- hastily walk from wall to wall,
- perform fussy manipulations with objects,
- make other unnecessary movements.

10 mistakes of a beginner speaker (continuation)

Mistake 9: Monotony.

- Nothing is more tiring than a lecture on an interesting topic delivered by a boring monotone voice.
- It is similar to the Chinese torture with drops of water: the water monotonously tortured Kapa Timya and gradually drove him to madness.

10 mistakes of a beginner speaker (the end)

Mistake 10: Lack of pauses.

- Newbies are terrified of pauses, which inevitably occur during public speaking.
- They are in a hurry to fill the pauses with various verbal nonsense and words-parasites (" Eeee ... So yes ... Eeee ... Well, what else to say ... Eeee ...").

Rules and techniques of public speaking

Evaluation of the audience and the environment

- Ask yourself: "Who are my listeners?"
- The following characteristics of the audience must be taken into account:
  - age and level of education;
  - profession;
  - the purpose of coming to the speech (discussion);
  - level of interest in the topic;
  - level of awareness in this matter.

Rules and techniques of public speaking
(the end)

- **The venue** is an important factor in a successful performance.
- To feel confident, you need to **come to the hall in advance** and get used to it.
- If **a microphone is to be used**, it must be adjusted.
- Before the speech, it is very important to establish **from which side the listeners will look at you**.
- When choosing a place, **consider your height**.

Control questions

1. Formulate the principles of systems thinking in scientific creativity.
2. What are the features and differences of different types of thinking: scientific, practical, everyday, vertical, lateral?
3. Describe the methods of activation of scientific creativity.
4. How are intuition and creativity related?
5. What is the essence of the art of creative thinking?
6. Reveal the essence and describe the principles of organization of scientific work.
7. How do scientific abilities develop?
8. Describe the factors and stages of creative thinking.
9. What are the mechanisms, properties and features of scientist's thinking.
10. Subjective representations of scientific problems.
11. What factors determine the solution of a scientific problem?

12 What can be an obstacle to creative thinking?

13. Describe the discussion as a form of scientific communication. Strategy and tactics of controversy.
14. Define the methods of correct and incorrect methods of searching for the truth.
15. What methods of argumentation are used in scientific discussion?

The practical component

Task 1.

Study the following video lessons with materials that teach the technique of public speaking. Perform and memorize the exercises given in these video lessons .

- How to make a voice BEAUTIFUL? Exercises for DICTION
- https://www.youtube.com/watch?v=aImrjNPrh30
- Public speaking. How to overcome the fear of public speaking?

https://www.youtube.com/watch?v=20cBDkD-ixo .

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The practical component (continuation)

- The Story of a Socially Anxious Public Speaker

https://www.youtube.com/watch?v=ogM4t_8pdd4

- How to prepare for a public speech

https://www.youtube.com/watch?v=0HCryLjGHIo .

The practical component (the end)

Task 2.

- Write two documents based on the section "Creative abilities", in one of which describe the abilities and qualities of a scientist that you currently have, and in the other document – what abilities and qualities of a scientist you want to form and develop in yourself.
- Make a presentation on the topic of how you want to achieve this goal, and use it in the future to develop yourself as a scientist.
- If you are not afraid, give this presentation to a group of PhD graduate students in which you study.

НАВЧАЛЬНЕ ВИДАННЯ

Лепейко Тетяна Іванівна

Пушкар Олександр Іванович

МЕТОДОЛОГІЯ ТА ОРГАНІЗАЦІЯ НАУКОВИХ ДОСЛІДЖЕНЬ

Навчальний посібник

(англ. мовою)

(в авторській редакції)

Самостійне електронне текстове мережеве видання

Відповідальний за видання *Т. І. Лепейко*

Відповідальний редактор *О. С. Вяткіна*

Розглянуто всі аспекти проведення наукових досліджень: як змістові (методи, моделі, технології дослідження), так і питання організації дослідження в університеті, на підприємстві та безпосередньо на виробництві. Поряд із традиційними темами, пов'язаними з методологічними основами наукового дослідження, формами організації наукового процесу, методами емпіричного та теоретичного дослідження, технологіями підготовки публікацій і захисту дисертацій, особливу увагу приділено сучасним інформаційно-комунікаційним технологіям, використовуваним у процесі дослідження, які базуються на використанні інтернет-ресурсів.

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